General contents

Contents

Introduction

Example of FBX-Extensible in industry

FBX, a versatile switchboard

FBX is a medium voltage switchboard up to 24 kV, 630/1250 A, 25 kA 1s, used in secondary distribution applications. It can be fitted with the following protection devices:

- **Transformer protection by fuse (T1 function)**
- **Transformer protection by vacuum circuit-breaker (T2 function)**
- **Protection by O-C-O vacuum circuit-breaker (CB or CBb function).**

Its compactness, wide range of functions and ease of installation and extensibility, make it a versatile switchboard to fit many secondary distribution applications such as: public distribution, industry, infrastructure or renewables.

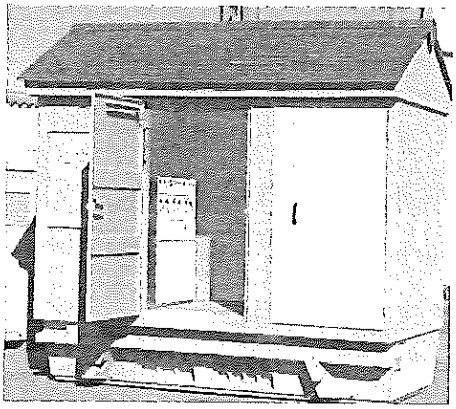
Electrically insulated using SF6 gas

The high voltage conductive parts of the FBX switchboard are placed in an insulating inert gas (Sulphur Hexafluoride - SF6) which is neither reactive nor toxic.

The gas is confined in a hermetically sealed stainless steel tank. FBX is insensitive to the outside environment and to any possible aggressions such as:

- Humidity
- Dust
- Pollution
- Dirt
- Harmful rodents.

The use of SF6 as an insulating gas, and the design of FBX, makes it one of the most compact MV switchboards on the market (for instance, a cubicle with 3 functional units is 1 metre wide).



FBX-C in a MV/LV substation – chosen for its compact size

Easy to install

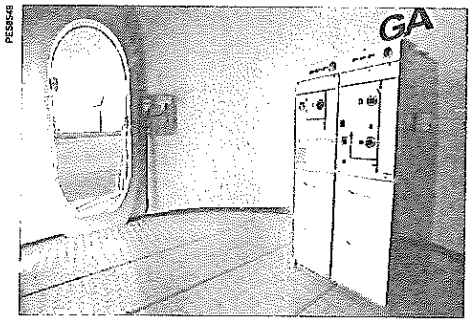
The installation of FBX is very easy whatever its installation location. Its functional units are ultra compact thanks to the technology of current interruption in SF6 gas, and their footprint on the floor is minimized.

FBX-E, the extensible version of FBX, can be assembled into a complete switchboard, functional unit by functional unit, with narrow installation access. For instance, for an installation underground or on upper floors, or in wind towers.

Simple operation and maintenance

With a service life of 30 years for the main circuit without maintenance, the overall design of the range of FBX switchboards guarantees simple and reliable use:

- Simplified maintenance of the functional units and with continuity of service for the other units (LSC2A class)
- No addition of gas during the service life of the cubicle
- Long service life
- Interlocking to ensure the correct sequences of operations
- Can be used in substations with or without walk-in operation corridors
- Voltage presence indicator light
- Wide cable compartment to allow the installation of various types of cable, etc.



FBX-E in the mast of a wind tower, can be installed through a narrow door thanks to its compact size

Safety and innovation

FBX has been designed for maximum safety of the operators and equipment in particular in case of internal arcing in the equipment:

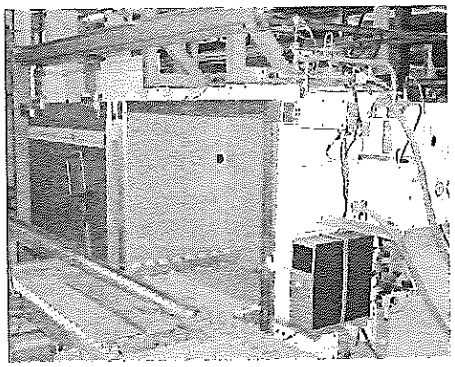
- Safety valves at the rear yield and thus avoid gas overpressure
- An exhaust duct cools down and evacuates the gases towards the top (optional) and/or a deflector at the rear channels and cools the hot gases
- Front protection for the operator (lateral also as an option).

Standards & quality

Conformity with standards in force

FBX meets the current national or international standards in force:
(IEC, NF, GOST, CNS, IS).
The main electro-technical standards cover:

- The design of the functional units and switchgear
- Medium voltage switchgear (interruption, sectionalizing, insulation)
- Current and voltage transformers
- Low voltage switchgear
- SF6 gas
- Cables and conductors
- Graphs and diagrams
- Tests
- International electro-technical vocabulary.



SF6 leak test

A quality and safety approach

The Mâcon site, in France, has, for many years, been committed to a global quality approach and is certified:

- ISO 9001: 2000
- ISO 14001: 2004
- OHSAS 18001 (since 1999).

Tests on the devices

Various factory tests are carried out on FBX before it is shipped to the customer:

- Tank leak-tightness test
- Mechanical test for control mechanisms
- Dielectric tests.

The FBX switchboards comply with the requirements of the following standards and regulations:

Description	IEC standard	IEC classes	EN standard
Switchboard	IEC 62271-200 IEC 62271-1	LSC partition class PM Continuity of service of the cable connection and fuse compartments: LSC2A(1)	EN 62271-200 EN 62271-1
Behaviour in the event of internal faults	IEC 62271-200		EN 62271-200
Earthing switch (in C, T1, T2, RE, CB, CBb)	IEC 62271-102	E2	EN 62271-102
Disconnector (in T2, CB, CBb)	IEC 62271-102	M0	EN 62271-102
General use switch (C)	IEC 62271-103	M1, E3, C1	
Switch-disconnector fuse combination (T1)	IEC 62271-105	M1, E1	
Circuit-breaker (in T2, CB, CBb)	IEC 62271-100	M1, E2	EN 62271-100
Current transformer	IEC 60044-1		EN 60044-1
Voltage transformer	IEC 60044-2		EN 60044-2
Voltage presence indicators	IEC 61958		EN 61958
Voltage detection systems	IEC 61243-5		EN 61243-5
Protection against accidental contact, foreign bodies and ingress of water	IEC 60529		EN 60529
Installation			HD 637 S
Operation of the electrical equipment			EN 50110

(1) The LSC 2A continuity of service may be limited if FBX is used with air insulated metering cubicles (M), depending on the general configuration of the switchgear. However, if the M1 metering cubicle of FBX can be insulated on the left or on the right (the right and left sections of the switchboard can be maintained energized), the LSC 2A continuity of service is guaranteed for the entire switchboard.

ВЯРНО С ОРИГИНАЛА

Product description

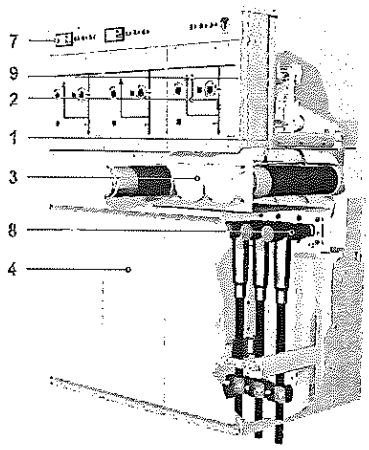


Illustration of an FBX-C
C-C-T1 function, protection by fuses

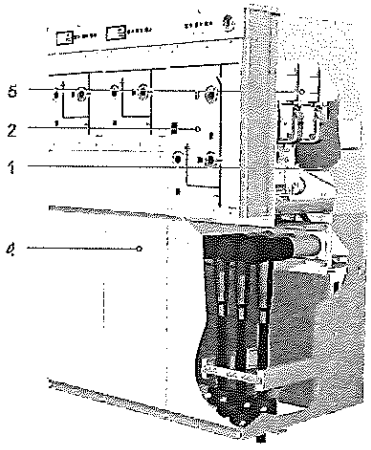


Illustration of an FBX-C
C-C-T2 function, protection by vacuum circuit-breaker

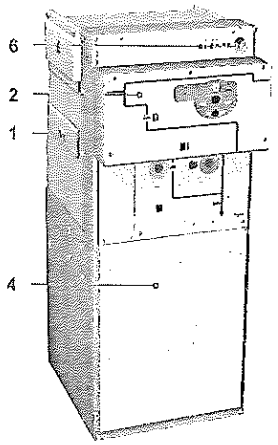


Illustration of an FBX-E
Vacuum circuit-breaker function

1 Hermetically-sealed stainless steel tank filled with gas to insulate the main circuit
2 Operating mechanism compartment and mimic diagram
3 Fuse compartment
4 Cables compartment door
5 Vacuum circuit-breaker
6 Tank pressure manometer
7 Voltage presence detection system and low voltage part
8 Cable plug-in connections
9 3-position switch-disconnector

Identification plate

The rating plate supplies information on the version, the short time rated current, rated voltage and components.

Example **FBX - C / 12 - 25 / C-C-T1**

Switchboard
Version:
C = Compact
E = Extensible

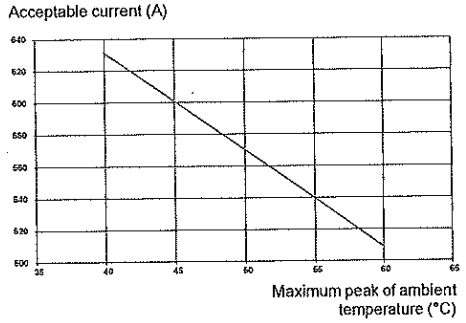
Rated voltage: 12 kV

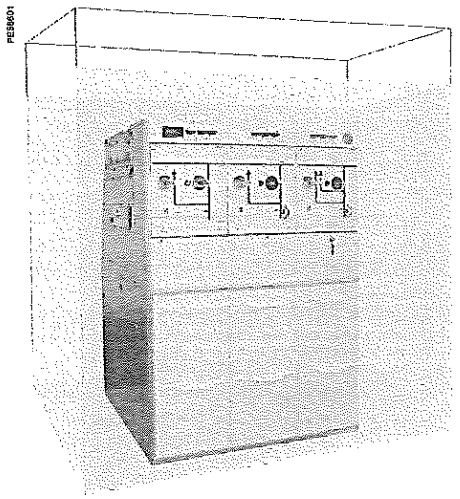
Short circuit current:
25 kA (1s)

Functions
Order: from left to right

Product description

Reduction of the current assigned in continuous service according to the maximum ambient temperature





Operating conditions

- Temperature classification: –5°C indoors (option: –25°C).
- Ambient temperature: from –5°C to +40°C (option: –25°C) (option: up to +55°C for reduced service currents)
- Average value over 24 hours (max.): +35°C
- Maximum altitude for installation (above sea level): 1,000 m. Higher altitudes are possible on request, notably for Type-M metering cubicles and for HV fuse-holders operating in a normal atmosphere.
- Type of insulating gas: sulphur hexafluoride (SF6)
- Rated pressure at +20°C: 0.03 MPa
- Flood proof (option): successfully tested under water for 24 hours at 24 kV 50 Hz.

Protection index (IP)

- Main electrical circuits: IP67
- Fuse compartment: IP65 (option: IP67)
- Operating mechanisms and low voltage compartment: IP2X (option: IP33)
- Cable connection compartment: IP2XC
- Busbar: 1250 A on top of unit: IP67
- Switchgear: IK07.

Internal Arc Classification

FBX is a pressurized sealed-unit system that complies with IEC 62271-1. Its tank is filled with SF6 gas that is used as an insulating and breaking medium. No gas filling is required on site at installation nor during the service life of FBX under normal operating conditions.

FBX internal arc classification as per IEC 62271-200 is detailed in the table below. In the unlikely event of gas overpressure, the gas is discharged via safety valves away from the operator.

Rated voltage	Functions	12 kV	17.5 kV	24 kV
Internal arc withstand	C - T1 - T2 - R - RE - CB - CBb	AFL 16 kA 1 s AFL 20 kA 1 s AFL 25 kA 1 s (1)	AFL 16 kA 1 s AFL 20 kA 1 s	AFL 16 kA 1 s AFL 20 kA 1 s
	M1 - M2 - M3 - M4 (2)	AF 16 kA 1 s AF 20 kA 1 s	AF 16 kA 1 s AF 20 kA 1 s	AF 16 kA 1 s AF 20 kA 1 s

(1) With exhaust towards the bottom. Nkt cable required for two cables per phase fitting.
(2) Can be considered "AFL" if surrounded on both sides by AFL FBX functions.

Contents

Introduction

FBX-C: compact version

This version can be easily integrated into a substation thanks to its compact size and small footprint. Up to 5 functional units can be assembled in a single tank insulated by SF6 gas.

FBX-E: extensible version

The extensible version of FBX, FBX-E, is used to enable the extension of a switchboard with additional functional unit to the left or to the right of the original switchboard. This version offers the following advantages:

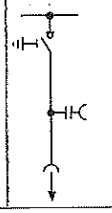
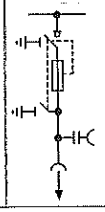
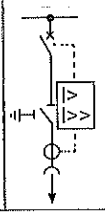
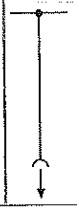
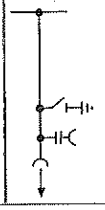
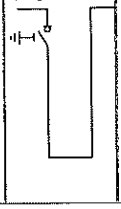
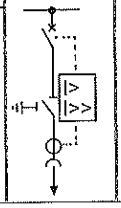
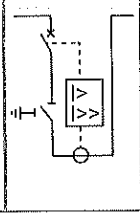
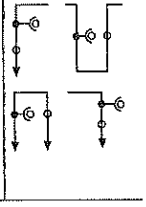
- A highly economic solution for secondary distribution applications
- Installation in very limited space locations such as through a narrow opening or hatch is possible
- The additional FBX-E functional units can be arranged in any order you like
- A subsequent extension is possible on both sides of the switchboard:
  - either with an extensible FBX-E functional unit connected with the A-link device at the bushing level
  - or via a 1250 A top busbar on the roof connecting FBX-E functional unit at busbar level.
- The flexibility and modularity of FBX-E make FBX an ideal MV switchboard for applications in the industrial sector, or for those liable to change in time such as public distribution network.

Main functional units:

C	Cable incoming or outgoing feeder with switch-disconnector and earthing switch
T1	Transformer protection with switch-disconnector fuse combination
T2	Transformer protection with vacuum circuit-breaker
R	Direct incoming feeder without earthing switch
RE	Direct incoming feeder with earthing switch
Sb	Busbar switch-disconnector
CB	Outgoing feeder protection with vacuum circuit-breaker
CBb	Busbar protection with vacuum circuit-breaker
M	Metering functional unit

Range of functions

Main functional units

Names	C	T1	T2	R	RE	Sb	CB	CBb	M
Functions	Cable incoming or outgoing feeder with switch-disconnector	Transformer protection with switch-disconnector fuse combination	Transformer protection with vacuum circuit-breaker	Direct incoming feeder without earthing switch	Direct incoming feeder with earthing switch	Busbar switch-disconnector	Outgoing feeder protection with vacuum circuit-breaker	Busbar protection with vacuum circuit-breaker	Metering
Mimic diagrams									

C function

- The interrupting mechanisms are located in the sealed-for-life tank filled with gas.
- The three-position switch is equipped with a spring-loaded closing mechanism for the switch-disconnector function and the earthing switch function.

T1 function

- To make the replacement of HV fuses secure, earthing switches are placed both upstream and downstream from the fuses.
- Both earthing switches are connected mechanically and are activated with a single operating mechanism.
- The switch-disconnector is equipped with a spring-loaded mechanism for the closing operations and a stored energy mechanism for breaking operations which is mechanically pre-loaded.
- When the striker pin trips on the blowing of one of the HV fuses, the switch-disconnector is opened mechanically on all three phases.
- An indicator on the front panel of the FBX visually signals the interruption due to a fuse blowing.
- A pushbutton for tripping the opening of the switch is available as an option.
- An opening by tripping coil is also possible.
- The earthing function is operated with a separate spring mechanism.

T2 function

- The transformer outgoing feeder with vacuum circuit-breaker can be used for applications where the load current is too high for the use of a switch-disconnector fuse combination.
- A typical application is the protection of distribution transformers and wind farm installations up to 21 MVA.
- The T2 three-phase transformer protection comprises a vacuum circuit-breaker (located upstream) and a 3-position disconnector carrying out the sectionalizing of the line.
- The disconnector and earthing switch with making capacity are activated by a spring-loaded mechanism.
- The vacuum circuit-breaker is equipped with an energy accumulation spring-loaded mechanism.
- The operating sequence in case of the use of a motorized mechanism is the following: O – 3 min. – CO.
- The vacuum circuit-breaker can be tripped manually by a pushbutton or automatically by a motorized mechanism controlled by a DPX-1 protection relay (standard equipment – other relays available on request). The latter analyses the metering data captured by the current transformers on each phase and is triggered at pre-defined threshold levels.
- Fault trips require no auxiliary voltage if an autonomous relay is used.

R function

- This function allows for the direct connection of a cable incoming feeder to the busbar of the FBX switchboard.

RE function

- This function, which is equipped with an earthing switch, allows for the direct connection of a cable incoming feeder to the busbar of the FBX switchboard.

Range of functions

Sb function

■ This function is used for the opening and disconnection of the busbar to separate the end-user from the energy provider.

CB function

■ The CB function includes a vacuum circuit-breaker and a three-position disconnector switch.
■ Fast auto-reclosing operating cycle: O - 0.3 s - CO - 15 s - CO.
■ The earthing switch with making capacity is activated by a spring-loaded mechanism.
■ The vacuum circuit-breaker is equipped with a double-latch energy accumulation spring-loaded mechanism and can be pre-loaded manually or electrically for a complete OCO cycle.
■ An integrated protection relay is linked to the circuit-breaker.
□ One of the following three autonomous relays can be integrated behind the front cover with the current transformers fitted on cable plug-in connections: DPX-1, WIC and P114S MiCOM.
□ Other non-autonomous relays can be used by fitting a low voltage cabinet with the current transformers fitted either to the withdrawable terminals or onto the outgoing feeder cables.
■ In option: metering with current transformers fitted to the cables in the cubicle's compartment.
■ When connected to an overhead line network, the CB function can protect from temporary line faults. It can also provide private network protection.

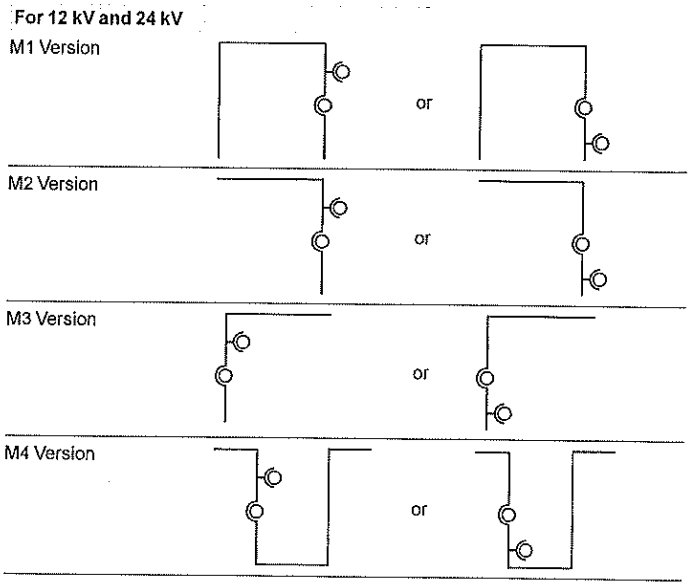
CBb function

■ The CBb function is used to protect the switchgear busbar (on the left or right-hand side). Example of use: medium voltage metering switchboard.
■ This function uses the same vacuum circuit breaker and mechanism as the CB function.
■ Please consult us for its availability.

M function

■ This function allows for metering of electricity consumption thanks to its current and voltage transformers.
■ To fit all possible configurations, four metering panel versions exist with different busbar positions. In the M1 to M4 versions, the current and voltage transformers can be switched between each other.
■ Options:
□ Flooring for M1, M2 and M3 with a rubber grommet for the passage of the cables.
□ Flooring completely closed, but with overpressure escape devices.

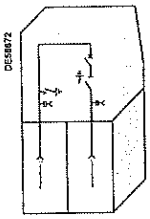
For 12 kV and 24 kV



Available configuration

FBX-C, compact version (non extendable)

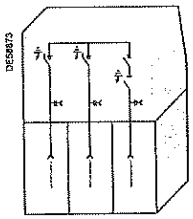
2 functions



Versions

C	C
C	T1
C	T2
RE	T1
RE	T2

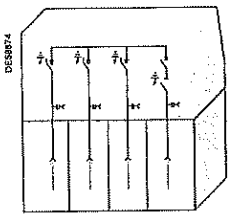
3 functions



Versions

C	C	C
C	C	T1
C	C	T2
C	RE	T1
C	RE	T2
R	RE	T1
R	RE	T2

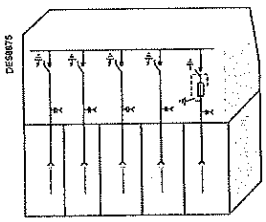
4 functions



Versions

C	C	C	C
C	C	C	T1
C	C	C	T2
C	T1	C	T1
C	T2	C	T2

5 functions (*)

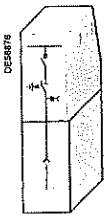


Versions

C	C	C	C	C
C	C	C	C	T1
C	C	T1	C	T1
C	C	C	T1	T1

FBX-E, extendable version

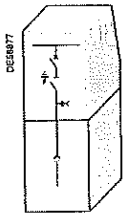
1 function



Versions

C
R
RE

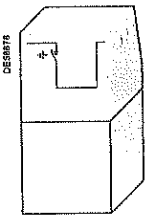
1 function



Versions

T1
T2

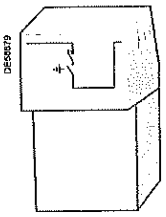
1 function



Version

Sb

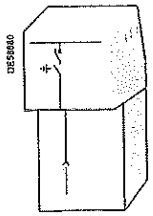
1 function (*)



Version

CBb

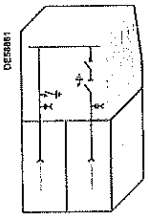
1 function



Version

CB

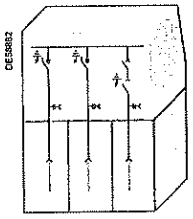
2 functions



Versions

C	C
C	T1
C	T2
T1	T1
T2	T2
RE	T1
RE	T2

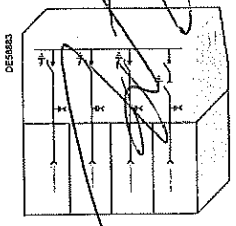
3 functions



Versions

C	C	C
C	C	T1
C	C	T2
C	RE	T1
C	RE	T2
R	RE	T1
R	RE	T2

4 functions



Versions

C	C	C	C
C	C	C	T1
C	C	C	T2
C	T1	C	T1
C	T2	C	T2

(*) Please consult us for availability of 5 functions switchboard and CBb function

Overall dimensions

Dimensions and weights of the FBX-C

Function	Number of functional units	Height (mm)	Depth (mm)	Width (mm)	Approximative weight (kg)
C-C	2	1380 (option 1040)	752	680	200
C-T1		1380 (option 1040)			200
C-T2		1380			240
RE-T1		1380 (option 1040)			210
RE-T2		1380			240
C-C-C	3	1380 (option 1040)	752	1000	320
C-C-T1		1380 (option 1040)			330
C-C-T2		1380			360
C-RE-T1		1380 (option 1040)			320
C-RE-T2		1380			360
R-RE-T1		1380 (option 1040)			320
R-RE-T2		1380			350
C-C-C-C	4	1380 (option 1040)	752	1320	440
C-C-C-T1		1380 (option 1040)			450
C-C-C-T2		1380			480
C-T1-C-T1		1380 (option 1040)			470
C-T2-C-T2		1380			530
C-C-C-C-C	5	1380 (option 1040)	752	1685	550
C-C-C-C-T1					550
C-C-T1-C-T1					550
C-T1-C-T1-T1				1805	570

Dimensions and weights of the FBX-E

Function	Number of functional units	Height (1) (mm)	Depth (mm)	Width (2) (3) (mm)	Approximative weight (kg)
M1	1	1380	720	1000	490
M2				1005	490
M3					490
M4				1010	490
C	1	1380	752	360	135
R					125
RE					135
T1				490	160
T2					190
CB			873	490	220
CBb				625	250
Sb			752	680	200
C-C	2	1380	752	680	210
C-T1					210
C-T2					240
T1-T1				1000	310
T2-T2					370
RE-T1				680	220
RE-T2					250
C-C-C	3	1380	752	1000	330
C-C-T1					340
C-C-T2					370
C-RE-T1					330
C-RE-T2					360
R-RE-T1					330
R-RE-T2					360
C-C-C-C	4	1380	752	1320	450
C-C-C-T1					460
C-C-C-T2					490
C-T1-C-T1					480
C-T2-C-T2					510

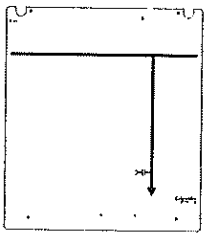
(1) With a 1250 A busbar on the top, add 217 mm.
(2) Add 17.5 mm for the busbar protective covers (right or left) at the extremity of the switchboard.
(3) To calculate the total width of several connected FBX-E switchboards, add 9 mm between each extension.

Contents

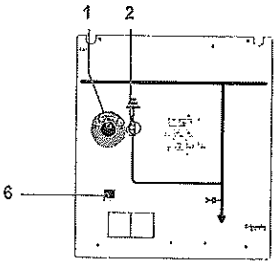
User interface

User interface description

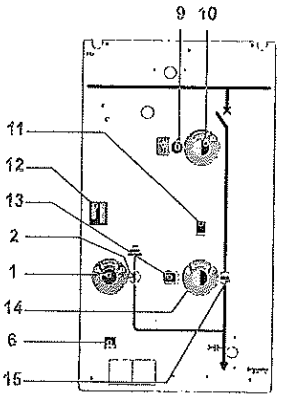
Thanks to its clear mimic diagram, the user interface makes it easy and safe to operate FBX.
Each switching device is equipped with an access point for the control lever and an indicator of the mechanical position.
The two earthing switches, both upstream and downstream from the MV fuse holders on the T1 switch-disconnector fuse combination, are activated simultaneously by a common mechanism.
The switch-disconnectors and vacuum circuit-breakers can be equipped, as an option, by a motorised control mechanism. In this case, a mechanical back-up crank handle is provided.



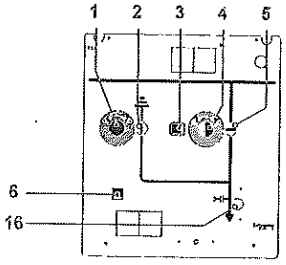
Direct incoming feeder without earthing switch (R)



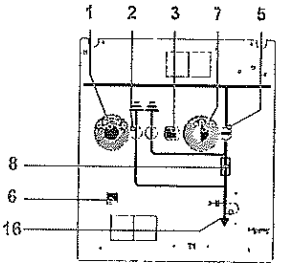
Direct incoming feeder with earthing switch (RE)



Transformer protection with vacuum circuit-breaker T2

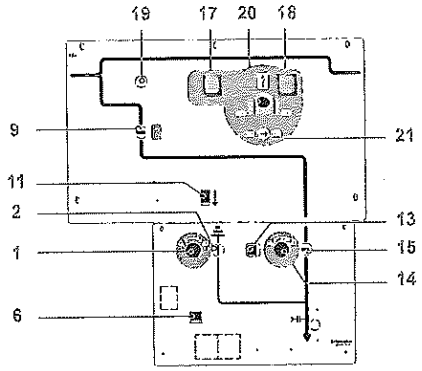


Incoming/outgoing feeder with switch-disconnector (C)

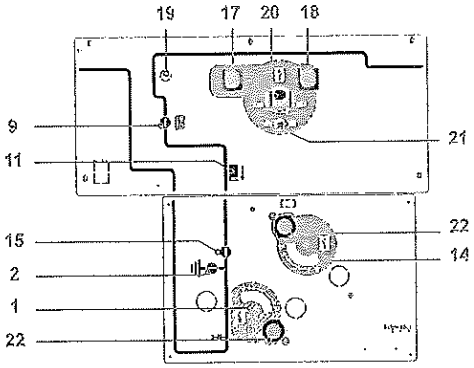


Outgoing feeder with T1 switch-disconnector fuse combination

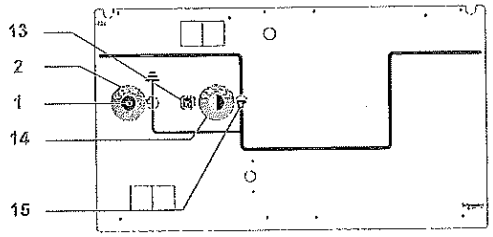
1 Lever hub socket for the earthing switch
2 Earthing switch position indicator
3 Interlocking between the switch-disconnector and earthing switch
4 Lever hub socket for the switch-disconnector
5 Switch-disconnector position indicator
6 Interlocking between the cable compartment door and the earthing switch
7 Lever hub socket for the switch-disconnector control mechanism in the transformer's outgoing feeder
8 Fuse tripping indicator
9 Vacuum circuit-breaker position indicator
10 Lever hub socket for the vacuum circuit-breaker control mechanism in the transformer's outgoing feeder
11 Interlocking of the vacuum circuit-breaker and disconnector
12 Protection relay tripping indicator
13 Interlocking between the disconnector and earthing switch
14 Lever hub socket for the disconnector
15 Disconnector position indicator
16 Optional: lever hub socket for the manual back-up operation of the switch-disconnector motorised mechanism (in this case, the opening 7 or 4 is blocked off at the factory)
17 Pushbutton to close circuit-breaker (CB, CBb)
18 Pushbutton to open circuit-breaker (CB, CBb)
19 Operations counter
20 Lever hub for circuit-breaker spring arming
21 Indicator light showing the status of the spring (primed or released)
22 Rotating button giving access to the hub socket



Feeder cable protection with vacuum circuit-breaker (CB)



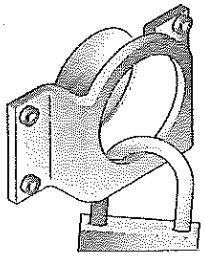
Busbar protection with vacuum circuit-breaker (CBb)



Busbar switch-disconnector (Sb)

Padlocking

The actuator's operating hub can be controlled by padlock (optional).



Obstruction of the lever hub socket by padlock

ВЯРНО С ОРИГИНАЛА

ИНЖЕНЕРИНГ ПЛОВДИВ ЕАД

Interlocks

Interlocking of the functional units

During the development of FBX switchboard, the accent was placed on personnel safety and the reliability of the operation.
An interlocking system prevents any incorrect use.
Thus, the operating levers can only be inserted if the service status permits it.

Access to the cables compartment and to the fuses is only possible if the appropriate outgoing feeder is connected to earth.
The switchboards are equipped in production series with the following interlocks:

Functional unit with switch-disconnector and earthing switch, switch-disconnector fuse combination (C, T1 and Sb functions)

Interrupting mechanism	Position	Interlock status...		
		Switch-disconnector	Earthing switch	Cables compartment panel or fuses
Switch-disconnector	Closed	–	Locked	Locked
	Open	–	Unlocked	Locked, if earthing switch is open
Earthing switch (ES)	Closed	Locked	–	Unlocked
	Open	Unlocked	–	Locked
Cable or fuses compartment panel (Sb function not concerned)	Removed	Locked	Locked	–
	Fitted	■ Unlocked, if earthing switch is open ■ Locked, if earthing switch is closed	Unlocked	–

Option: switch-disconnector – locking of the cables compartment panel, for example, for the cable tests.

Functional unit with vacuum circuit-breaker, disconnector and earthing switch (T2, CB and CBb function)

Interrupting mechanism	Position	Interlock status...						
		Disconnector		Earthing switch		Circuit-breaker		Cable compartment panel (not CBb)
		Open	Closed	Open	Closed	Open	Closed	
Disconnector (Disc.)	Open	–	–	Unlocked	Unlocked	Unlocked	Unlocked	–
	Closed	–	–	Locked	–	Unlocked	Unlocked	–
Earthing switch (ES)	Open	Unlocked	Unlocked	–	–	Unlocked	Unlocked	Locked
	Closed	Locked	–	–	–	Unlocked	Unlocked	Unlocked
Circuit-breaker	Open	■ Unlocked if ES open ■ Locked if ES closed	Unlocked	■ Unlocked if DISC open ■ Locked if DISC closed	Unlocked	–	–	–
	Closed	Locked	Locked	■ Unlocked if DISC open ■ Locked if DISC closed	Unlocked	–	–	–

Extensibility

Extensibility of FBX-E

- FBX-E offers extensible configurations for secondary distribution applications.
- The connection of each functional unit allows for multiple combinations depending on the installation requirements.
- FBX-E permits the connection of additional units on the left or right-hand side, thereby offering greater flexibility in the choice and positioning of the medium voltage switchboard functions.
- The installation and in-line connection of FBX-E does not require any handling of gas.
- Maximum current: 630 A

Erection and assembly

The extension is a very simple process thanks to:

- The A-link device used to connect the busbars of two cubicles.

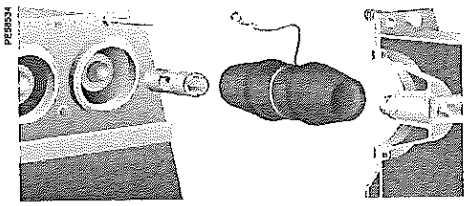
Variations in positioning are compensated by fixed, spherical contacts and mobile couplings that can be adjusted axially and radially.

- Highly secure dielectric seals made with silicone insulating conical connectors adapted to the electrical voltage.

The assembly of the insulating connectors is maintained by a mechanical force generated by:

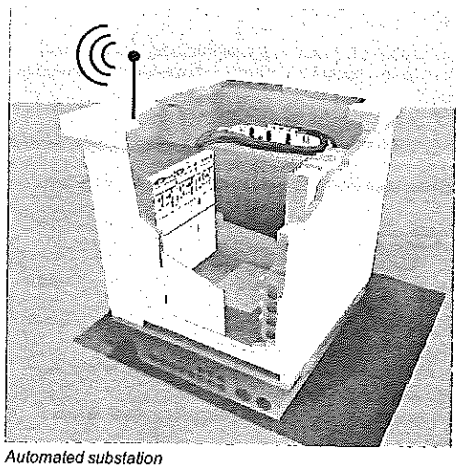
- Integrated guiding pins for the correct alignment of the cubicles
- An assembly by bolts secured by mechanical stops.

During the assembly of an extension cubicle, an additional space of at least 450 mm is necessary to allow for handling.



A-Link device for the in-line connection of the FBX-E

Remote control



Automated substation

Remote control & monitoring

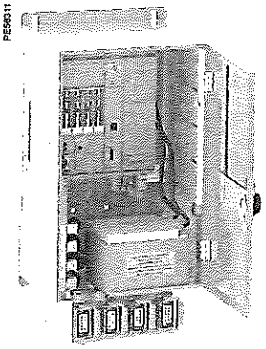
FBX can be motorized by functional units allowing for the remote control and monitoring of the components of FBX.
Complete automation of the network is therefore possible and avoids costly human interventions on the site.

To enable communication with the network control centres, FBX integrates communication systems such as:
- Modem solutions for telephone lines
- Radio
- The GSM network.

Possible equipment levels for remote control and monitoring are detailed in the table below.

The levels correspond to the basic variants. Level 3 includes the control relays, local/remote selector switches and microswitches.
Other documents covering the level of equipment for monitoring (Lvl 1) and integrated remote control & monitoring (Lvl 3) are available on request.

Standard Action	Equipment level
No indication at the terminal	0
Indications at a terminal block	1
Indications and motor control at the terminal	2
Signalling and motor control management via the power relays	3
Remote control system with modem - to control and monitor the switchboard via communications systems such as telephones, optical fibre networks, or GSM networks.	4



T200 I remote terminal unit

Easergy T200 I: an interface designed for telecontrol of MV networks

Easergy T200 I is a "plug and play" or multifunction interface that integrates all the functional units necessary for remote supervision and control of the FBX:
- acquisition of the different types of information: switch position, fault detectors, current values...
- transmission of switch open/close orders
- exchanges with the control center.

Required particularly during outages in the network, Easergy T200 I is of proven reliability and availability, being able to ensure switchgear operation at any moment. It is simple to set up and to operate.

Functional unit designed for the Medium Voltage network

- Easergy T200 I is designed to be connected directly to the MV switchgear, without requiring a special converter.
- It has an integrated MV network fault current detection system (overcurrent and zero sequence) with detection set points that can be configured channel by channel (current value and fault current duration).
- Open communications thanks to appropriate protocols (IEC101/104, DNP3 or Modbus) and large choice of media (GSM/GPRS, radio, telephone, etc.).
- Automation function with an optional Auto-transfer-switch capability for power source permutation.

Medium Voltage switchgear operating guarantee

- It is a backed up power supply which guarantees continuity of service for several hours in case of loss of the auxiliary source, and supplies power to the Easergy T200 I and the MV switchgear motor mechanisms.

Cable compartment

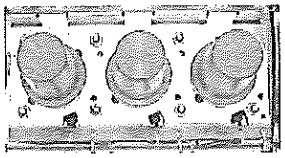
The cables connection compartment has been designed to accept connection systems that are:
- Completely insulated
- In metallic housing
- Partially insulated.

Cable support mountings are adjustable horizontally and vertically to enable installation of various cable systems. The cable mountings are equipped with either round or long holes for standard cable terminals.
Additional support structures can be supplied (available only in the 1,380 mm height version) for the installation of two cables per phase cable plug-in connections or surge arresters.

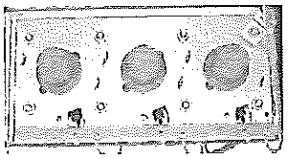
Bushing connector cones in accordance with NF-EN-50181:

Switchboard function	R / RE	C	T1	T2 / CB
Connector cone Type A (250 A)	–	–	■	–
Connector cone Type C (630 A)	■	■	■ (optional)	■

FBX switchboard is equipped with PF250 or PF630 plug-in bushings:

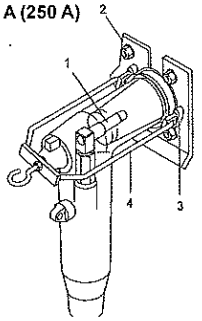


C / T2 / CB / T1 (optional on T1):
PF630 plug-in bushing
NF EN 50181, with C type connection
(Ir: 630 A; Ø M16 mm)



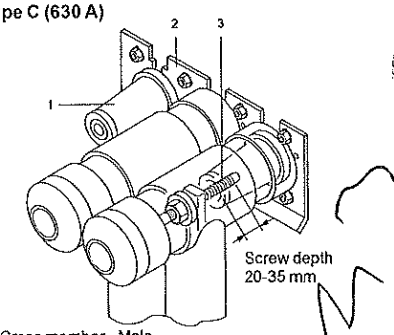
T1 (as standard):
PF250 plug-in bushing
NF EN 50181, with A type connection
(Ir: 250 A; contact finger Ø M7.9 +0.02/-0.05 mm)

Type A (250 A)



1 - Sliding contact pin
2 - Support plate
3 - Mounting flange
4 - Mounting device

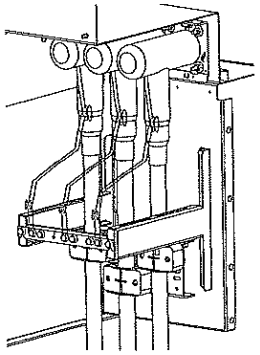
Type C (630 A)



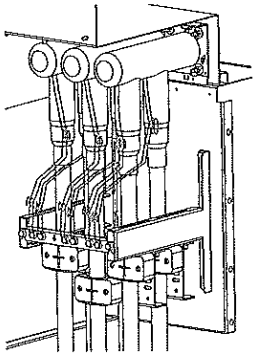
1 - Cross member - Male
2 - Support plate
3 - Screw contact

Type of connection

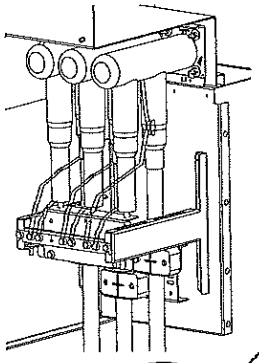
FBX cable compartment is spacious and allows for various connections (cf. § Selection of cables):
- Single cable per phase
- Two cables per phase
- Single cable per phase + surge arresters
- A triple cable per phase connection is also available (please consult us).



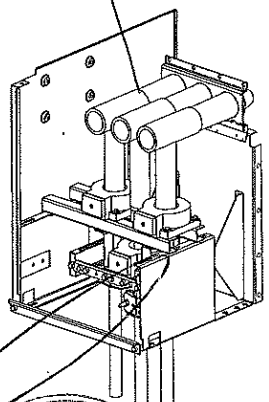
Single cable per phase connection



Two cables per phase (only available in the FBX 1,380 mm height version)

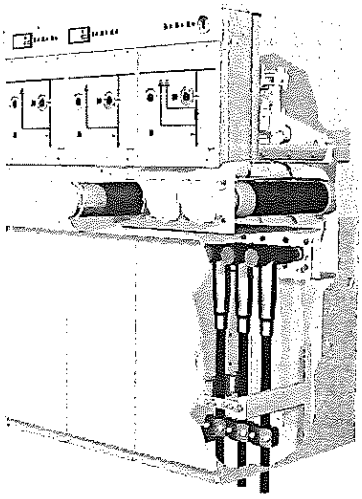


Cables & surge arresters (only available in the FBX 1,380 mm height version)

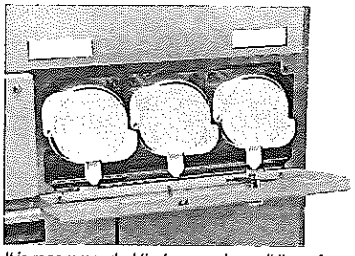


CB cable compartment with metering CT cores

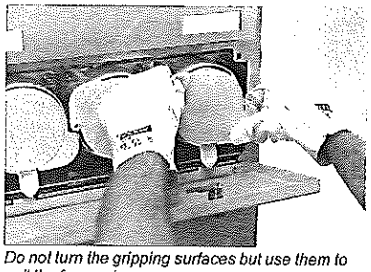
Fuse compartment



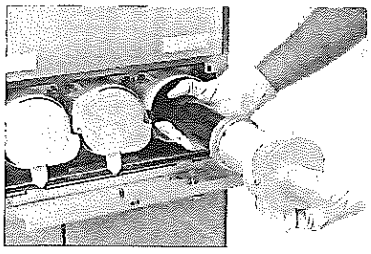
FBX with fuse protection



It is recommended that you replace all three fuses at the same time



Do not turn the gripping surfaces but use them to pull the fuse out



Removal of the fuse

Fuse compartment

The fuses are located within plugged and insulated fuse-holders. These fuse holders are integrated into the gas tank and offer the following advantages:

- The electrical field is placed in the SF6 gas,
- The fuse-holder plugs are placed outside the electrical field which is contained in the tank filled with SF6 gas,
- The fuse-holder is located in the tank and cannot be affected by outside elements,
- The dielectric strength of the plug is thus not ensured by the compression of a seal but by an insulating distance.

Available option: watertight plugs.

Fuse tripping

The stored energy mechanism and the tripping striker open all three phases thanks to the switch-disconnector. If the striker on a single HV fuse is actuated, all three phases are disconnected.

Fuse replacement

The interlocking guarantees maximum safety for the personnel during the replacement of fuses. The fuse compartment panel can only be opened if it has been earthed correctly. Inversely, the earthing can only be removed once the fuse compartment panel is closed and locked.

Two earthing switches with making capacity (both upstream and downstream from the fuses) allow the fuses to be replaced without using auxiliary equipment. The two earthing switches with making capacity are operated by a common spring loaded mechanism.

Contents

C, Sb, R, RE functions

Characteristics of the C, Sb, R, RE functions (switch-disconnector) (1)

Rated voltage			kV	12			17.5		24	
Rated frequency			Hz	50/60			50/60		50/60	
Rated lightning impulse withstand voltage										
Directly earthed			kV	75			95		125	
On the sectionalized distance			kV	85			110		145	
Rated power frequency withstand voltage										
Directly earthed			kV	28			38		50	
On the sectionalized distance			kV	32			45		60	
Level of insulation for the SF6 pressure - Pre = 0.00 MPa										
Rated lightning impulse withstand voltage			kV	75			95		95	
Rated power frequency withstand voltage			kV	28			38		50	
Level of insulation of the sectionalized distance for the cable test										
Energized busbar		Ur	kV	12			17.5		24	
Maximum AC feeder test voltage (30 min)			kV 0.1 Hz	18			26		35	
Maximum DC feeder test voltage (15 min)			kV	48			60		96 (2)	
Rated current										
Busbar, C, R, RE functions			A	630 / 1250			630 / 1250		630 / 1250	
Busbar, Sb function			A	630			630		630	
Outgoing feeder			A	630			630		630	
Rated peak current			kA	40	52.5	62.5	40	52.5	40	50
Rated short-circuit making capacity			kA	40	52.5	62.5	40	52.5	40	50
Rated short time current, main electrical circuit		1 s	kA	16	21	25	16	21	16	20
		3 s	kA	16	21	–	16	21	16	20
Rated short-time current of earthing circuit		1 s	kA	16	21	25	16	21	16	20
		3 s	kA	16	21	–	16	21	16	20
Rated network load and closed-loop breaking current			A	630			630		630	
Rated no-load cable-breaking current		C1	A	160			160		160	
Rated breaking current under earth fault conditions			A	600			600		600	
Rated no-load cable breaking current under earth fault conditions			A	277			277		277	
Number of operating cycles without inspection										
Mechanical: Switch-disconnector/ Earthing switch		M1/–		1000			1000		1000	
Electrical: Rated current E		E3		100			100		100	
Short circuit making	Switch-disconnector	E3		5			5		5	
	Earthing switch	E2		5			5		5	

(1) General use switch. The characteristics of the switch-disconnector are not applicable to the R and RE functions.
(2) For the first cable test on a new unit. Later tests can be carried out at 67 kV.

T1 function

Characteristics of the T1 function (switch-disconnector/fuse combination)

Rated voltage		kV	12				17.5		24	
Rated frequency		Hz	50/60				50/60		50/60	
Rated lightning impulse withstand voltage										
Directly earthed		kV	75				95		125	
On the sectionalized distance		kV	85				105		145	
Rated power frequency withstand voltage										
Directly earthed		kV	28				38		50	
On the sectionalized distance		kV	32				45		60	
Level of insulation for the SF6 pressure - Pre = 0.00 MPa										
Rated lightning impulse withstand voltage		kV	75				95		95	
Rated power frequency withstand voltage		kV	28				38		50	
Rated current for continual service										
Busbar		A	630 / 1250				630 / 1250		630 / 1250	
Outgoing feeder		A	Refer to the fuses selection table							
Rated peak current, main circuit (prospective current, limited by fuses)		A	40	52.5	52.5	62.5	40	52.5	40	50
Rated short-time current, downstream of fuse protection circuit	1 s	kA	1	1	5	5	1	5	1	5
	3 s	kA	–	–	3	3	–	3	–	3
Rated peak current, downstream of fuse protection circuit		kA	2.5	2.5	13	13	2.5	13	2.5	13
Rated short circuit making current, downstream of fuse protection circuit		kA	2.5	2.5	13	13	2.5	13	2.5	13
Rated short-time current of earthing circuit	1 s	kA	16	21	21	25	16	21	16	20
	3 s	kA	16	21	21	–	16	21	16	20
Rated no-load cable-breaking current		A	60				60		60	
Rated breaking current under earth fault conditions		A	200				200		200	
Rated no-load cable breaking current under earth fault conditions		A	87				87		87	
Rated transfer current in accordance with IEC 62271-105		A	2000				1100		1100	
Opening time in the case of fuse striker tripping T_0		ms	34				34		34	
Number of operating cycles without inspection										
Mechanical: Switch-disconnector/ Earthing switch		M1/–	1000				1000		1000	
Electrical: Rated current E		E1 (1)	10				10		10	
Short circuit making Switch-disconnector		E3	5				5		5	
Earthing switch		E2	5				5		5	

(1) E3 (100 x rated current) on request.

716

T2 function

Characteristics of the T2 fixed circuit-breaker

Rated voltage			kV	12			17.5		24		
Rated frequency			Hz	50/60			50/60		50/60		
Rated lightning impulse withstand voltage											
	Directly earthed		kV	75			95		125		
	On the sectionalized distance		kV	85			105		145		
Rated power frequency withstand voltage											
	Directly earthed		kV	28			38		50		
	On the sectionalized distance		kV	32			45		60		
Level of insulation for the SF6 pressure - Pre = 0.00 MPa											
	Rated lightning impulse withstand voltage		kV	75			95		95		
	Rated power frequency withstand voltage		kV	28			38		50		
Level of insulation of the sectionalized distance for the cable test											
	Energized busbar	Ur	kV	12			17.5		24		
	Maximum AC feeder test voltage (30 min)		kV 0.1 Hz	18			26		35		
	Maximum DC feeder test voltage (15 min)		kV	48			60		96 (2)		
Rated current											
	Busbar		A	630 / 1250			630 / 1250		630 / 1250		
	Outgoing feeder		A	400 / 630			400 / 630		400 / 630		
Rated peak current			kA	40	52.5	62.5	40	52.5	40	50	
Rated short-circuit making capacity			kA	40	52.5	62.5	40	52.5	40	50	
Rated short time current, main electrical circuit		1 s	kA	16	21	25	16	21	16	20	
		3 s	kA	16	21	–	16	21	16	20	
Rated short-time current of earthing circuit		1 s	kA	16	21	25	16	21	16	20	
		3 s	kA	16	21	–	16	21	16	20	
Rated short circuit breaking current			kA	16	21	25	16	21	16	20	
Percentage of the direct current component			%	28			28		28		
Rated operating sequence (1)				O - 3 min CO							
Rated no-load cable-breaking current			A	25			31.5		31.5		
Number of operating cycles without inspection											
Mechanical:	Vacuum circuit-breaker		M1	2000			2000		2000		
	Disconnector/ Earthing switch		M0/–	1000			1000		1000		
Electrical:	Short circuit making	Disconnector	E2	5			5		5		
		Earthing switch	E2	5			5		5		
	Vacuum circuit-breaker	At E2 rated current		2000			2000		2000		
		At rated short circuit breaking current		50			50		50		

(1) Spring-loaded current making and breaking mechanism with stored energy and motor.
(2) For the first cable test on a new unit. Later tests can be carried out at 67 kV.

CB, CBb functions

Characteristics of the CB, CBb functions (vacuum circuit-breaker)

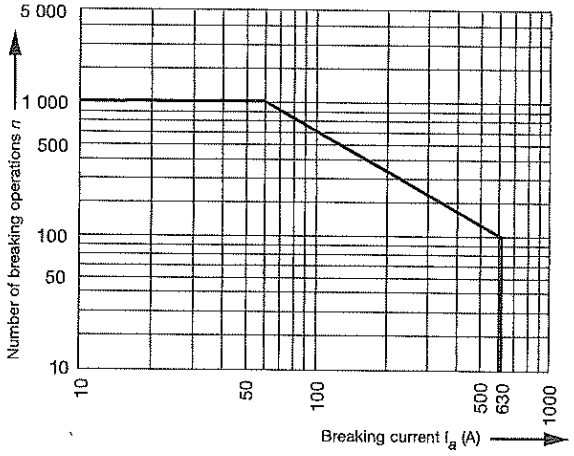
Rated voltage			kV	12			17.5		24	
Rated frequency			Hz	50/60			50/60		50/60	
Rated lightning impulse withstand voltage										
Directly earthed			kV	75			95		125	
On the sectionalized distance			kV	85			110		145	
Rated power frequency withstand voltage										
Directly earthed			kV	28			38		50	
On the sectionalized distance			kV	32			45		60	
Level of insulation for the SF6 pressure - Pre = 0.00 MPa										
Rated lightning impulse withstand voltage			kV	75			95		95	
Rated power frequency withstand voltage			kV	28			38		50	
Level of insulation of the sectionalized distance for the cable test										
Energized busbar		Ur	kV	12			17.5		24	
Maximum AC feeder test voltage (30 min)			kV 0.1 Hz	18			26		35	
Maximum DC feeder test voltage (15 min)			kV	48			60		96 (2)	
Rated current for continual service										
Busbar, CB function			A	630 / 1250			630 / 1250		630 / 1250	
Busbar, CBb function			A	630			630		630	
Circuit-breaker			A	630			630		630	
Rated peak current			kA	40	52.5	62.5	40	52.5	40	52.5
Rated short-circuit making capacity			kA	40	52.5	62.5	40	52.5	40	52.5
Rated short time current, main electrical circuit		1 s	kA	16	21	25	16	21	16	21
		3 s	kA	16	21	–	16	21	16	21
Rated short-time current of earthing circuit		1 s	kA	16	21	25	16	21	16	21
		3 s	kA	16	21	–	16	21	16	21
Rated short circuit breaking current			A	16	21	25	16	21	16	21
Percentage of the direct current component			%	40			40		40	
Rated operating sequence (1)				O - 0,3 s - CO - 15 s - CO						
Rated no-load cable-breaking current			A	25			31.5		31.5	
Rated operating time										
Opening with tripping release			ms	40 to 50			40 to 50		40 to 50	
Breaking with tripping release			ms	55 to 65			55 to 65		55 to 65	
Arcing			ms	< 15			< 15		< 15	
Closing			ms	30			30		30	
Number of operating cycles without inspection										
Mechanical: Vacuum circuit-breaker			M1	2000			2000		2000	
Disconnector/ Earthing switch			M0/–	1000			1000		1000	
Electrical: Short circuit making	Disconnector		E2	5			5		5	
	Earthing switch		E2	5			5		5	
Vacuum circuit-breaker			At rated current	2000			2000		2000	
	At rated short circuit breaking current			50			50		50	

(1) Spring-loaded current making and breaking mechanism with stored energy and motor.
(2) For the first cable test on a new unit. Later tests can be carried out at 67 kV.

Maximum number of mechanism operations

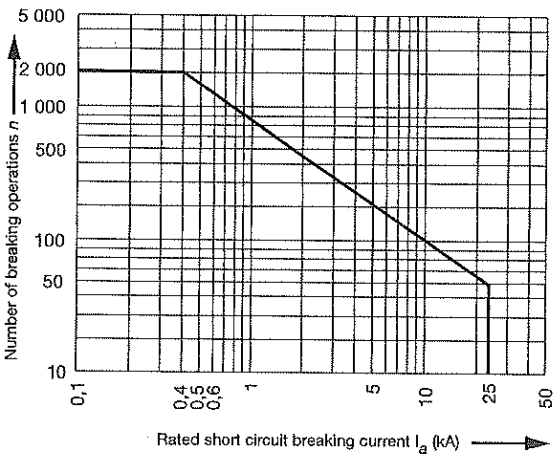
C function

Cable incoming or outgoing feeder with switch-disconnector (C)
Rated current 630 A



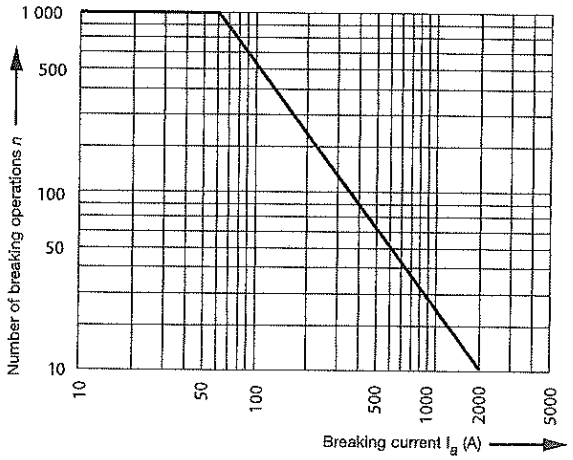
T2 / CB / CBb functions

Transformer protection with circuit-breaker (T2 / CB / CBb)
Rated current 200-400/630 A



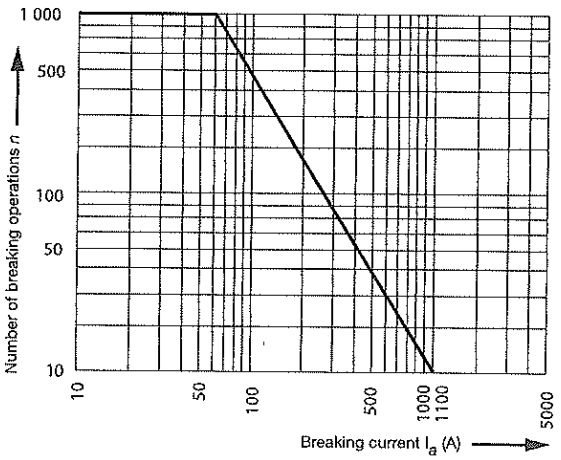
T1 function

Transformer protection with switch-disconnector
and associated fuse (T1),
12 kV transfer current 2000 A



T1 function

Transformer protection with switch-disconnector
and associated fuse (T1),
24 kV transfer current 1100A *(higher values on request)*



Choice of mechanisms and equipment

Mechanism operating principles

SFU or CD 110 (tumbler)

It is a tumbler mechanism with a dead point passage. The energy is stored by tumbler mechanism.

■ **Manual:** the opening or closing operation is manual and independent of the operator. The operation is performed without any duration or time constraint

■ **Motorized:** the opening or closing operations are performed by a motor without duration or time constraint.

SF (tumbler with 1 latch for opening)

It is a tumbler mechanism for closing, with a latch-in feature for opening. The energy needed for opening is stored while closing.

■ **Manual:** the operator manually closes the switch-disconnector in one single operation, and in the same time loads a spring for next opening. The mechanism is thus ready for a snap opening operation. Tripping can be performed with a coil, a fuse striker or a push-button.

■ **Motorized:** the closing operation is performed by a motor. The opening operating can be done with the motor or with a shutter release.

SU or CD 110 (tumbler)

It is a tumbler mechanism for closing operation.
The opening is manual and dependent of the operator, a spring is loaded and stores energy for next closing.
The closing is independent of the operator, the energy is released from the spring and closes the earthing switch in a snap operation.

C 150 mechanism

These operating mechanisms use the energy stored by springs to close and open the circuit-breaker on the CB and CBb functions. There are two types:

■ **Manual:** the operator manually operates to load the control mechanism's spring. The spring is held in place by a latch, freed manually by a mechanical button, causing:
□ the release of the spring
□ the closing of the CB
□ the arming of the trip spring, now held in place by a latch.
It is thus possible to open the circuit-breaker by freeing the trip spring latch manually (mechanical button) or electrically (electro-magnet).
Note: with the circuit-breaker closed, it is possible to rearm the closing spring, which authorises a rapid re-closure cycle.

■ **Motorized:** the closing spring is armed by a motor (arming time < 7 s). Opening and closure operations are carried out electrically (magnets).
Note: It is possible to manually arm, close and trip the circuit-breakers.

Functions									
Type of operating mechanism		**C**	**T1**	**T2**	**R**	**Re**	**CB**	**CBb**	**Sb**
Switch-disconnector	SFU or CD 110	■ SFU	–	■ SFU	–	–	■ SFU	■ CD 110	■ SFU
	SF	□	■	–	–	–	–	–	□
Earthing switch	SU or CD 110	■ SU	■ SU	■ SU	–	■ SU	■ SU	■ CD 110	■ SU
Circuit-breaker	SF	–	–	■	–	–	–	–	–
	C150	–	–	–	–	–	■	■	–
Equipment		**C**	**T1**	**T2**	**R**	**Re**	**CB**	**CBb**	**Sb**
Manual opening and closing		■	■	■	–	■	■	■	■
Mechanical position indicator		■	■	■	–	■	■	■	■
Motorization		□	□	□	–	–	□	□	□
Trip coil		□ if SF drive	□	□	–	–	■	■	–
2nd trip coil		–	–	□	–	–	□	□	–
Autonomous tripping device without any auxiliary source (striker)		–	–	–	–	–	□	□	–
Undervoltage tripping coil		–	–	–	–	–	□	□	–
Closing coil		–	–	–	–	–	□	□	–
Operating counter		–	–	□	–	–	□	□	–
Auxiliary contacts		**C**	**T1**	**T2**	**R**	**Re**	**CB**	**CBb**	**Sb**
Switch-disconnector position	Manual: 2 NO + 2 NC Motorized: 2 NO + 2 NC	□	□	–	–	–	–	–	–
Earthing switch position	1 NO and 1 NF	□	□	□	–	□	□	□	–
Vacuum circuit-breaker position	Manual: 2 NO + 2 NC Motorized: 2 NO + 2 NC	–	–	□	–	–	□	□	–
Fuse blown indicators	2 O/C inverters	–	□	–	–	–	–	–	–

Legend: ■ Standard
□ Option

The connection and wiring diagrams for the motorized mechanism, the magnetic tripping devices and auxiliary contacts are supplied in the event of an order.

718

SFU/SU, SF/SU, CD 110 operating mechanisms

Electrical characteristics of the SFU/SU, SF/SU, CD 110 operating mechanisms

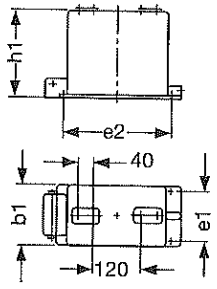
Reference standards			IEC								
Type of current			DC						AC		
Rated supply voltage		V	24	48	60	110	125	220	100/110	120/125	230
Frequency		Hz	–						50/60		
Rearming motor											
Voltage range		% of Un	85 to 110						85 to 110		
Max. absorbed power			150 W						150 VA		
Starting current	SFU/SU or SF/SU drive	A	13.3	12.1	8.4	4.7	4.1	2.5	6.9	6.8	3.7
	CD 110 drive	A	4.0	9.5	11.7	2.0	2.3	0.8	2.5	2.5	1.1
Absorbed current	SFU/SU or SF/SU drive	A	5.5	2.8	2.2	1.2	1.1	0.6	2.3	2.2	1.2
	CD 110 drive	A	1.0	1.0	1.1	0.3	0.3	0.1	0.5	0.5	0.2
Rearm time	SFU/SU or SF/SU drive	s	< 6						< 6		
	CD 110 drive	s	9	4	3	6	5	6	5	5	5
Trip coil											
Coil current		A	6	3	2.5	1	1	0.5	1	0.9	0.5
Auxiliary contacts											
Rated voltage		V	24	48	60	110	125	220	100/110	120/125	230
Rated current		A	10						10		
Short circuit current, 30 ms		A	100						100		
Breaking capacity (L/R ≤ 20 ms)	SFU/SU or SF/SU drive	A	8	4	3	2	1	0.5	–		
Breaking capacity (L/R ≤ 0.33 ms)	CD 110 drive	A	16	2.5	–	0.4	0.4	0.2	–		
Breaking capacity U ≤ 230 Vac (resistive)	SFU/SU or SF/SU drive	A	–						10		
Breaking capacity U ≤ 230 Vac (resistive) cos φ = 0.9	CD 110 drive	A	–						16		

Electrical characteristics of the C150 operating mechanisms

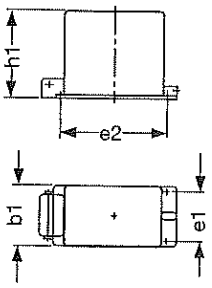
Reference standards			IEC	
Type of current			DC	AC
Rated supply voltage		V	24 - 48 - 60(*) - 110 - 125 - 220	120 - 230
Frequency		Hz	–	50/60
Rearming motor				
	Voltage range	% of Un	85 to 110	85 to 110
	Max. absorbed power		100 W	150 VA
	Starting current	A	28.6 A / 24 Vdc 12.8 A / 48 Vdc 6.2 A / 110 Vdc 5.2 A / 125 Vdc 3.1 A / 220 Vdc	8.6 A / 110 Vac 4.4 A / 230 Vac
	Absorbed current	A	8.8 A / 24 Vdc 5.1 A / 48 Vdc 1.7 A / 110 Vdc 2.1 A / 125 Vdc 0.7 A / 220 Vdc	3.5 A / 110 Vac 1.8 A / 230 Vac
	Rearm time	s	< 6.5	< 6.5
Tripping device				
Tripping coil				
	Voltage range	% of Un	70 to 110	85 to 110
	Absorbed power	W/VA	960 W / 24 Vdc 470 W / 48 Vdc 620 W / 110 Vdc 521 W / 125 Vdc 386 W / 220 Vdc	502 VA / 120 Vac 422 VA / 230 Vac
Undervoltage coil				
	Closing voltage range	% of Un	> 35	> 35
	Tripping voltage	% of Un	70 to 35	70 to 35
	Absorbed power	W/VA	240 W - 4.6 W / 24 Vdc 256 W - 4.7 W / 48 Vdc 172 W - 4.0 W / 110 Vdc 166 W - 4.2 W / 125 Vdc 193 W - 3.5 W / 220 Vdc	164 VA - 4.5 VA / 120 Vac 266 VA - 4.1 VA / 230 Vac
Autonomous tripping device without any auxiliary source (striker)			The low energy release type MITOP, trips at 200 µF / 12 V Trip energy ≤18 mJ	
Closing device				
	Voltage range	% of Un	85 to 110	85 to 110
	Absorbed power	W/VA	960 W / 24 Vdc 470 W / 48 Vdc 620 W / 110 Vdc 521 W / 125 Vdc 386 W / 220 Vdc	502 VA / 120 Vac 422 VA / 230 Vac
Auxiliary contacts				
Rated current		A	10	10
Breaking capacity 110 Vdc (L/R = 10 ms)		A	1	–
Breaking capacity 230 Vac Cos φ = 0.4		A	–	10

(*) Please consult us.

M function



Current transformer (C)
(DIN 42600, Section 8)



Single phase voltage transformer (W)
(DIN 42600, Section 9)

Characteristics of the M function

Current and voltage transformers in compliance with the DIN 42600 standard (narrow version) must be used in metering cubicles.

Remarks:

- Installation of current and voltage metering devices is possible with or without a selector switch,
- Option: a voltage indicator can be added
- Pre-assembled cable connections can be purchased as an option.

Dimensions	Um (kV)	
	12 kV version	24 kV version
b1	148	178
e1	125	150
e2	270	280
h1	220	280

Contents

Fuses
Selection of HV fuses

Types of HV fuse

To protect distribution transformers, we recommend that you use Schneider Electric Fusarc-CF HV fuses that have been thoroughly tested with FBX. These fuses have an integrated thermal striker which is activated at a certain temperature threshold, in compliance with the selection tables. The fuse with thermal striker operates:
- In case of overcurrent
- In case of accidental damage.

It then switches off the switch-disconnector which avoids a thermal overload in the fuse holder.

Necessary data when placing an order

The following data must be specified:
- Transformer power
- Transformer service voltage.

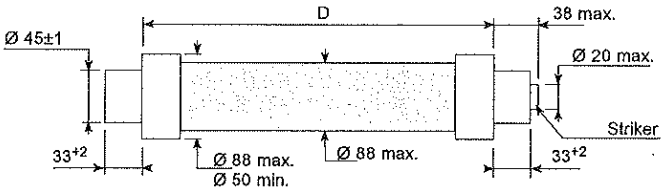
Rated current of suitable HV fuses is then given by the selection tables.
If not applicable, please consult us.

Technical characteristics

The fuses meet the following standards:
- Protection of the distribution transformers in compliance with the IEC 60787 standard.
- Fuses in compliance with the IEC 60282-1 standard.
- Specifications of the IEC 62271-105 standard.
- Maximum ambient temperature for the switchboards: 40°C in accordance with standards IEC 62271-1. For higher temperature conditions, please consult us.
- HV fuses can bear 1.3 times the transformer's rated current for a minimum of ten hours.
- The interruption is made at 1.5 times the transformer's rated current for two hours.

Voltage	D (mm)
Up to 12 kV	292 (with adaptor to extend to 442 mm)
Up to 12 kV	442
17.5 kV	442
24 kV	442

HV fuse



Spare fuses

Spare fuses must meet the following requirements:
- Dimensions in compliance with technical data sheet 1 (type 1, line 1), IEC 60282-1 publication.
- "Medium" type of striker with a maximum initial tripping force of 80 N.
- When using spare fuses without tripping with a thermal limitation integrated striker, the following requirements must be fulfilled:
  - in case of overcurrents, the interruption must be carried out by LV fuses
  - if the switchboard is installed in an exposed area, in which the fuse links may be submitted to damage due to transient events (e.g. lightning), all the fuses must be replaced in accordance with the appropriate maintenance intervals.

If these requirements are not fulfilled, only the backup HV fuses with integrated tripping of the striker and thermal limitation must be used in the FBX switchboard to protect from a thermal overload.

Fuses
Selection tables

Fusarc-CF type as per IEC		Power of transformer (kVA)																		
		25	50	63	80	100	125	160	200	250	315	400	400	500	630	800	1000	1250	1500	1600
		Uk = 4%											Uk = 6%							
Fuse rated voltage (kV)	Transformer service voltage (kV)	Rated current for fuses (A)																		
7.2	3	10	25	25	31.5	40	50	50	80	100	100(2)	–	–	–	–	–	–	–	–	–
7.2	3.3	10	25	25	31.5	40	40	50	63	80	100(2)	–	–	–	–	–	–	–	–	–
7.2	5.5	6.3	16	16	20	25	31.5	31.5	40	50	63	80	80(1)	100 (1) (2)	–	–	–	–	–	–
7.2	6	6.3	10	16	20	25	25	40	40	50	63	80	63	80(1)	100 (1) (2)	–	–	–	–	–
7.2	6.6	6.3	10	16	16	25	25	31.5	40	50	63	63	63(1)	80(1)	80(2)	–	–	–	–	–
12	10	–	–	10	10	16	20	25	25	31.5	40	50	40	50	63(2)	80 (1) (2)	–	–	–	–
12	11	–	6.3	10	10	16	16	25	25	31.5	40	40	40	63(1)	63(1)	80 (1) (2)	–	–	–	–
24	13.8	4	6.3	6.3	10	10	16	16	20	25	31.5	31.5	31.5	40	50 (1) (2)	63 (1) (2)	–	–	–	–
24	15	4	6.3	6.3	10	10	16	20	20	25	31.5	31.5	31.5	40(1)	50 (1) (2)	63 (1) (2)	–	–	–	–
24	20	–	–	6.3	6.3	10(1)	10	16	16	20	25	25	25	31.5 (1)	40(1)	40 (1) (2)	63 (1) (2)	–	–	–
24	22	–	–	6.3	6.3	6.3	10	10	16	16	25	25	25(1)	31.5 (1)	40(1)	40(2)	50 (1) (2)	63 (1) (2)	–	–

(1) With mechanical time-delay device 70 ms.
(2) Without transformer overload.

Siemens Fusarc HV fuses selection table

Fusarc-CF type as per DINVDE		Power of transformer (kVA)																			
		25	50	63	80	100	125	160	200	250	315	400	500	630	630	800	1000	1250	1500	1600	2000
		Uk = 4%													Uk = 6%						
Fuse rated voltage (kV)	Transformer service voltage (kV)	Rated current for fuses (A)																			
7.2	6	6.3	10	16	20	25	25	40	40	50	63	80	100	100 (2)	100 (1) (2)	–	–	–	–	–	–
12	10	–	–	10	10	16	20	25	25	31.5	40	50	63	80	63(2)	80 (1) (2)	–	–	–	–	–
24	15	4	6.3	6.3	10	10	16	20	20	25	31.5	31.5	50	63	50 (1) (2)	63 (1) (2)	–	–	–	–	–
24	20	–	–	6.3	6.3	10(1)	10	16	16	20	25	25	40	40	40(1)	40 (1) (2)	63 (1) (2)	–	–	–	–

(1) With mechanical time-delay device 70 ms.
(2) Without transformer overload.

HV fuses (SIBA) selection table with mechanical striker (not delivered)

Type Siba HH-DIN		Power of transformer (kVA)																			
		25	50	63	80	100	125	160	200	250	315	400	500	630	630	800	1000	1250	1500	1600	2000
		Uk = 4%													Uk = 6%						
Rated voltage (kV)	Service voltage (kV)	Rated current for fuses (A)																			
7.2	6	–	–	–	–	25	–	40	–	50	63	80	100	125	100	125	160(1)	–	–	–	–
12	10	–	–	–	–	16	–	25	–	32	40	50	63	80	63	80	100	100	–	160(1)	160
17.5	15	–	–	–	–	16	–	20	–	32	32	40	50	63(1)	50	63(1)	63(1)	80(1)	–	–	–
24	20	–	–	–	–	10	–	16	–	20	25	32	40	40	40	40	50	80(3)	–	100 (1) (3)	125 (1) (3)

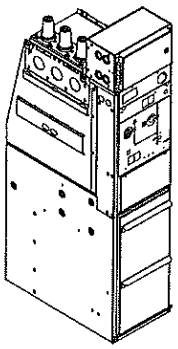
(1) With mechanical time-delay device.
(3) Specific SSK type fuses.

Other HV fuses also available with FBX such as Ferraz fuses or Jean Müller IKUS type fuses.

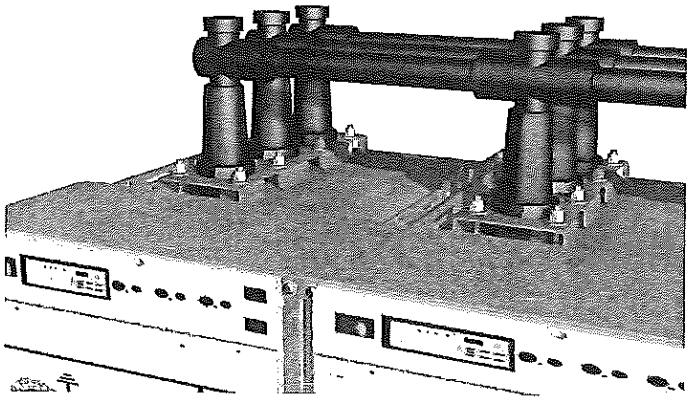
1250 A busbar

Busbar – 1250 A on top of unit

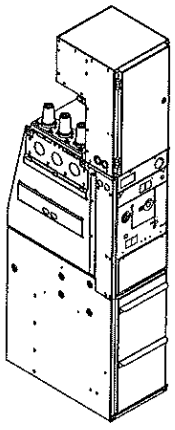
- The top-mounted busbar is used to increase the electrical distribution capacity of the equipment up to 1250 A.
- Available for the following FBX-E functions: C, R, RE, T1, T2 & CB.
- Increases the standard height of the equipment by 217 mm.
- Two types of LV cabinets are available to fit with 1250 A top busbars: heights of 200 or 600 mm.



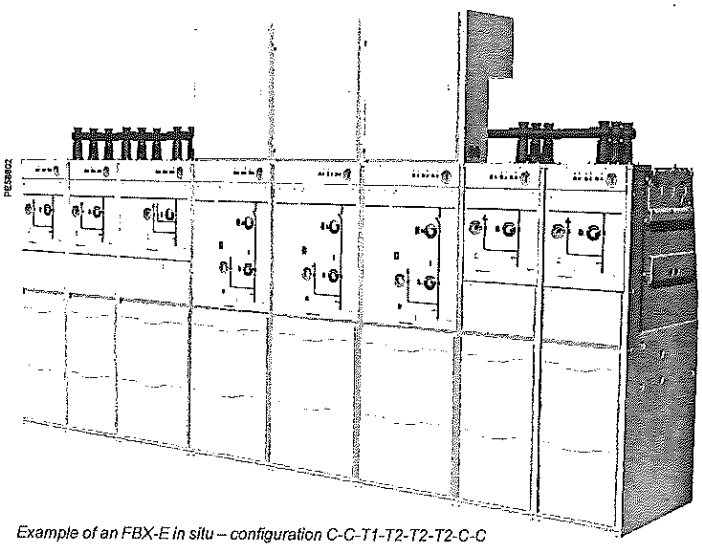
200 mm high LV cabinet for top busbar FBX



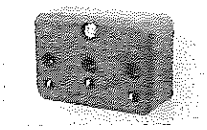
View of the busbars



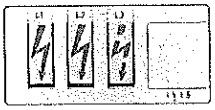
600 mm high LV cabinet for top busbar FBX



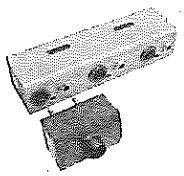
Example of an FBX-E in situ – configuration C-C-T1-T2-T2-T2-C-C



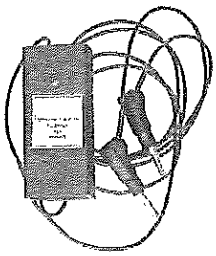
VPIS, Voltage Presence Indicator System



IVIS, Voltage presence detection system (IVIS, Intelligent Voltage Information System)



VDS HR and its removable luminous indicator



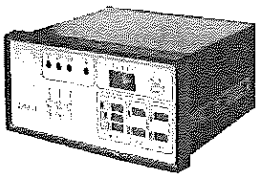
Phase comparator

Voltage detection systems

The absence, or presence, of voltage at outgoing feeders level can be checked using 3 types of device:
- VDS-HR
- VDS-LR
- VPIS.

Voltage indicators and any connectors for warning lights can be found to the top of the FBX front panel.
In particular, FBX can be fitted with the VDS-LR IVIS device:
- The integrated IVIS system (Integrated Voltage Detection System) checks for the absence of a voltage.
- Flashing arrow symbols light up on the indicators in case of the presence of a voltage within defined threshold response limits.

The IVIS is equipped with a self-test in order to avoid any electrical tests.
The IVIS system also provides a phase comparison function.
- It is equipped with integrated electronics, protected against bad weather conditions and requires no maintenance. It is auto-supplied. An auxiliary contact is available for remote monitoring (optional).



DAX-I fault passage indicator

Compass B directional fault passage indicator

Fault Passage Indicators

Outgoing feeder functions can be equipped with various fault passage indicators integrated in FBX Low Voltage front panel (non-exhaustive list):
- Alpha, Sigma or Opto (Horstmann make)
- IKI20 (Kries make)
- Dax-I (Schneider Electric).

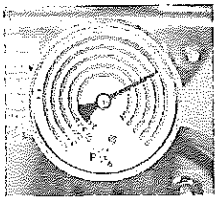
Main characteristics of Dax-I fault passage indicator:
- Earth and phase fault detection
- Earth fault measurement range: 100 to 1000 A
- Phase fault measurement range: 5 to 160 A
- Reaction time: 40 to 999 ms
- Autonomous power supply with 10-year battery
- Remote signalling.

Current sensors of fault passage indicators can be installed either on cables or close to the bushings.

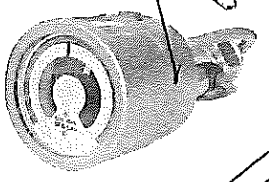
To accompany the rise of distributed power generation on distribution networks, FBX can be equipped with directional fault indicators such as:
- Compass B (Horstmann make)
- IKI20a (Kries make).

Manometer

- The interrupting mechanisms are installed in stainless steel tanks filled with gas. During the service life of the switchboard, the addition of SF6 gas is not necessary.
- The gas pressure in the hermetically sealed tank is indicated, as an option, by a relative or absolute pressure manometer for uses at high altitude.
- An auxiliary contact can be fitted to the manometers (optional).



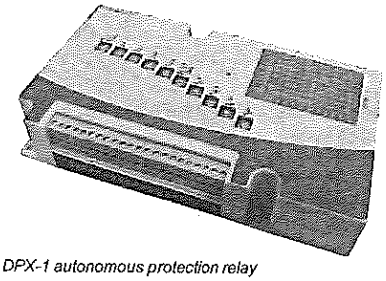
Relative pressure gauge



Absolute pressure gauge

Protection relays

FBX can be fitted with different types of protection relays:
- Autonomous protection relays directly integrated behind FBX front face: DPX-1, MiCOM P114S or SEG WIC
- Other protection relays located in FBX low voltage cabinet.



DPX-1 autonomous protection relay

DPX-1 autonomous protection relay

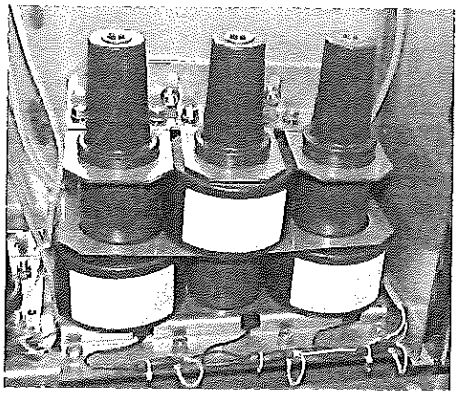
The DPX-1 system, consisting of a compact protection relay and a toroidal type current transformer, has been specially developed for compact medium voltage switchboards with circuit-breakers.
The following protection functions have been integrated into the DPX-1:

- Constant three phase over-current protection with variable tripping times (ANSI 50/51).
- Three phase over-current protection with selection capability characteristics of inverse time and constant time short circuit current element (ANSI 50/51).
- Protection of inverse and constant time earthing over-current by internal calculation (ANSI 50N/51N).

In the DPX-1, the phase current and earth current are calculated using an arithmetic mean value.

Protection characteristics

- Protection independent from the line current at two levels (UMZ).
- Inverse time delay characteristics with an independent time short circuit current element:
  - Normal Inverse (NINV)
  - Very Inverse (VINV)
  - Extremely Inverse (EINV)
  - Long Inverse (LINV)
  - RI-Inverse (RIINV).
- The system of protection enables a tripping time of 40 ms.
- The tripping time in the event of a fault varies, depending on the fault current level.
- The parameters are adjusted with the rotary switches.
- Any current interruption following tripping of the protection relay is signalled by a warning light on the front panel of the rotary switch.



Bottom view of toroidal type current transformers on external-cone cable plug-in terminals (T2 function)

Presentation of the adjustment ranges and functions

	Adjustment range	Function
I>	0.5 x - 2.5 x Is	
tI>	0.04 - 300 s	UMZ / DEFT
	Factor (a): 0.05 to 10	NINV, VINV, EINV, RIINV, LINV
I>>	1 x - 20 x Is	UMZ / DEFT
tI>>	0.04 - 3 s	
IE>	0.1 - 2.5 x Is	
tIE>	0.06 - 300 s	UMZ / DEFT

DPX-1 is activated by standard and toroidal type current transformers and is described in the table below.

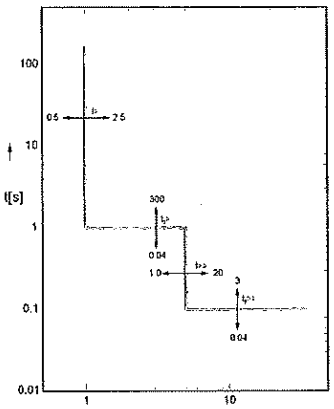
Standard current transformer

Description	Conversion	Rated power	Degree of precision
CT1	30/1A	1VA	10P5
CT2	50/1A		5P10
CT3	100/1A		
CT4	200/1A		
CT5	400/1A		
CT6	800/1A		

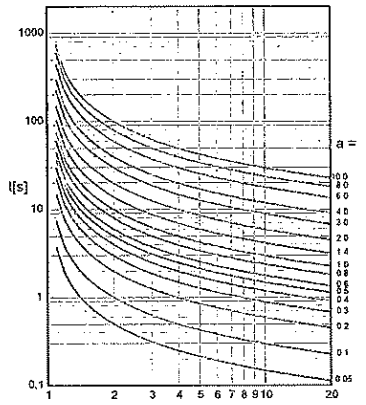
These standard current transformers are available in these versions.

DPX-1 characteristics curves

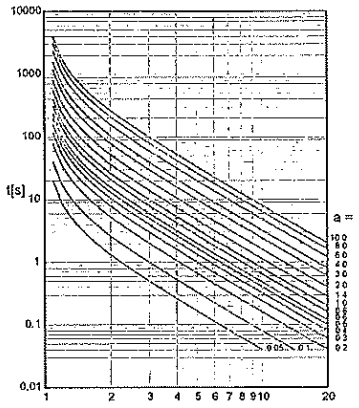
Pre-defined time



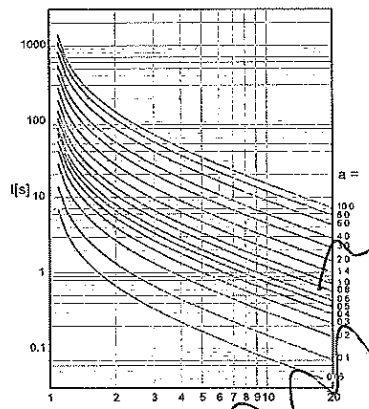
Normal inverse



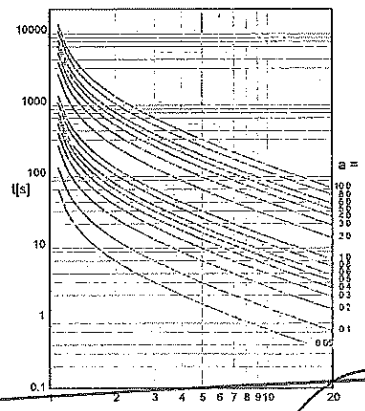
Extremely inverse



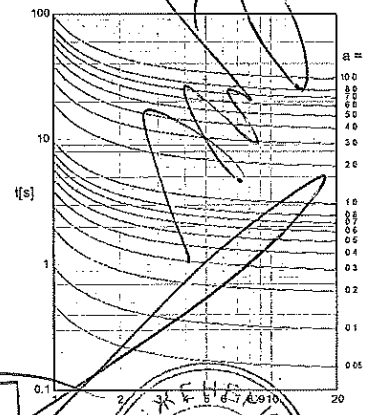
Very Inverse



Long Inverse



RI Inverse

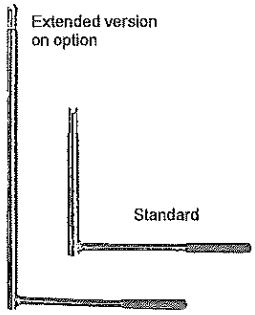


Accessories

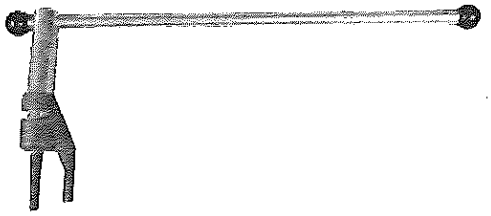
Accessories

Standard accessories supplied with FBX switchboard are:
- A set of operating levers
- A set of keys to lock fuse compartment
- In case of motorized mechanisms, an emergency back-up handle.

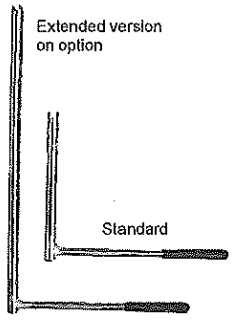
Ask for details of other supplies. Only Schneider Electric accessories are authorised for use with FBX.



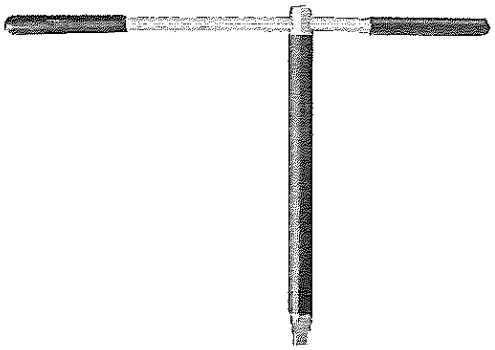
Operating lever for the earthing switch



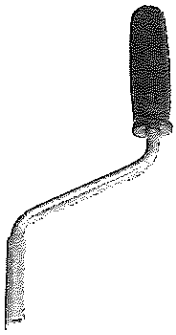
Standard operating lever for the disconnector, earthing switch and non-return circuit-breaker for CD 110 drive.



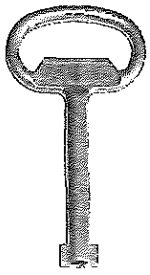
Operating lever for the disconnector, switch disconnector, and T2 circuit-breaker



Operating lever for the CB and CBb circuit-breaker



Emergency back-up handle for the motorised control mechanism (optional)



Key with a double bit

Contents

Selection of cables

Cable with synthetic insulation – Single connection per phase for C, T2, CB, R and RE functions

630 A connector, external cone as per EN 50181, C type connector, screw type contact with M16 x 2 internal threading

			12 kV		24 kV	
Type of cable	**Manufacturer**	**Rated current**	**Type of connector**	**For sections in mm²**	**Type of connector**	**For sections in mm²**
Complete insulation	EUROMOLD	630	430TB/G	35 - 300	K400LB/G	25 - 300
	EUROMOLD	630	430TB	35 - 300	430TB	35 - 300
	EUROMOLD	630	434TB/G	35 - 300	K400TB/G	35 - 300
	EUROMOLD	630	440TB/G	185 - 630	K440TB/G	185 - 630
	nkt	630	CB 12/630	25 - 300 (1)	CB 24/630	25 - 300 (1)
	Südkabel	630	SET 12	50 - 300	SET 24	25 - 240
	Südkabel	630	SEHDT 13	300 - 500	SEHDT 23	300 - 630
	Tyco	400	RSES-54xx	25 - 240	RSES-54xx	25 - 240
	Tyco	800	RSTI-58xx	25 - 300	RSTI-58xx	25 - 300
	Tyco	800	RSTI-395x	400 - 800	RSTI-595x	400-800
Partially insulated	nkt	630	AB 12/630	25 - 300	AB24/630	25 - 300
	Tyco	400/630	RICS-51xx with sealing end IXSU-F for one wire cables	25 - 300	RICS-51xx with sealing end IXSU-F for one wire cables	25 - 300
	Tyco	400/630	RICS-51xx with sealing end IXSU-F for three wires cables	25 - 300	RICS-51xx with sealing end IXSU-F for three wires cables	25 - 300
Earthing cable						
Complete insulation	Tyco	400/630	RICS-51xx with sealing end UHGK for belted cables	16 - 300	–	–
	Tyco	400/630	RICS-51xx with sealing end IDST-51xx for cables with one or three paper insulated wires	50 - 300	RICS-51xx with sealing end IDST-51xx for cables with one or three paper insulated wires	35 - 240

(1) Sections 300 – 500 mm² on request.
Conforming with the manufacturer's technical data and mounting instructions.

Cable with synthetic insulation - Single connection per phase for T1 transformer protection (250 A)

250 A connector, external cone as per EN 50181, A type connector, with male contact Ø 7.9 mm

		12 kV		24 kV	
Type of cable	**Manufacturer**	**Type of connector**	**For sections in mm²**	**Type of connector**	**For sections in mm²**
Complete insulation	EUROMOLD	158LR	16 - 120 (1)	K158LR	16 - 120 (1)
	EUROMOLD	158LR+MC3-158LR-R02	16 - 120 (1)	K158LR+MC3-158LR-R02	16 - 120 (1)
	EUROMOLD	AGW 10/250	25 - 95	AGW 20/250	25 - 95
	EUROMOLD	AGWL 10/250	25 - 95	AGWL 20/250	25 - 95
	nkt	CE 24-50	25 - 95	CE 24-50	25 - 95
	Südkabel	SEW 12	25 - 150	SEW 24	25 - 95
	Südkabel	–	–	SEHDW 21	120 - 150
	Tyco	RSES-52xx-R	25 - 120	RSES-52xx-R	16 - 120

(1) 150 mm² on request.
Conforming with the manufacturer's technical data and mounting instructions.

Selection of cables

Cables with synthetic insulation - Double connection per phase for C, R, RE functions

630 A connector, external cone as per EN 50181, C type connector, screw type contact with M16 x 2 internal threading

			12 kV		24 kV	
Type of cable	Manufacturer	Rated current	Type of connector	For sections in mm²	Type of connector	For sections in mm²
Complete insulation	EUROMOLD	630	434 TB/G + 300 PB	300 - 630	434 TB/G + 300 PB	300 - 630
	EUROMOLD	630	430 TB + 300 PB	35 - 300	430 TB + 300 PB	35 - 300
	nkt (1)	630	CB 12/630 + CC 12/630	25 - 300	CB 24/630 + CC 24/630	25 - 300
	Südkabel	630	SET 12 + SEHDK 13.1	70 - 300	SET 24 + SEHDK 23.1	35 - 240
	Tyco	800	RSTI-58xx + RSTI-CC-58xx	25 - 300	RSTI-58xx + RSTI-CC-58xx	25 - 300
Partially insulated	nkt	630	AB 12/630 + AC 12/630	25 - 300	AB 24/630 + AC 24/630	25 - 300
	Tyco	400/630	RICS-57xx with sealing end IXSU-F for one wire cables + RICS-51xx with sealing end IXSU-F for one wire cables	25 - 300	RICS-57xx with sealing end IXSU-F for one wire cables + RICS-51xx with sealing end IXSU-F for one wire cables	25 - 300
	Tyco	400/630	RICS-57xx with sealing end IXSU-F for three wires cables + RICS-51xx with sealing end IIXSU-F for three wires cables	25 - 300	–	–
Earthing cable						
Partially insulated	Tyco	400/630	RICS-57xx with sealing end IDST-57xx for cables with one or three paper insulated wires	50 - 300	–	–

(1) Obligatory for the IAC 25 kA option
The second cables mounting support must be specified when ordering the FBX.
A surge arrester may be installed instead of a second cable connection. These mounting supports are available on request. Conforming with the manufacturer's technical data and mounting instructions.

Cables with synthetic insulation - Triple connection per phase for C, R and RE functions

630 A connector, external cone as per EN 50181, C type connector, screw type contact with M16 x 2 internal threading

			12 kV		24 kV	
Type of cable	Manufacturer	Rated current	Type of connector	For sections in mm²	Type of connector	For sections in mm²
Complete insulation	nkt	630	CB 12/630 + CC 12/630	25 - 300	CB 24/630 + CC 24/630	25 - 300

Note: the IAC 25 kA option is not available if 3 cables are used per phase.
The cables mounting support must be specified when ordering the FBX.
A surge arrester may be installed instead of a third cable connection. These mounting supports are available on request. Conforming with the manufacturer's technical data and mounting instructions.

ВЯРНО С ОРИГИНАЛА

ИНЖЕНЕРИНГ ПЛОВДИВ ЕАД

F25

Selection of cables

Cable with synthetic insulation - Single connection per phase with surge arrester for T2, CB

630 A connector, external cone as per EN 50181, C type connector, screw type contact with M16 x 2 internal threading

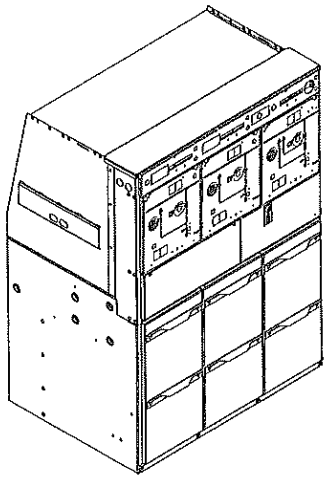
			12 kV		24 kV	
Type of cable	**Manufacturer**	**Rated current**	**Type of connector**	**For sections in mm²**	**Type of connector**	**For sections in mm²**
Complete insulation	EUROMOLD	630	430 TB + 300 PB	35 - 300	430 TB + 300 PB	35 - 300
	Südkabel	630	SET 12 + MUT 23	50 - 300	SET 24 + MUT 23	25 - 240
	Südkabel	630	SEHDT 13.1 + MUT 23	70 - 300	SEHDT 23.1 + MUT 23	35 - 240
	Tyco	800	RSTI-58xx + RSTI-CC-58SAxx05 (5 kA) RSTI-58xx + RSTI-CC-66SAxx10 (10 kA)	25 - 300	RSTI-58xx + RSTI-CC-58SAxx05 (5 kA) RSTI-58xx + RSTI-CC-66SAxx10 (10 kA)	25 - 300
	Tyco	800	RSTI-395x + RSTI-CC-58SAxx05 (5 kA) RSTI-395x + RSTI-CC-66SAxx10 (10 kA)	25 - 300	RSTI-595x + RSTI-CC-58SAxx05 (5 kA) RSTI-595x + RSTI-CC-66SAxx10 (10 kA)	400 - 800
Partially insulated	Tyco	400/630	RICS-57xx with sealing end IXSU-F for one wire cables + RICS-51x9 plus RDA-xx	25 - 300	RICS-57xx with sealing end IXSU-F for one wire cables + RICS-51x9 plus RDA-xx	25 - 300
	Tyco	400/630	RICS-57xx with sealing end IXSU-F for three wires cables + RICS-51x9 plus RDA-xx	25 - 300	–	–
Earthing cable						
Partially insulated	Tyco	400/630	RICS-51xx with sealing end IDST-51xx for cables with one or three paper insulated wires	50 - 300	–	–

Cable with synthetic cable insulation – Double connection per phase for T2, CB functions

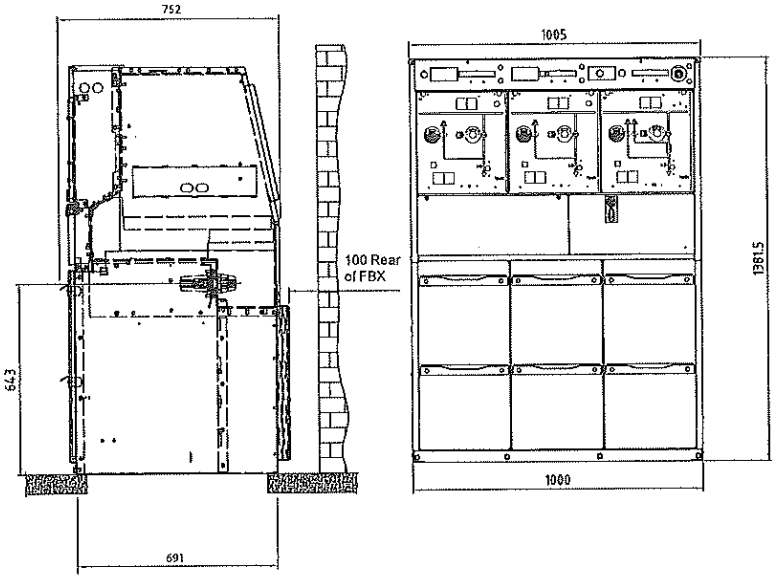
630 A connector, external cone as per EN 50181, C type connector, screw type contact with M16 x 2 internal threading

			12 kV		24 kV	
Type of cable	**Manufacturer**	**Rated current**	**Type of connector**	**For sections in mm²**	**Type of connector**	**For sections in mm²**
Complete insulation	nkt	630	CB 12/630 + CC 12/630	25 - 300	CB 24/630 + CC 24/630	25 - 300
	Tyco	800	RSTI-58xxx + RSTI-CC-58xx	25 - 300	RSTI-58xx + RSTI-CC-58xx	25 - 300
	Südkabel	630	SEHDT 13	300 - 500	SEHDT 23	300 - 630
Partially insulated	nkt	630	AB 12/630 + AC 12/630	25 - 300	AB 24/630 + AC 24/630	25 - 300
	Tyco	400/630	RICS-57xx with sealing end IXSU-F for one wire cables + RICS-51xx with sealing end IXSU-F for one wire cables	25 - 300	RICS-57xx with sealing end IXSU-F for one wire cables + RICS-51xx with sealing end IXSU-F for one wire cables	25 - 300
	Tyco	400/630	RICS-57xx with sealing end IXSU-F for three wires cables + RICS-51xx with sealing end IIXSU-F for three wires cables	25 - 300	–	–
Earthing cable						
Partially insulated	Tyco	400/630	RICS-57xx with sealing end IDST-57xx for cables with one or three paper insulated wires	50 - 300	–	–

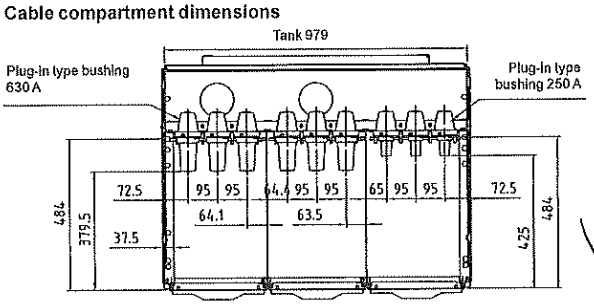
Overall dimension drawings



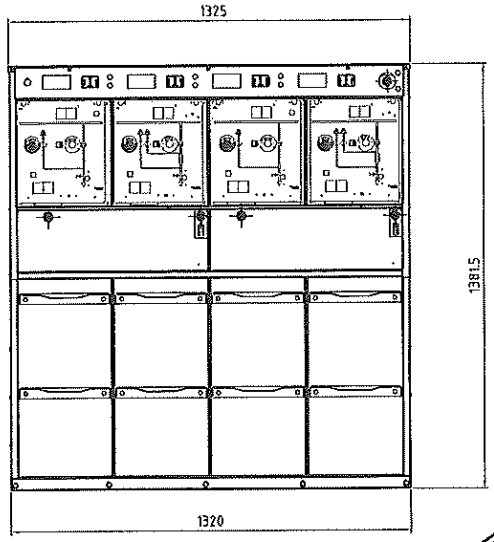
FBX-C, 3 functions switchboard
C-C-T1 configuration



Cable compartment dimensions

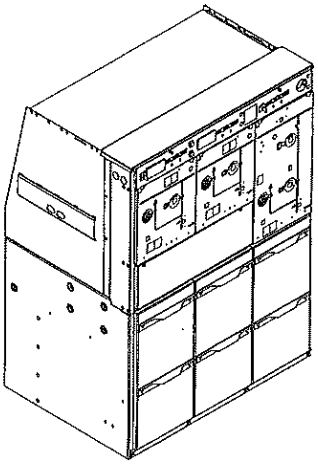


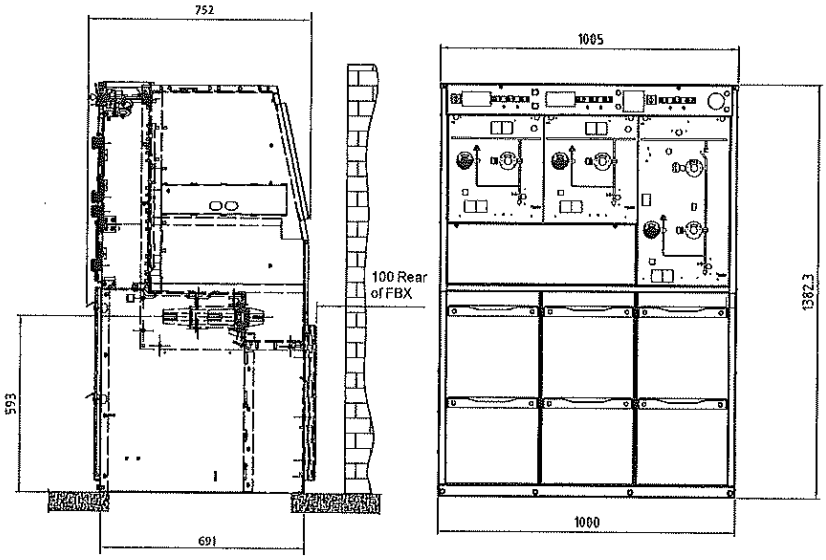
FBX-C, 4 functions switchboard
C-T1-C-T1 configuration



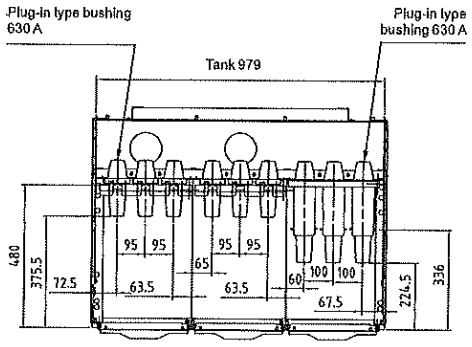
Overall dimension drawings

FBX-C, 3 functions switchboard
C-C-T2 configuration



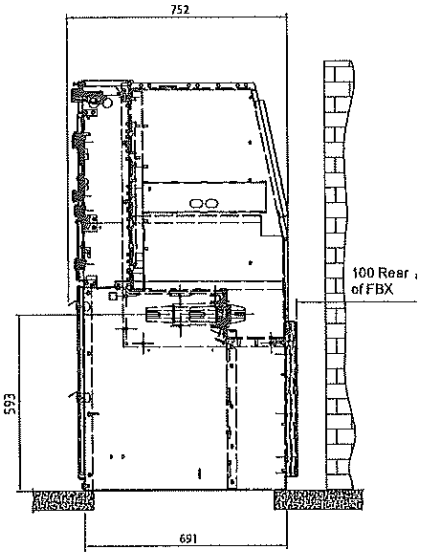


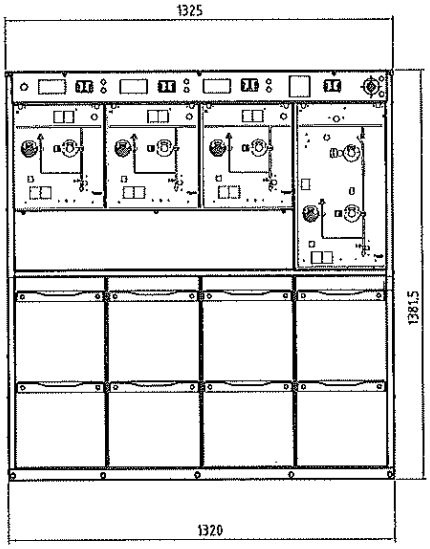
Cable compartment dimensions



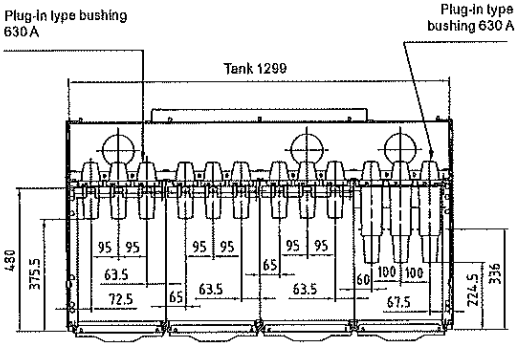
Overall dimension drawings

FBX-C, 4 functions switchboard
C-C-C-T2 configuration

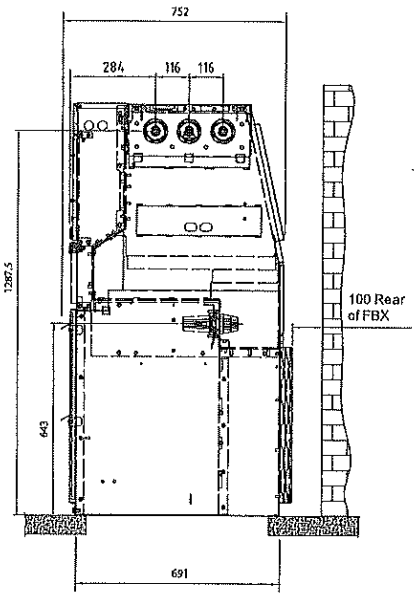




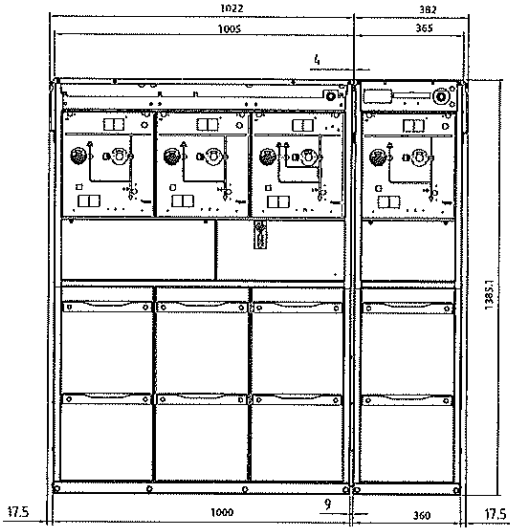
Cable compartment dimensions



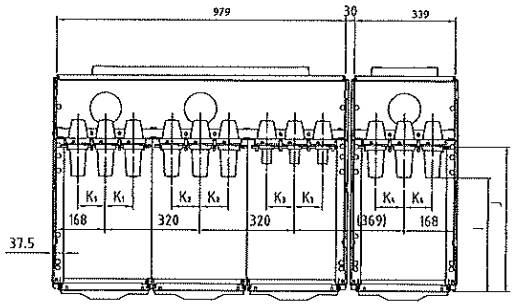
Overall dimension drawings



FBX-E, 4 functions switchboard
C-C-T1+C configuration



Cable compartment dimensions

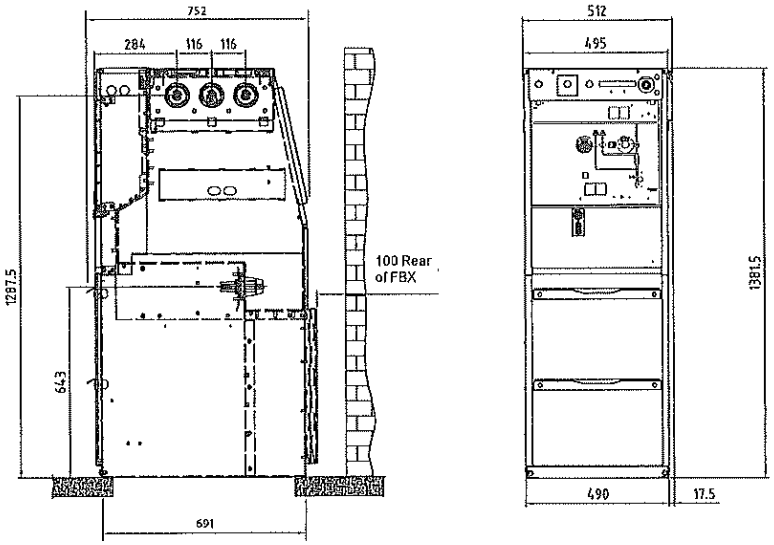


K = 95 mm
I = 381 mm (400 A)
379.5 mm (630 A)
J = 484 mm

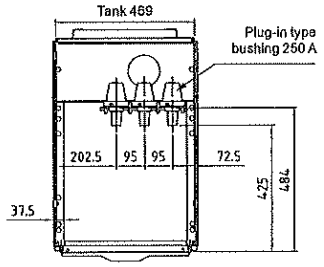
A minimum of 450 mm is required to install an extension unit to a FBX-E.

Overall dimension drawings

FBX-E, 1 function switchboard
T1 configuration

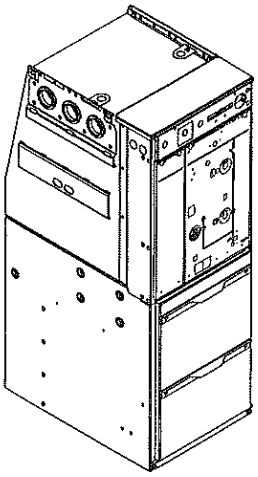


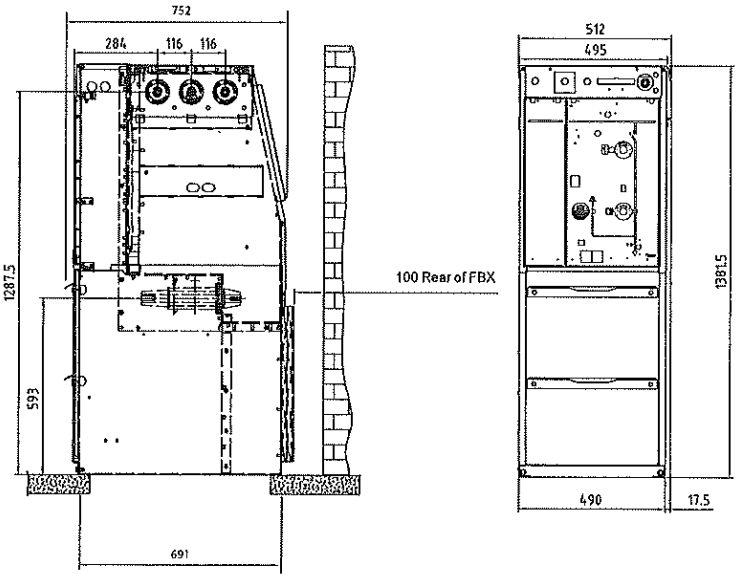
Cable compartment dimensions



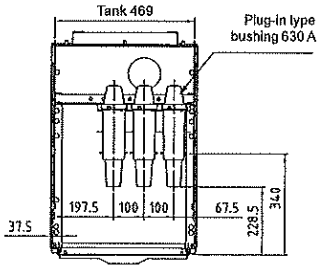
Overall dimension drawings

FBX-E, 1 function switchboard
T2 configuration



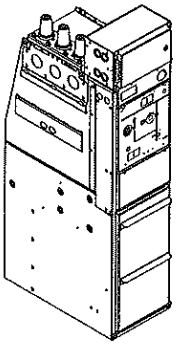


Cable compartment dimensions

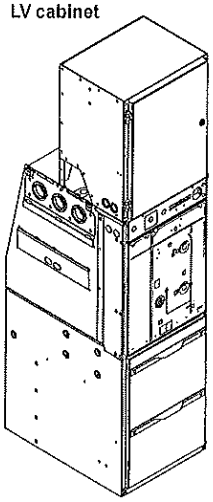


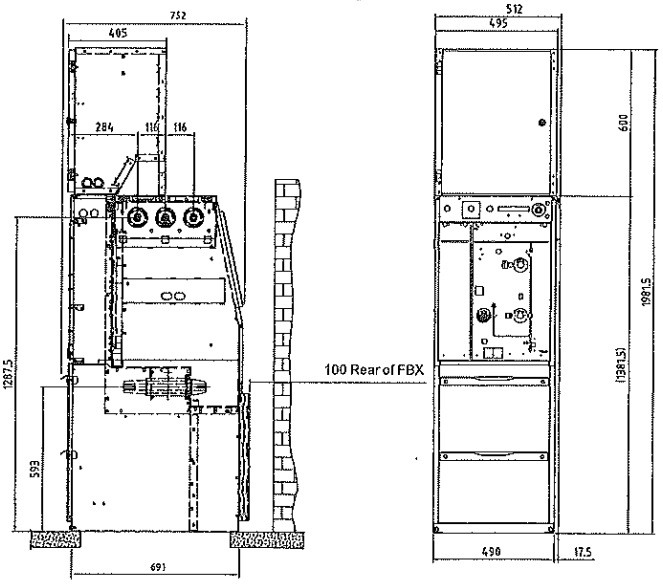
FBX-E, 1 function switchboard
T2 + LV cabinet (600 mm) configuration

T2 with 200 mm LV cabinet



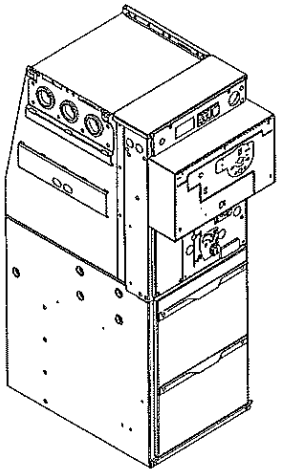
T2 with 600 mm LV cabinet

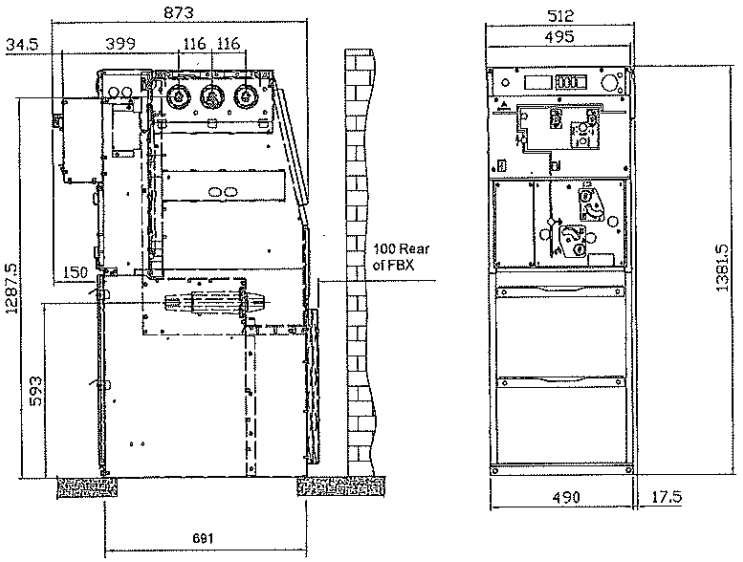




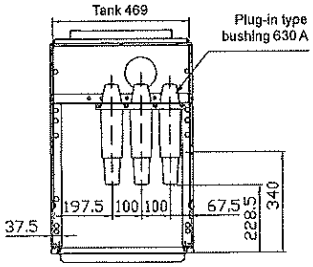
Overall dimension drawings

FBX-E, 1 function switchboard
CB configuration





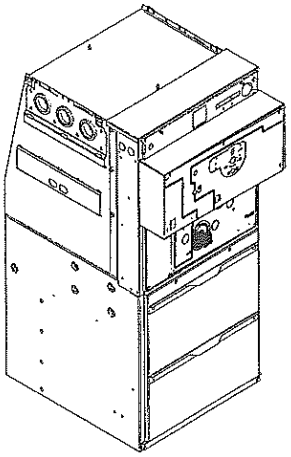
Cable compartment dimensions

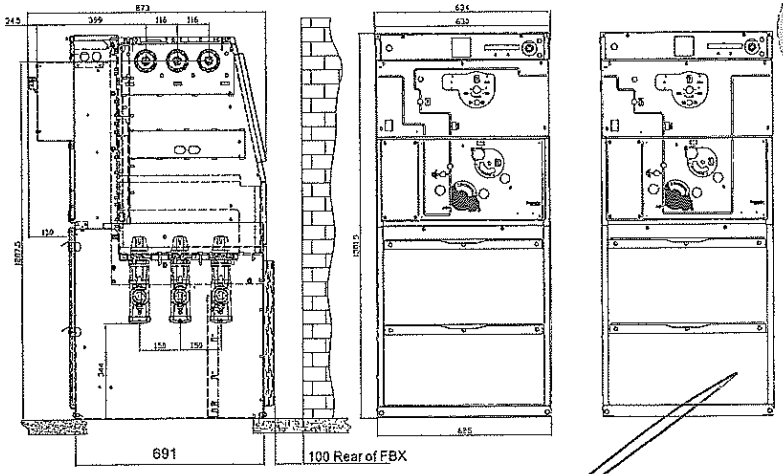


FBX-E, 1 function switchboard
CBb configuration

CBb - right busbar coupling

CBb - left busbar coupling

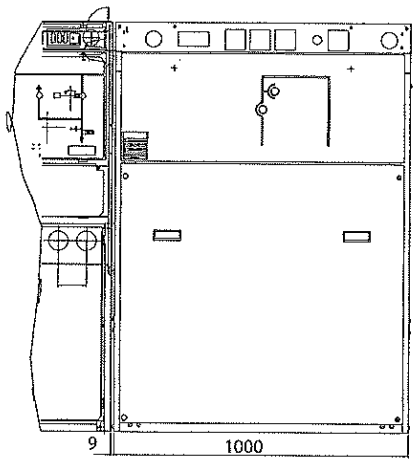




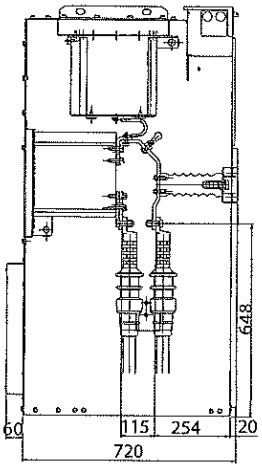
Overall dimension drawings

Metering cubicles

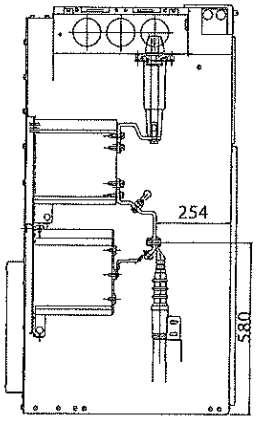
M1



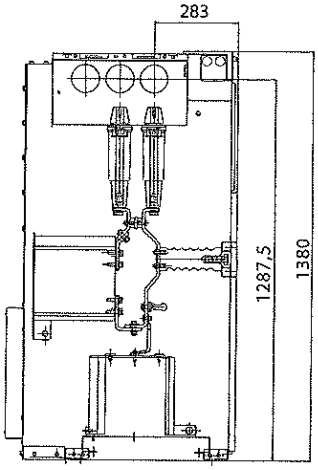
M1

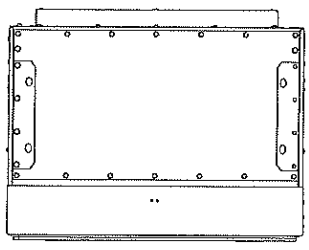


M2/M3

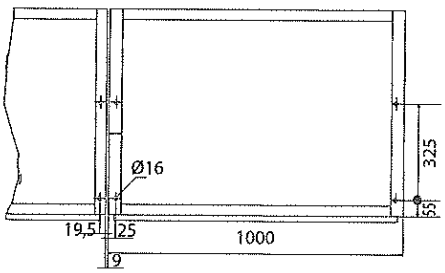


M4





Fixing points

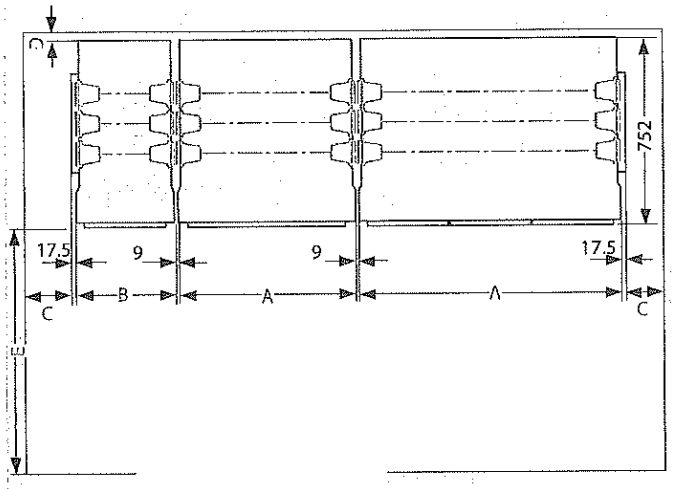


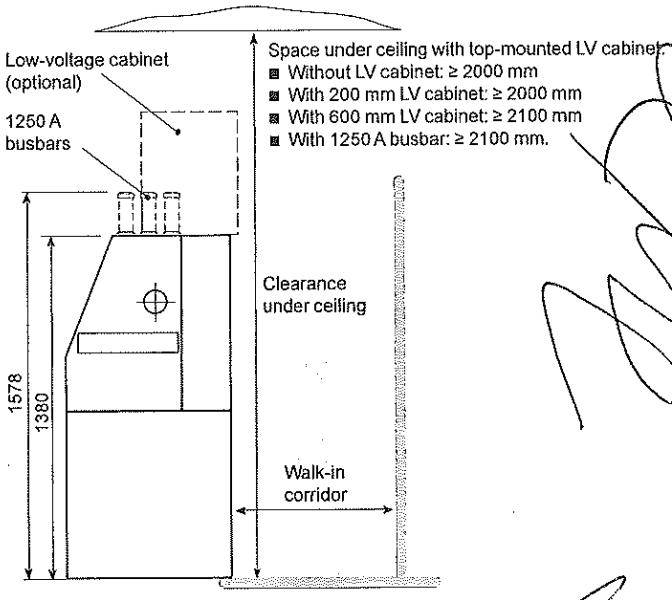
Indoor installation

Minimum distances between the FBX-E and the building's walls

Top view

	Functions and distances		Space (mm)
A	Unit 1 function M1, M2, M3, M4		1000
	Unit 2 functions		680
	Unit 3 functions		1000
	Unit 4 functions		1320
B	Unit 1 function C, R, RE		360
	Unit 1 function T1, T2, CB		490
	Unit 1 function CBb		625
C	Distance with the side wall of the building for extensions at the extremity of the switchboard		450
D	Distance between the rear of the switchboard and the building's wall	Release of overpressures only towards the bottom	20
		Release of overpressures towards the top and the rear	100/140
E	Minimum width of passage in front of the FBX-E switchboard: the national standards/ instructions must be respected! For a subsequent extension to the existing FBX-E: access for assembly E > 950; FBX-C: > 800		





730

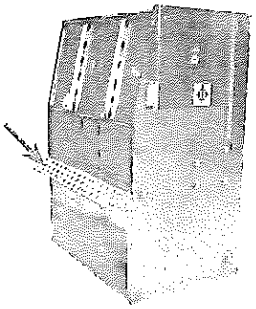
Indoor installation

Indoor installation & evacuation of overpressures

We are presenting several examples of installation for transformer substations (IAC classification as per IEC 62271-200).
For further information, consult the civil engineering guide.

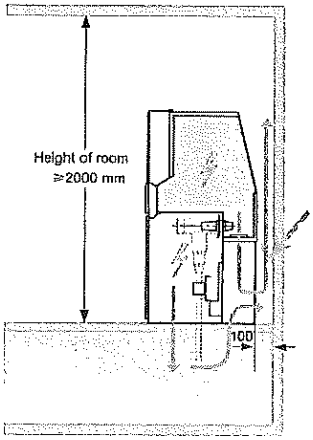
Example of an FBX-C C-C-T1 installation:
Height of the room ≥ 2,000 mm with possible solutions for the evacuation of gases in case of overpressure.

With rear deflector



■ **IAC class AF 16/20 kA 1s**

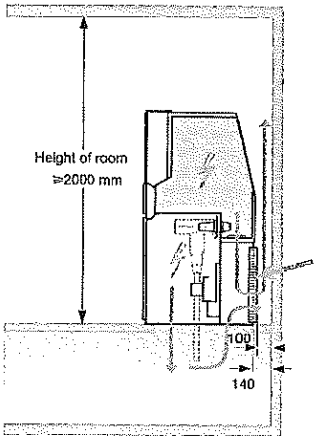
With rear deflector



→ : *Evacuation of gas in the event of overpressure*

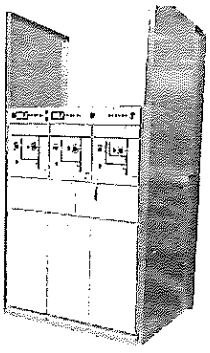
■ **IAC class AF 16/20 kA 1s**

With gas cooler



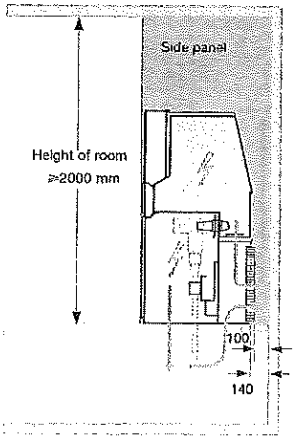
→ : *Evacuation of gas in the event of overpressure*

With double side panel



■ **IAC class AFL 16/20 kA 1s**

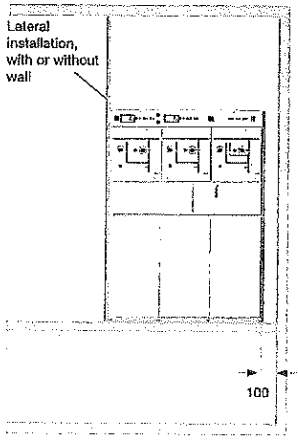
With side panel



→ : *Evacuation of gas in the event of overpressure*

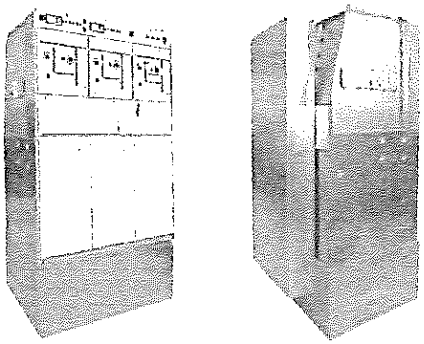
■ **IAC class AFL 16/20 kA 1s**

With side panel



Indoor installation

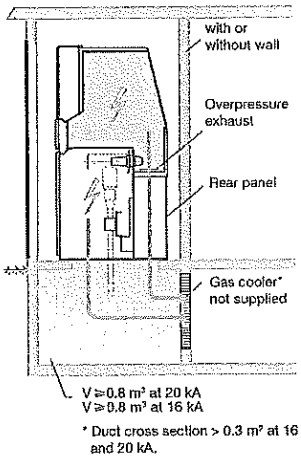
With mounting base and gas exhaust duct



Example of an installation for transformer substations without cable trough or double panel IAC classification as per IEC 62271-200.

■ **IAC class AFL 16/20 kA 1s (25 kA 1 s under 12 kV)**

Without side panel



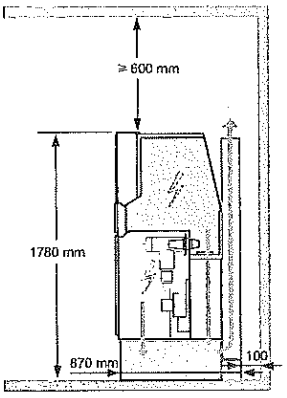
* Duct cross section > 0.3 m² at 16 and 20 kA.

→ : *Evacuation of gas in the event of overpressure*

Example of an installation:
FBX-C C-C-T1
Ceiling clearance ≥ 100 mm
Distance to the wall ≥ 30 mm
(Exhaust of the overpressure in the cable duct with gas cooler, with 5 layers of metal deployed, e.g. 66 x 3.4 x 0.5).

■ **IAC class AFL 16/20 kA 1 s**

With gas exhaust duct



→ : *Evacuation of gas in the event of overpressure*

731

Packaging and transport

Packaging

- For road and rail transport:

FBX switchboard is packaged under protective sheeting. It is delivered fixed on to a wooden pallet by two plastic tapes.

- For maritime transport:

FBX is packaged in a heat-sealed cover with bags of desiccant, then enclosed in a wooden case with a solid leaktight bottom (including transport by container).

- For air transport:

FBX switchboard is packaged in a wooden boxes (crates) with solid walls and a protective cover (dust cover).

Handling

The FBX must be transported vertically:

- When moving using a forklift:

Only move the device on a pallet.

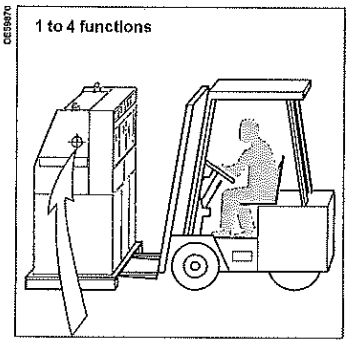
- When moving without a pallet:

A lifting sling must be hooked on to the switchboard's lifting rings. The angle with the lifting sling must be at least 45°.

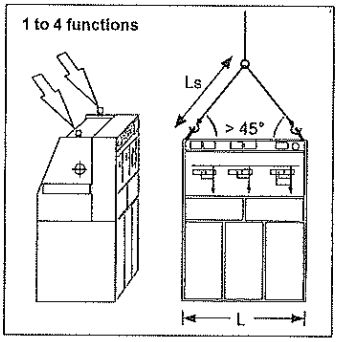
- When transporting a switchboard:

Maximum width of transport unit: 1330 mm.

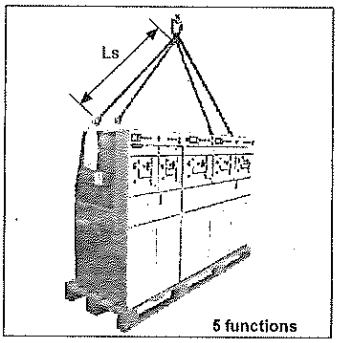
DE59870



When transporting on a pallet, do not tilt the switchboard. Respect the centre of gravity markings.



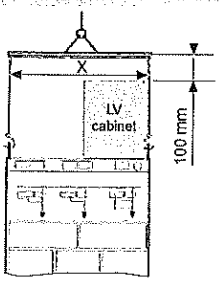
When transporting with slings, use the two lifting rings.



This switchboard can be transported:

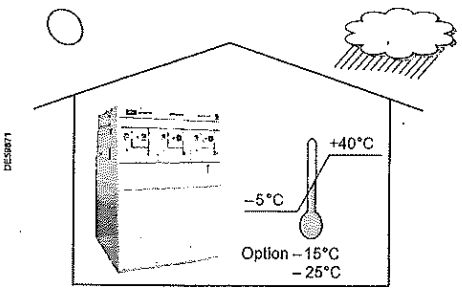
- either using slings, attached to the 4 lifting rings
- or, by two hand trolleys, one at either end.

Switchboard with LV cabinet



Number of functions	Composition of the switchboard	Width X (mm) from the swing arm
1	C/RE/R	370
1	T1/T2/CB	500
2	All types, except T1-T1/T2-T2	690
2		990
3	All types	1010
4	All types	1330
5	C-C-C-C-C/C-C-C-C-T1/C-C-C-T1-T1	1685
5	C-T1-C-T1-T1	1815

DE59871



Storage

FBX must be packaged depending on the requirements for its planned storage duration. FBX must be preserved intact in its factory.origin packaging.
The storage area must not have any sharp and important changes in temperature.
Consult us for any particular storage condition.

Contents

Sustainable development


PE86547

Schneider Electric has resolved to engage itself in a dynamic process of sustainable development through 6 commitments:
- To develop eco-design to reduce environmental impact of the products during their lifetime
- To reduce greenhouse effect gases related to SF6
- To develop environmental management and safety
- To participate in the local economy
- To develop a responsible purchasing policy
- To minimise impact on the environment by offering solutions allowing for enewable energies to be connected to electrical networks.

Eco-design and impact on the environment

Schneider Electric contributes efficiently to worldwide savings in terms of energy resources.
FBX replies to a high degree of ecological requirements related to environmental protection thanks to:
- The optimisation of consumption of materials and energy during manufacture
- The compliance with all ecological requirements during the service life of the product
- The use of materials that can be recycled for an efficient valorisation.

A responsible design

Our construction directives relating to an ecological design specifiy the use of materials that are easy to recycle and dismantle:
- 90% of the metals of a switchboard (CCT1 type) can be recycled, as well as
- all thermosetting plastics and thermoplastics.

All the materials have been selected and developed in such a way that, for instance, a switchboard affected by a fire in a building has a minimal impact on the load of the fire (development of heat and toxic substances in the emissions).

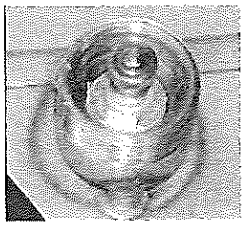
Eco-declarations are available on request.

Environmental impact

The end of service life phase is considered a very important part of the life cycle of Schneider Electric products. The environmental impact inherent to the disposal of equipment is sometimes more polluting than the manufacturing, delivery or use. European directives, such as WEEE, ELV and RoHS, have confirmed this point and all insist upon the recovery of waste products and their valorisation at the end of the equipment's service life.

Even though our switchgear is not covered by this legislation, Schneider Electric is willingly attempting to optimise the recycling, the processing of waste and, as a consequence, the end of service life phase of our products, which is an integral part of the operating costs.

End of service life processing



Release valve

At the end of the FBX service life

The dismantling and disassembly of FBX is possible at the end of its service life.
The separation of the elements making up the switchgear will be made:

- Either by disconnecting the mechanical connections
- Or, by dismantling, that is to say, by breaking or shearing the connections.

To guarantee efficient and ecological sorting and destruction of the materials, all plastic components have been identified.

- A description of the materials is supplied to customers
- Information on the valorisation process that are supplied to companies in charge of the recycling.

End of service life processing

Schneider Electric can help you in your FBX end of service life processing approach.

SF6 gas recovery

The volume of the insulating gas used in FBX is equivalent to 0.5% of the total weight of the switchboard. At the end of the switchboard's service life, gas can be evacuated via the valve to be recycled thanks to a process developped by gas suppliers.

Composition of materials and valorisation at end of service life

After disassembly (or dismantling), the recovered elements must be forwarded for treatment in the following manner:

Waste processing

Type of waste	Destination	Recommended processing
SF6 gas	Supplier	Recovery, storage and regeneration
Steel & stainless steel	Local recovery agent	Shredding, sorting and recycling
Non-ferrous metals	Local recovery agent	Shredding, sorting and recycling
Epoxy resin	Cement plant	Revalorisation at a lower added value
Thermoplastics	Local recovery agent	Incineration
Molecular sieve	Authorised network	Elimination
Soiled protective equipment	Authorised network	Incineration
Cables	Local recovery agent	Separation of sheathing and conductors

ВЯРНО С ОРИГИНАЛА

ИНЖЕНЕРИНГ ПЛОВДИВ ЕАД

Notes

ВЯРНО С ОРИГИНАЛА

ИНЖЕНЕРИНГ ПЛОВДИВ ЕАД

734

Schneider Electric Energy France

335, rue Joseph Monier
CS 30323
F - 92506 Rueil Malmaison Cedex (France)
Tel.: +33 (0)1 41 29 70 00
RCS Nanterre 954 503 439
Capital social 896 313 776 €
www.schneider-electric.com

NRJED311061EN

Design: Schneider Electric Energy France
Photos: Schneider Electric Energy France
Printed: Altavia Connexion - Made in France

10-31-1247

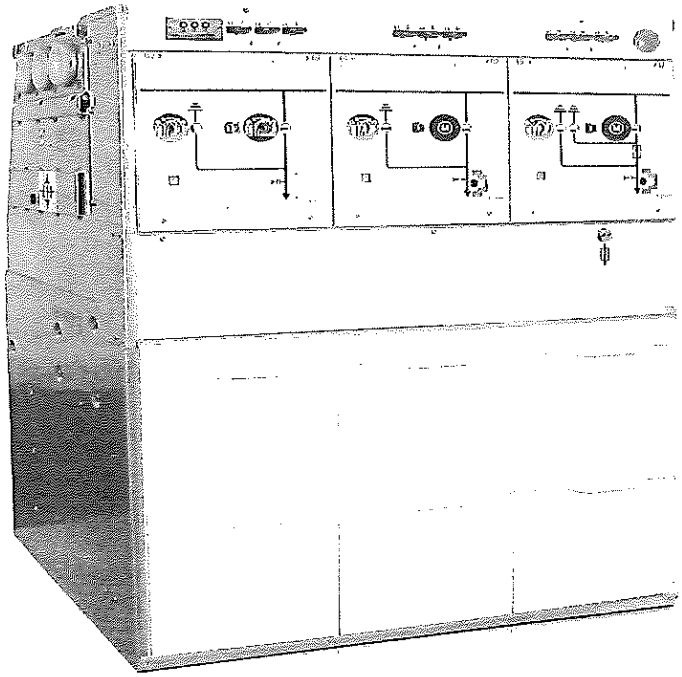
This document has been printed on recycled paper

12-2011

С компактен и иновативен дизайн

FBX

Комутационни апарати средно напрежение с газова изолация, с номинално напрежение до 24 kV



Непрекъснатост на обслужване

Лесно разширение

Безопасност

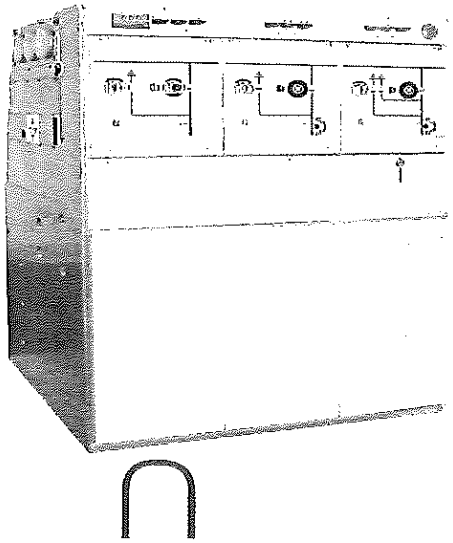
Готова интелигентна мрежа

ВЯРНО С ОРИГИНАЛА

И.Н.ЖЕНЕРИНГ ПЛОВДИВ ЕАД

735

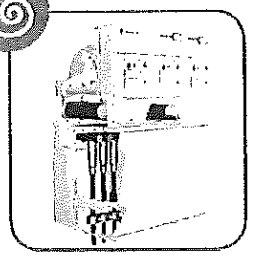
Безопасност чрез иновация



FBX е компактен, иновативен с газова изолация комутационен апарат с номинално напрежение до 24 kV и 630 A, с вътрешна дъга издържаща до 25 kA/1 s. Общо пет функции могат дабъдат комбинирани за максимална гъвкавост.

FBX е наличен в две изключително конфигурируеми. В компактната си версия FBX-C е с най тесен отпечатък на пазара. С разширената си версия, FBX-E, лесно развива потребностите ви разпределение на електро енергия, благодарение на патентованото устройство A-връзка.

Всичко това превръща FBX в логичен избор за голямо разнообразие от съвременните приложения. Било да послужи като основен възел на контура във вторичната публична мрежа за разпределение или като табло за разпределение за промишлени или инфраструктурни мрежи, предоставя високо качествена ефективност с минимални разходи на собственост.



Максимална непрекъснатост на обслужването

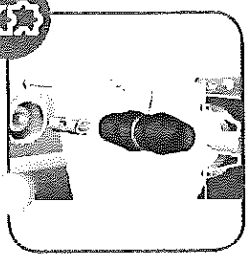
FBX е базиран върху иновативен, елегантен и лесен дизайн, който гарантира максимална непрекъснатост на обслужването.

> LSC2A-клас на продължителност на обслужване.

> Ключовите части са запечатани в корпус от неръждаема стомана, SF_6-напълнен резервоар, което ги прави непромокаеми (непропускливи) за условията на околната среда.

> Без поддръжка на запечатаните части на резервоара през периода на експлоатационен живот на изделието.

> Дизайн устойчив на наводнения.



Лесен за монтаж и експлоатация

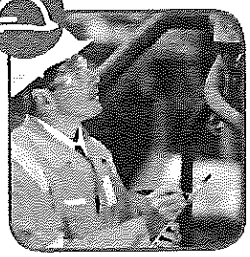
С най тесния отпечатък на пазара и възможността за лесно разширяване, FBX понижава необходимото време и усилия за настройка на електрическата мрежа.

> Компактен размер и лесен монтаж.

> Просторно отделение за кабел за MV кабелна връзка.

> Лесна смяна на предпазители

> Лесно за разширяване посредством патентованата A - система за връзка.



Безопасен инженеринг

Дизайна на FBX поставя на първо място безопасността , гарантирайки най- високо ниво на сигурност за персонала и оборудването.

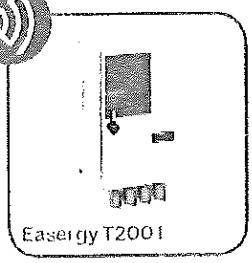
> FBX отговаря на националните и международни действащи стандарти: IEC, NF, GOST, CNS, и IS

> Вътрешна дъга, издържаща до 25 kA/1 сек. (за използване на 12 kV)

> Изпускане на горещ газ далеч от оператора в редките случаи на вътрешна дъга, благодарение на клапаните за налягане и заден канал.

> Интегрирани блокировки осигуряващи пълна херметичност.

> Широка гама от заключващи опции.



Smart grid-ready

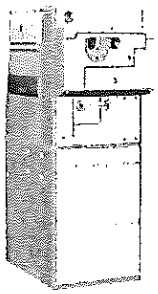
Електрическите мрежи са развити за да обслужват разпределението на генерираната ел. енергия и възобновяемите енергийни източници. FBX е конструиран за да еволюира с тях.

> Дистанционно управление и наблюдение на капацитета, с отворени комуникации и превключвател авто-трансфер, благодарение на Easergy ™ T200 I дистанционен терминал.

> Подобрена възможност за захранване или възстановяване посредством CB630A's O-C-O функция за бързо повтроно затваряне.

> Разнообразие от показатели за грешка, включително показатели за насочване на грешка.

736



FBX непрекъснато се подобрява.

Една то последните иновации е CB630A, бърз вакуумен изключвател за повторно затваряне:

O - 0.3 s - CO - 15 s - CO.

Възела CB630A е широк само 490 mm и може да бъде разширен и в двете страни.

Над 200,000 FBX функции монтирани в целия свят

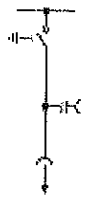
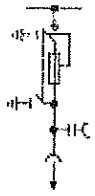
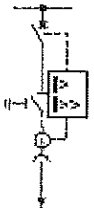
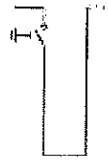
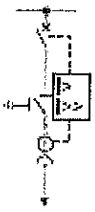
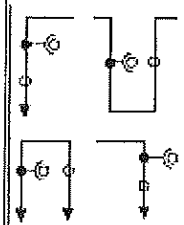
Технически характеристики

Номинално напрежение	kV	12	17.5	24
Издържано номинално напрежение при 50 Hz 1 mn на земята, както и между полюсите.	kV	28	38	50
Издържано номинално напрежение на импулс на мълния на земята и между полюсите.	kV	75	95	125
Текуща стойност на кратко време (1 s)	kA rms	16/21/25	16/21	16/21
Текуща стойност на кратко време (3 s)	kA rms	16/21	16/21	16/21
Кратко време пикова текуща стойност	kAp	40/52.5/62.5	40/52.5	40/52.5
Номинален ток на камерата	A	630	630	630
Номинален ток на шината	A	1 250(1)	1 250(1)	1 250(1)
IAC класификация съгласно IEC 62271-200	kA 1 s	21/25(2)	16/21	16/21

(1)С горна шина 1 250 A

(2)Моля свържете се с нас

Основни функционални единици

Наименование	C	T1	T2	R	RE	Sb	CB	M
Функции	Кабел входящ или изходящ подаване с превключвател прекъсвач	Защита на трансформатор с прекъсвач превключвател комбинация с предпазител	Защита на трансформатор с вакуум прекъсвач	Директно входящо подаване без заземяващ превключвател.	Директно входящо подаване със заземяващ превключвател.	Шина превключвател прекъсвач	Изходящо подаване защита с O-C-O вакуумен прекъсвач на веригата	Измерване
Диаграми симулация								

Приблизителни размери и тегла за избрани конфигурации

Версия	Функция	Брой функционални единици	Височина [1]	Дълбочина	Ширина [2] [3]	Приблизително тегло
			(mm)	(mm)	(mm)	(kg)
FBX-C	C-T1	2	1 380 (1 040 опционално)	752	680	200
	C-C-T1	3	1 380 (1 040 опционално)	752	1 000	330
	C-T1-C-T1	4	1 380 (1 040 опционално)	752	1 320	470
	C-C-C-C-T1	5	1 380 (1 040 опционално)	752	1 685	550
FBX-E	C	1	1 380	752	360	135
	CB	1	1 380	873	490	220
	RE-T2	2	1 380	752	680	250
	C-C-T2	3	1 380	752	1 000	370
	C-C-C-C	4	1 380	752	1 320	450

(1) С 1 250 А шина отгоре, прибавят се 217 mm
(2) Да се прибавят 17.5 mm за защитни капаци на шината (дясно или ляво) от края на таблото.
(3) да се изчисли общата широчина на няколко свързани FBX-E табла, да се прибавят 9 mm между всяко разширение

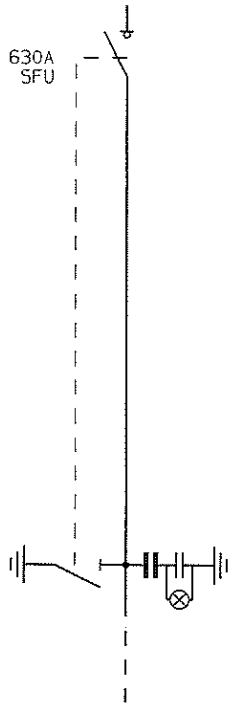
Направете всичко за Вашата енергия

Дизайн : Глобъл Маркетинг, Комюникейшънс Стратегия и Дизайн.
998-5957_GMA-GB RJED111340EN

ВЯРНО С ОРИГИНАЛА

ИНЖЕНЕРИНГ ПЛОВДИВ ЕАД

737



ВЯРНО С ОРИГИНАЛА

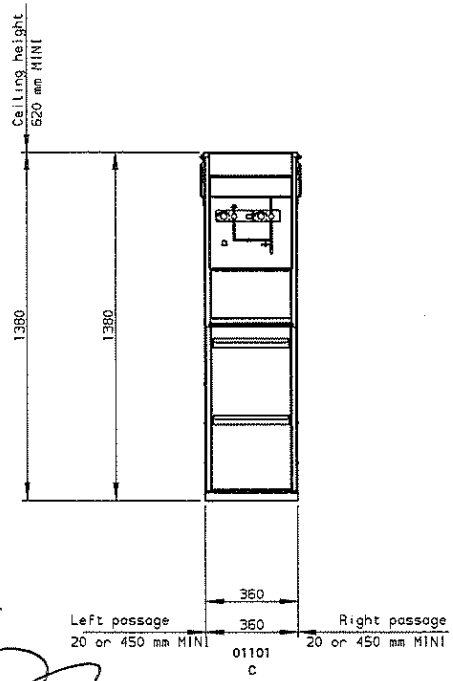
devis n° :012123
nom du projet :CEZ TENDER
client :SCHNEIDER ELECTRIC BULGARIA EOOD
ref. client :

FBX-E/24-16/C

Document CAO MEDEA 14 a ne modifier qu'en CAO

variante du devis :A
version du devis :00
date :10/05/2011

Schneider Electric



ВЯРНО С ОРИГИНАЛА

ИНЖЕНЕРИНГ ПЛОВДИВ ЕАД

For details refer to FBX leaflet
Installation - Commissioning - Operation - Maintenance
Civil engineering guide.

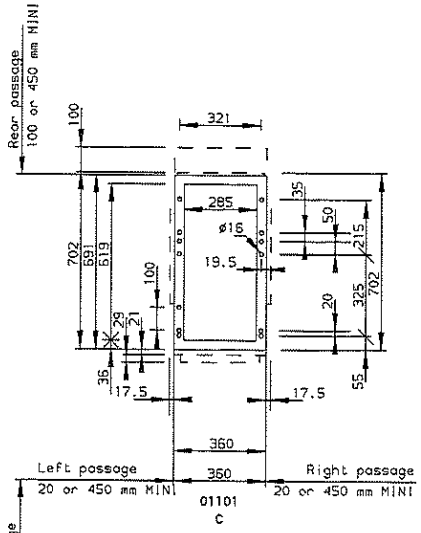
devis n° :012123
nom du projet :CEZ TENDER
client :SCHNEIDER ELECTRIC BULGARIA EOOD
ref. client :

FBX-E/24-16/C

Document CAO MEDEA 14 a ne modifier qu'en CAO

variante du devis :A
version du devis :00
date :10/05/2011

Schneider Electric



ВЯРНО С ОРИГИНАЛА

ИНЖЕНЕРИНГ ПЛОВДИВ ЕАД

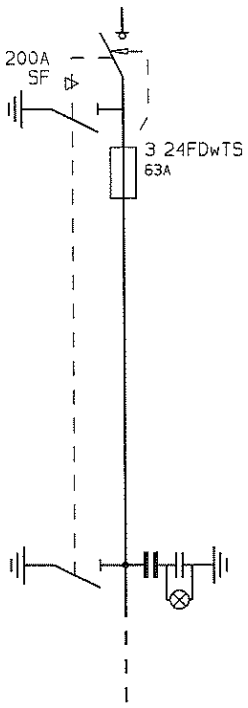
For details refer to FBX leaflet
Installation - Commissioning - Operation - Maintenance
Civil engineering guide

devis n° :012123
nom du projet :CEZ TENDER
client :SCHNEIDER ELECTRIC BULGARIA EOOD
ref. client :

FBX-E/24-16/C

variante du devis :A
version du devis :00
date :10/05/2011

Document CAO MEDEA 14 a ne modifier qu'en CAO



ВЯРНО С ОРИГИНАЛА

T1
01201
T1

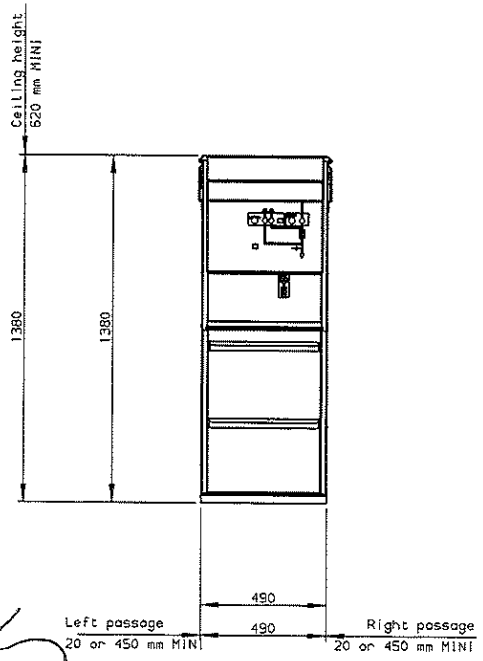
devis n° :012123
nom du projet :CEZ TENDER
client :SCHNEIDER ELECTRIC BULGARIA EOOD
ref. client :

FBX-E/24-16/T1

Document CAO MEDEA 14 a ne modifier qu'en CAO

variante du devis :A
version du devis :00
date :10/05/2011

Schneider Electric



01201
T1

ВЯРНО С ОРИГИНАЛА

For details refer to FBX leaflet
Installation - Commissioning - Operation - Maintenance
Civil engineering guide

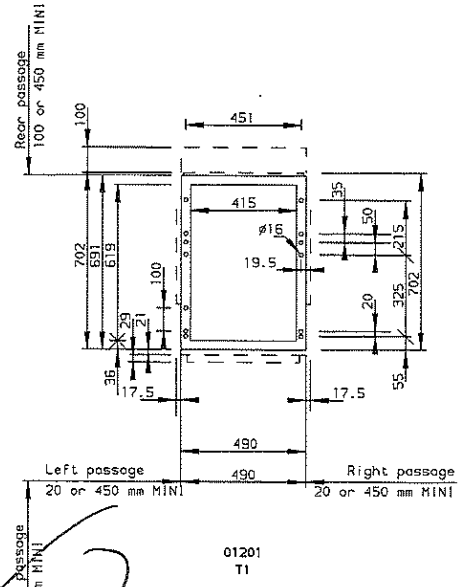
devis n° :012123
nom du projet :CEZ TENDER
client :SCHNEIDER ELECTRIC BULGARIA EOOD
ref. client :

FBX-E/24-16/T1

variante du devis :A
version du devis :00
date :10/05/2011

Document CAO MEDEA 14 a ne modifier qu'en CAO

Schneider Electric



ВЯРНО С ОРИГИНАЛА

ИНЖЕНЕРИНГ ПЛОВДИВ ЕАД

For details refer to FBX Leaflet
Installation - Commissioning - Operation - Maintenance
Civil engineering guide

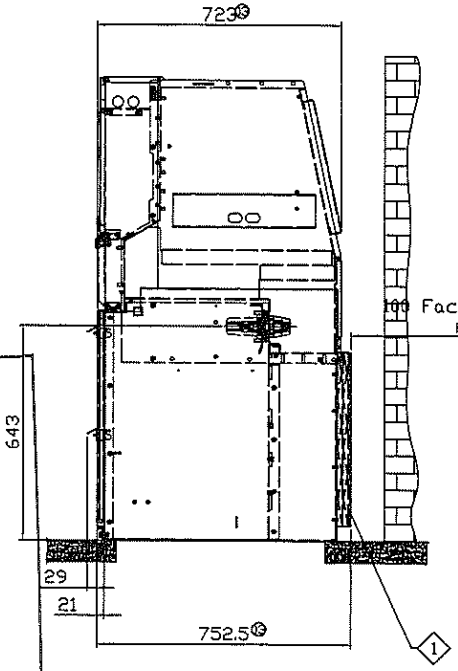
devis n° :012123
nom du projet :CEZ TENDER
client :SCHNEIDER ELECTRIC BULGARIA EOOD
ref. client :

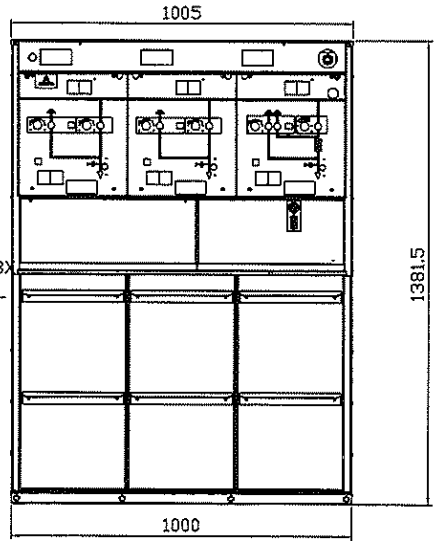
FBX-E/24-16/T1

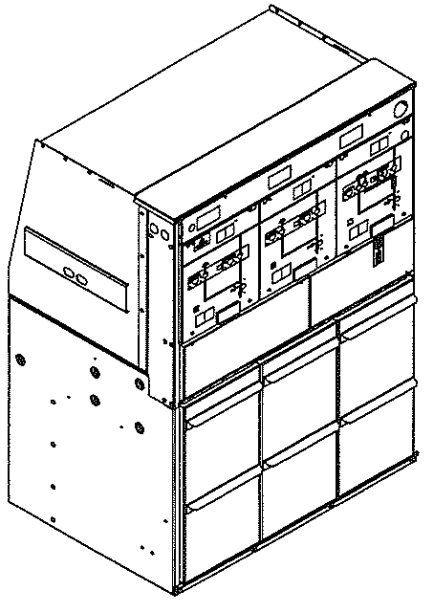
Document CAO MEDEA 14 a ne modifier qu'en CAO

variante du devis :A
version du devis :00
date :10/05/2011

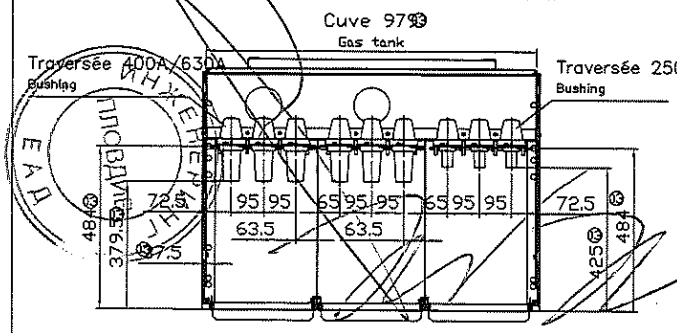
REPRESENTATION C-C-T1





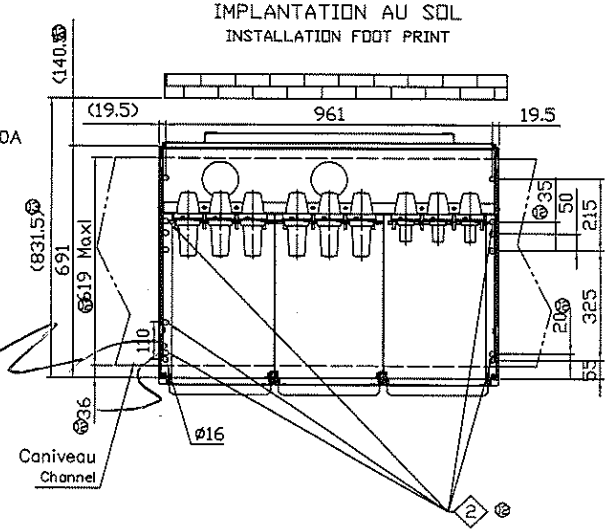


ENCOMBREMENT INTERIEUR DU COMPARTIMENT CABLES
OUTLINE OF CABLE COMPARTMENT INTERIOR



Cotes prises depuis l'intérieur
Dimensions taken from the interior

IMPLANTATION AU SOL
INSTALLATION FOOT PRINT



1 Option:Panneau arrière avec grilles de refroidissement; échappement des gaz de l'arc interne vers arrière.
Option:Rear cover with cooling grid, pressure relief to the rear.

2 Trous de fixation optionnelle
Optional fixing holes

Plan source 3D, voir N°

На основание чл. 2 от ЗЗЛД

NOTA
Table
Compo

C-C-T1 / C-RE-T1 / R-RE-T1 /C-
/ C-RE-T1 / R-RE-T1 /C-C-C

Traitement de surface / Surface Treatment / Oberflaschenbehandlung	Traitement thermique / Thermic Treatment / Wärmebehandlung
Nom/Name : M. Naumann	Industrialisation Date/Datum: 2008/05/13 Nom/Name : D. Laurent

FONCTIONELLE
CTIONAL UNIT

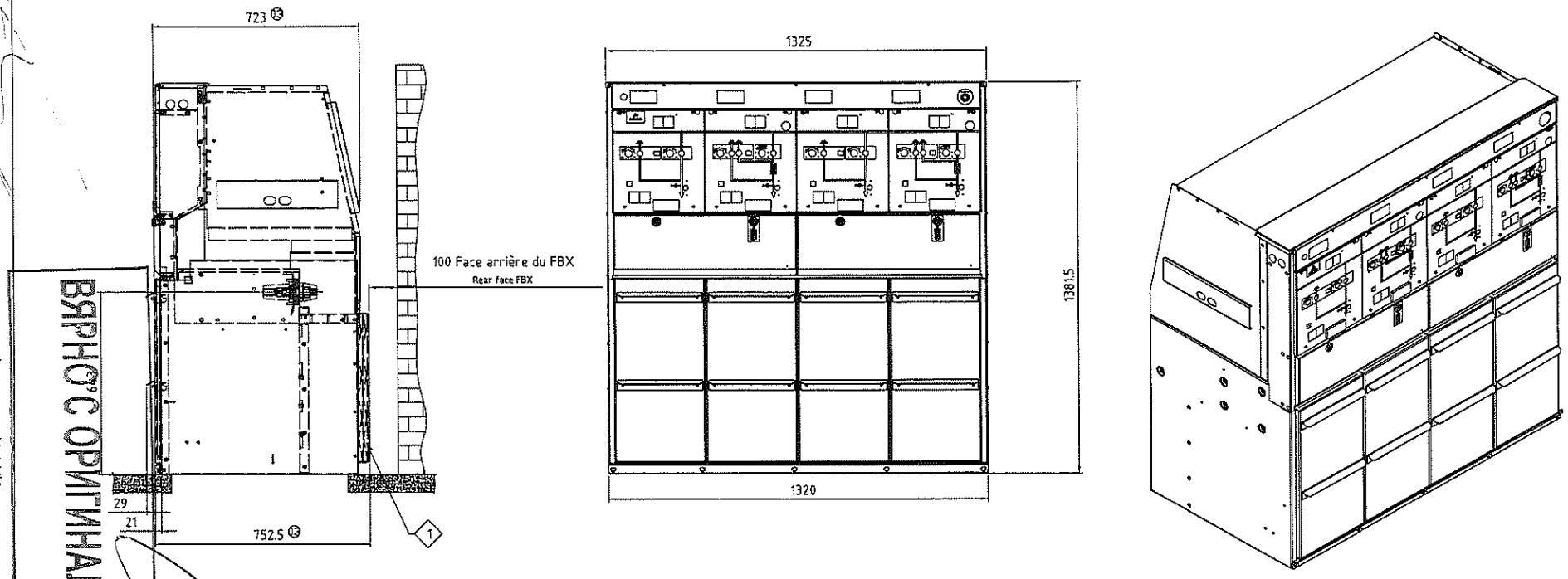
AMT006700-01

REVISION 03 AUSGABE

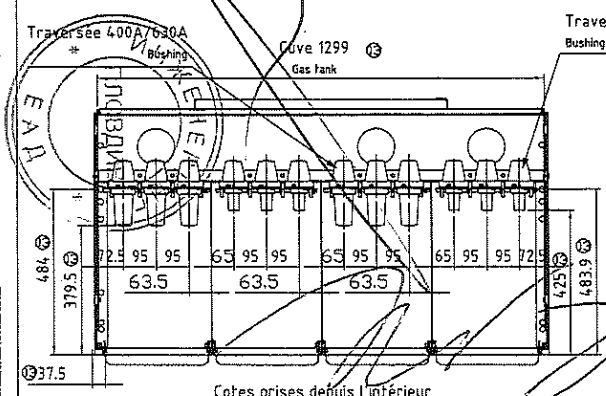
Documenttype: Mechanical Desktop 5.0
Titleblock Version: 3 - (04/2006)

ВЯРНО С ОРИГИНАЛА

REPRESENTATION C-T1-C-T1

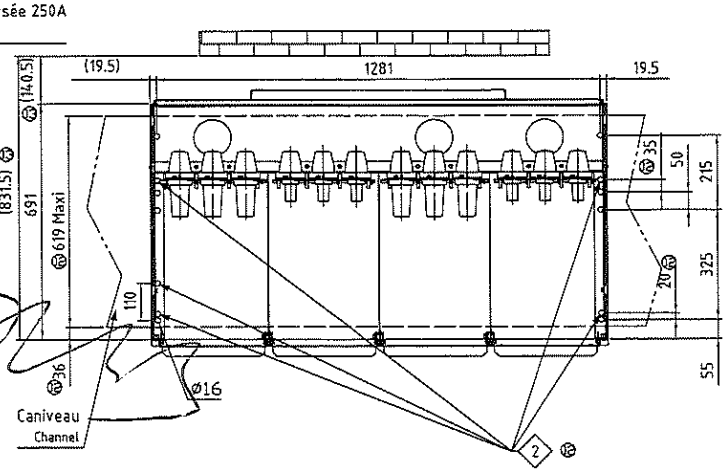


ENCOMBREMENT INTERIEUR DU COMPARTIMENT CABLES
OUTLINE OF CABLE COMPARTMENT INTERIOR



Cotes prises depuis l'intérieur
Dimensions taken from the interior

IMPLANTATION AU SOL
INSTALLATION FOOT PRINT



1 Option:Panneau arrière avec grilles de refroidissement, échappement des gaz de l'arc interne vers arrière.
Option:Rear cover with cooling grid, pressure relief to the rear.

2 Trous de fixation optionnelle
Optional fixing holes

Plan source 3D, voir N° AMT006580-02
Source drawing 3D, see N° AMT006580-02

NOTA
Tableau compact FBX IS C-C-C-T1 / C-T1-C-T1 / C-C-C-C
~~Compact unit FBX IS C-C-C-T1 / C-T1-C-T1 / C-C-C-C~~

Matière / Material / Werkstoffe	Tolérances Générales / General Tolerances / Allgemeine Toleranzen	Traitement de surface / Surface Treatment / Oberflächenbehandlung	Traitement thermique / Thermic Treatment / Wärmebehandlung
NONE	None / None	None	None

Rev.	N°	Date/Datum			
			Creation/Revision	Design	Industrialisation
04	AMT009736M	2009/09/25	Date/Datum: 2009/09/25	Date/Datum: 2009/09/21	Date/Datum: 2009/09/28
03	AMT006513M	2008/04/07	Nom/Name : C. Grech	Nom/Name : M. Naumann	Nom/Name : D. Laurent
02	AMT006119M	2007/11/26			

N° Projet/Proto N° | Technical Prescription
A2H | GA 3 | Quality Prescription
Echelle/Scale/Maßstab 1/10

UNITE FONCTIONELLE
FUNCTIONAL UNIT

Weight (kg)

AREVA | T&D | AMT | AMT006580-01 | REVISION 04 AUSGABE

Documenttype. Mechanical Desktop 5.0
Titleblock Version. 3 - (04/2008)

Schneider Electric

Inspection 228

Year 2012

Serial Number *FBX--1335012/AMT*

Order number S000017881

Customer ID 4151412

Position 011XX Diagram

Type FBX-C/24-16/C-T1		
IEC 62271-200	Instruction AMTNOT131-01 / AMTNOT132-01	
Ur 24 kV	Ir 630 A	fr 50 Hz
Up 125 kV	Ik 16 kA	tk 1s
Ud 50 kV	IAC -	Max. unit weight (kg)
Pre 0.03 Mpa	Pae 0.02 Mpa	220
SF6 1.7 kg	Pme 0.02 Mpa	sealed pressure system
C function	T1 function	
IEC 62271-103	IEC 62271-105	
Ir 630 A	Pref. W	
Ik 16 kA / 1 s	Ir acc. fuses choice grid	
Class E3 - M1 - C1	Type medium	
Ur V	Ua V	
IEC 62271-102	IEC 62271-102	
Ik 16 kA / 1 s	Ik 5 kA / 1 s	
Class E2	Class E2	

AMT1335012/01760101

Service

AMT014501-01

ВЕРНО С ОРИГИНАЛА

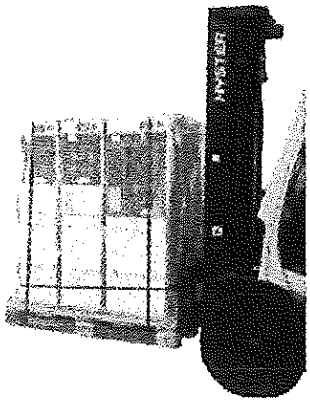
ПЛОВДИВ

716

FBX-E

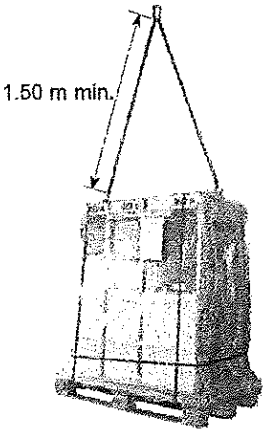
Обслужване на свързани функционални единици

Допълнителна информация към Ръководство на Потребителя AMTNoT131-02.



Процедура за обслужване по време на транспортиране

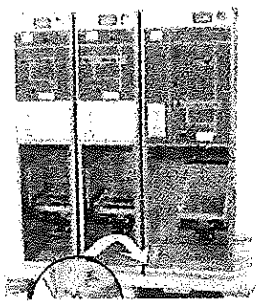
- с мотокар



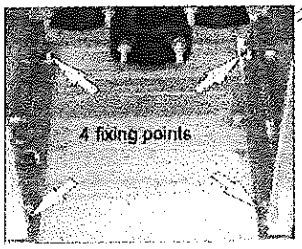
- с такелажна верига по 1,000 кг. всяка

Разопаковане на таблото

- Преместване на таблото, така както е опаковано, възможно най-близо до местоположението му за монтаж.
- Отстранете предпазното покривало .



- Отстранете панелите на вратата .
- Развинтете винтовете за дърво с квадратна глава, фиксиращи таблото към палета (четири точки в краищата на функционалните единици).



- Напасвайте панелите на вратата обратно на местата им.

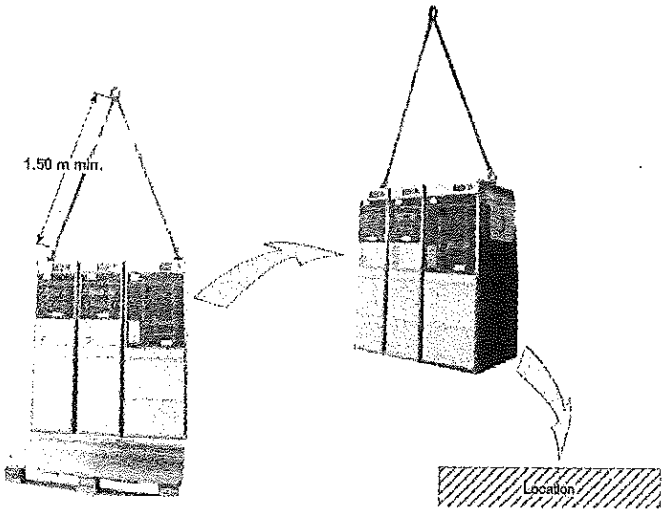
Обслужване на свързани функционални единици

Монтаж на таблото

- Проверете равнината на пода, където разпределителното табло ще бъде монтирано

- Повдигнете таблото посредством такелажните вериги и го спуснете надолу бавно, без резки движения, до окончателните му местоположение

Таблото не бива да се мести като се плъзга по пода.



Проверки

- Заклинете таблото на място, ако е необходимо.
- Уверете се, че функционалните единици от които е изградено разпределителното табло са свързани заедно и съосни (нивелирани)

Въвеждане на разпределителното табло в експлоатация

- Завършете монтажа, и след това въведете в експлоатация съгласно указанията дадени в Ръководство на потребителя AMTNoT131-02.

ВЯРНО С ОРИГИНАЛА
748

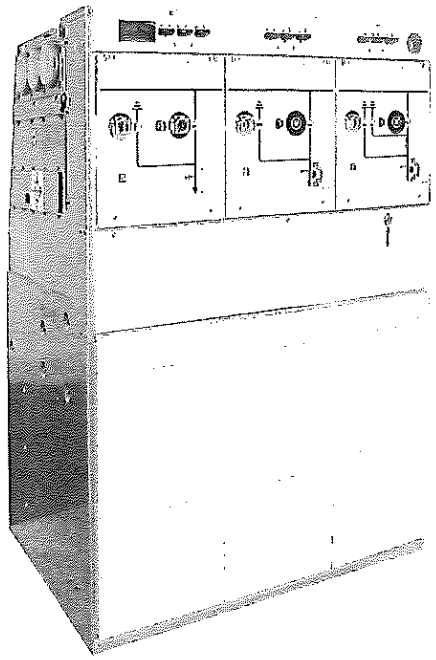
ИНЖЕНЕРИНГ ПЛОВДИВ ЕАД

Secondary Distribution Switchgear

FBX

SF6 Gas-insulated switchboards

Instructions
Guide for Civil Engineering Structures



ВЯРНО С ОРИГИНАЛА

ИНЖЕНЕРИНГ ПЛОВДИВ ЕАД

Schneider Electric

749

Contents

757

1 Schneider Electric at your service

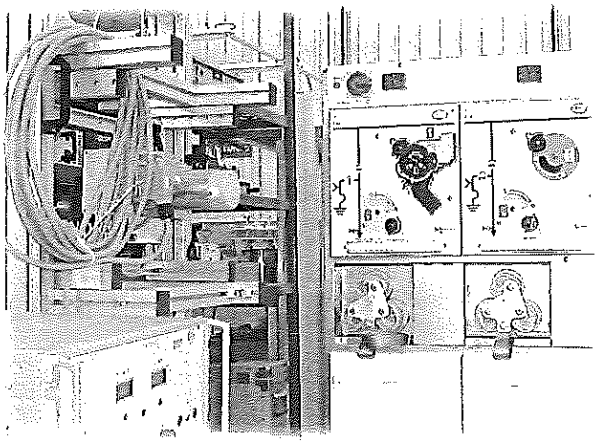
Operations and maintenance may only be carried out by personnel who have received suitable authorization for the operations and manœuvres they are responsible for performing.

If this is not the case, please refer to our Service Unit or Training Centre.

All locking-out operations must be performed according to the "General Safety Instructions booklet for Electrical Applications" UTE C 18 510 (or its equivalent outside FRANCE).

1.1 Our Service Unit: our specialists, and suitably adapted services...

- Guarantee extension contracts in relation to the selling of new equipment,
- Supervision of HVA switchgear installations,
- Technical advice, diagnoses of the facilities, expertise,
- Maintenance contracts adapted to operational constraints,
- Systematic or conditional preventive maintenance,
- Corrective maintenance in case of partial or complete failure,
- Supply of spare parts,
- Overhauling of equipment and requalification of installations in order to benefit from new technologies and extend the life of your switchgear by limited investments.



Contact the Schneider Electric Service Unit for diagnoses and advice:
Working hours

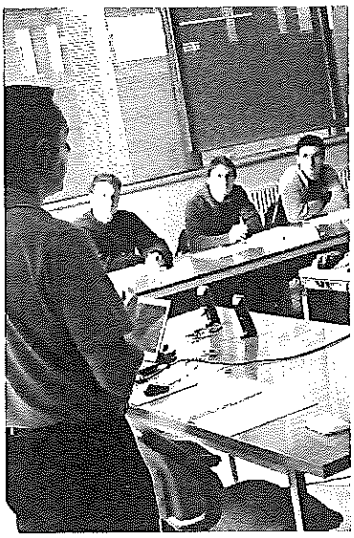
✆	33 (0)3 85 29 35 00
🖷	33 (0)3 85 29 36 30
or	33 (0)3 85 29 36 43

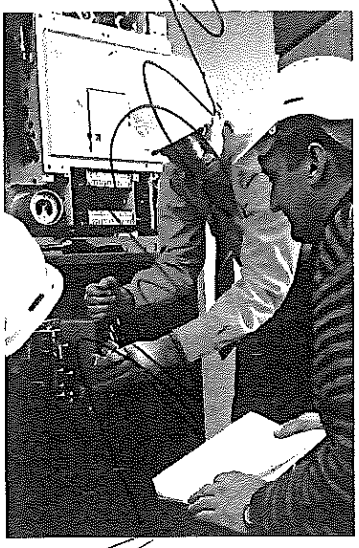
1.2 Schneider Electric Training: Together, let us develop our skills...

We can place at your disposal all of our trainers' expertise, our teams' pedagogical experience and the wealth of our equipment, to help you face the challenge of encouraging the personal development of each individual through the optimization of their skills.

From a few hours up to several weeks, Schneider Electric Training has the control over all of the teaching processes in order to meet the needs of each customer.

- Specific training, directly operational with practical work on real machines.
- Small groups to facilitate communication.
- Balance between theory and practice.
- Evaluation and management of the skills: Measurement and optimization of the trainees' knowledge.





Faced with the direct and indirect training costs of the operational stoppages and shutdown, training is a real investment

Schneider Electric France
Training Centre

35 rue Joseph Monier - CS 30323 - F-92506 Rueil-Malmaison Cedex

www.schneider-electric.fr/formation

2 With regards to this User Manual

2.1 Use of this User Manual

This User Manual describes the works or arrangements necessary for the installation of a HVA switchboard of the FBX type.

2.2 Responsibilities

Our devices are quality controlled and tested at the factory in accordance with the standards and the regulations currently in force.

Apparatus efficiency and apparatus life depend on the compliance with the installation, commissioning and operation instructions described in this user manual.

Non respect of these instructions is likely to invalidate any guarantee.

The texts in this User Manual refer to international regulations.

Local requirements especially about safety and which are in accordance with the indications given in this document, must be observed.

2.3 Definition of the substations

Amongst substations that are prefabricated or built outdoors, walk-in substations can reach, or even exceed 2.5 m in height. They allow operating personnel to penetrate into the substation and work in them sheltered from bad weather.

The indoor substations with "prefabricated metal-clad bays" are installed in areas that the User reserves in one of the buildings in the factory, or in a building specially built for this purpose for the case of transformer substations for HVA distribution networks.

The recommended minimum volume for the room is: **12 m^3**

2.4 Access to the substation

Substation access must remain free at all times and under any circumstances. It is therefore generally installed on the side of the road.

Passages must be designed to permit easy maintenance for all of the substation's elements (circuit breaker, transformer, etc.).

2.5 Other technical notices to be consulted

- AMTNoT131-02 FBX Installation - Commissioning
- AMTNoT132-02 FBX Operation - Maintenance
- AMTNoT170-02 FBX Function CB Installation - Commissioning - Operation - Maintenance
- AMTNoT174-02 FBX Assembly a 1250A busbar

3 Dimensions of the FBX switchboards

3.1 Description of the functions

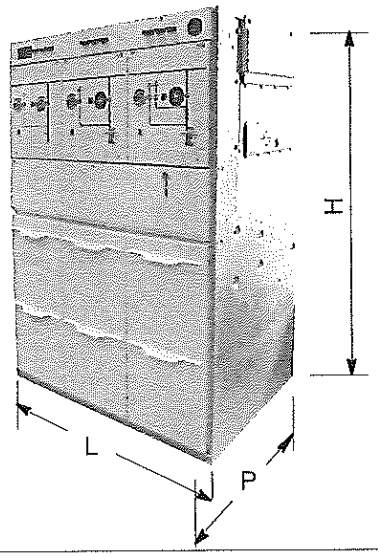
C = Load break switch
T1 = Combined or associated fused interrupter switch
T2 = Transformer protection circuit breaker
CB = Cables protection circuit breaker
CBb = Busbar protection circuit breaker
R = Direct linkage
RE = Direct incoming feeder with earthing switch

M1 = Measurement with cable connections
M2 = Measurement with RHS extension
M3 = Measurement for LHS extension
M4 = Measurement for extension (right or left)
Sb = Busbar isolator

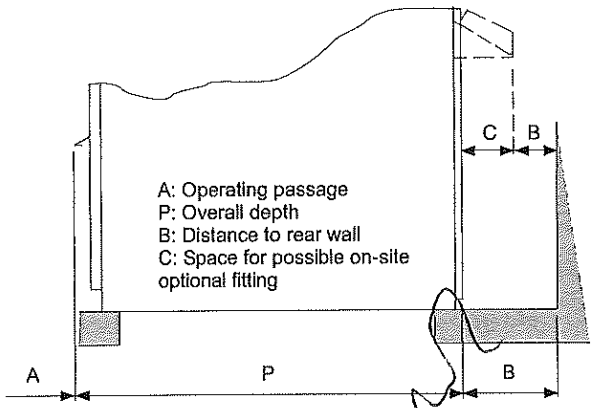
3.2 Overall dimensions

These are used to position the switchboard within the room.

The dimensions for the total switchboard volume (excluding optional extras) are:
- Width
- Depth
- Height.



Example for the depth of a switchboard



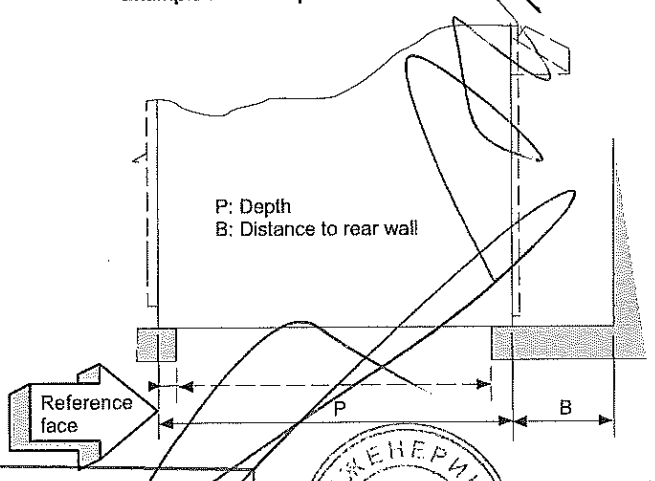
3.3 Ground plan dimensions

These are used for the civil engineering work relating to the switchboard.

In this case, the dimensions of the surfaces touching the ground are given.

The reference face is the front panel as it touches the ground. The sizes are taken from this reference.

Example for the depth of a switchboard



3.4 Dimensions and weights of the FBX-C switchboards (non-extendable model)

Switchboard	Number of modules	Overall Depth (mm)			Floor dimensions (mm)		Weights approximate (kg)
		Height[1]	Depth[2]	Width	Depth	Width	
C-C	2	1380/1040	752	680	691	680	200
RE-T1	2	1380/1040	752	680	691	680	210
RE-T2	2	1380	752	680	691	680	240
C-T1	2	1380/1040	752	680	691	680	200
C-T2	2	1380	752	680	691	680	230
C-C-T1	3	1380/1040	752	1000	691	1000	330
C-C-T2	3	1380	752	1000	691	1000	360
C-C-C	3	1380/1040	752	1000	691	1000	320
C-RE-T1	3	1380/1040	752	1000	691	1000	320
C-RE-T2	3	1380	752	1000	691	1000	360
R-RE-T1	3	1380/1040	752	1000	691	1000	320
R-RE-T2	3	1380	752	1000	691	1000	350
C-C-C-T1	4	1380/1040	752	1320	691	1320	450
C-C-C-T2	4	1380	752	1320	691	1320	480
C-T1-C-T1	4	1380/1040	752	1320	691	1320	470
C-T2-C-T2	4	1380	752	1320	691	1320	500
C-C-C-C	4	1380/1040	752	1320	691	1320	440
C-C-C-C-C	5	1380	752	1675	691	1675	540
C-C-C-C-T1	5	1380	752	1675	691	1675	550
C-C-T1-C-T1	5	1380	752	1675	691	1675	580
C-T1-C-T1-T1	5	1380	752	1805	691	1805	570

1) Add 200 or 600 mm depending on the height of the box
2) Without a cooler at the rear. In the case of a cooler, add 38.5 mm

3.5 Dimensions and weights of the FBX-M switchboards

Module	Number of modules	Overall Depth (mm)			Floor dimensions (mm)		Weights approximate (kg)
		Height	Depth[1]	Width[2]	Depth	Width	
M1	1	1380	720	1000	691	1000	490
M2	1	1380	720	1005	691	1000	490
M3	1	1380	720	1005	691	1000	490
M4	1	1380	720	1010	691	1000	490

1) Without a cooler at the rear. In the case of a cooler, add 38.5 mm
2) Plus 17.5 mm for the busbar cover (on the right or left-hand side) at the far end of the switchboard

3.6 Dimensions and weights of the FBX-E switchboards (extendable model)

Extendable switchboards

Module	Number of modules	Overall Depth (mm)			Floor dimensions (mm)		Weights approximate (kg)
		Height[1)]	Depth[2)]	Width[3)]	Depth	Width	
C-C	2	1380	752	690	691	690	210
C-T1	2	1380	752	690	691	690	210
C-T2	2	1380	752	690	691	690	240
RE-T1	2	1380	752	690	691	690	220
RE-T2	2	1380	752	690	691	690	250
C-C-T1	3	1380	752	1010	691	1010	340
C-C-T2	3	1380	752	1010	691	1010	370
C-C-C	3	1380	752	1010	691	1010	330
C-RE-T1	3	1380	752	1010	691	1010	330
C-RE-T2	3	1380	752	1010	691	1010	360
R-RE-T1	3	1380	752	1010	691	1010	330
R-RE-T2	3	1380	752	1010	691	1010	360
C-C-C-T1	4	1380	752	1330	691	1330	460
C-C-C-T2	4	1380	752	1330	691	1330	490
C-T1-C-T1	4	1380	752	1330	691	1330	480
C-T2-C-T2	4	1380	752	1330	691	1330	510
C-C-C-C	4	1380	752	1330	691	1330	450

1) - Add 200 or 600 mm depending on the height of the box
2) - Without a cooler at the rear. In the case of a cooler, add 38.5 mm
3) - Plus 17.5 mm for the busbar cover (on the right or left-hand side) at the far end of the switchboard
- To calculate the total width of several connected FBX-E switchboards, add 9 mm between each extension

Functional Unit - Extension

Module	Number of modules	Overall Depth (mm)			Floor dimensions (mm)		Weights approximate (kg)
		Height[1)]	Depth[2)]	Width[3)]	Depth	Width	
C	1	1380	752	370	691	360	135
R	1	1380	752	370	691	360	125
RE	1	1380	752	370	691	360	135
T1	1	1380	752	500	691	490	160
T2	1	1380	752	500	691	490	190
CB	1	1380	873	500	691	490	220
CBb	1	1380	873	635	691	625	250
Sb	1	1380	752	690	691	680	200
T1-T1	2	1380	752	1010	691	1000	310
T2-T2	2	1380	752	1010	691	1000	370

1) - Add 200 or 600 mm depending on the height of the box
- With a 1250 A busbar on the top, add 217 mm
2) - Without a cooler at the rear. In the case of a cooler, add 38.5 mm
3) - Plus 17.5 mm for the busbar cover (on the right or left-hand side) at the far end of the switchboard
- To calculate the total width of several connected FBX-E switchboards, add 9 mm between each extension

753

4 General rules for the installation of FBX switchboards

4.1 Reminder concerning normal installation and service conditions (in accordance with IEC62271-1)

* Permissible ambient temperature

The ambient air temperature should be comprised between - 5°C (on option -15 or -25°C) and + 40°C.

The mean measured value for a 24 hour period must not exceed 35°C.

* Installation altitude

HV equipment is defined in accordance with European Standards and can be used up to an altitude of 1,000 m.

Beyond this, account must be taken of the decrease in dielectric withstand.

For these specific cases, contact the Schneider Electric Sales Department.

* Atmospheric pollution

The ambient air must not contain any dust particles, fumes or smoke, corrosive or flammable gases, vapours or salts.

* Permissible atmospheric humidity level

The average atmospheric relative humidity level measured over a 24-hour period must not exceed 95%.

The average water vapour pressure over a period of 24 hours must not exceed 22 mbar.

The average atmospheric relative humidity value measured over a period of one month must not exceed 90 %.

The average water vapour pressure over a period of one month must not exceed 18 mbar.

Condensation may appear in case of any sharp variation in temperature, due to excessive ventilation, a high atmospheric humidity level or the presence of hot air. This condensation can be avoided by an appropriate lay-out of the room or of the building (suitably adapted ventilation, air driers, heating etc.).

Whenever the humidity level is higher than 90 %, we recommend that you take appropriate corrective measures. For any assistance or advice, contact the Schneider Electric After-Sales department (See § 1.1).

Please consult Schneider Electric for any installation conditions which differ from the standard.

4.2 Substation installation requirements

The substation must be sheltered from flooding and any infiltrations of water. No ducts of any kind must pass through the substation's immediate environment without special protection (sheaths or ducts). Water, snow, or animal salts must not be able to penetrate.

Also prevent any penetration by small animals such as rodents, snakes, lizards, etc. especially in tropical areas.

The room must be equipped with standardised high level and low level ventilation.

Cable troughs and ducts must be blocked up to avoid:
- any draughts of air below the Functional Units,
- any rise in humidity or pollution coming from below ground.

4.3 Installation of the switchboard

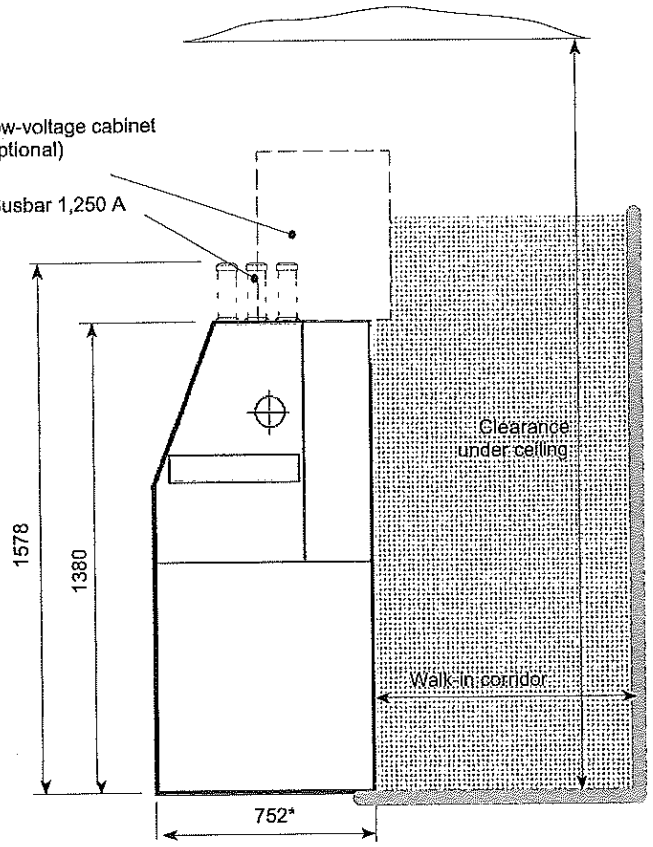
The positioning of the switchboard is paramount for:
- minimum spaces at the front (walk-in corridor for manoeuvering), at the rear and on each side of the switchboard. Certain passages must be sufficient for free movement and execution of operation and maintenance manoeuvres,
- leave the room's access door free,
- Take all measures to prevent all incidence of climatic conditions (humidity, pollution, etc.).

Respect the imposed distances (see following chapter).

Do not place the switchboard below any ventilation grilles, air vents, or air conditioning grilles or in the immediate proximity of glass tile panels in direct contact with the outside.

The switchboard must not be exposed to any solar radiation. A direct exposure can lead to excessive overheating of the low voltage racks.

4.4 Examples of the positioning of an FBX switchboard in a room



Side views

1) Free passages for installation:

Minimum width: 950 mm

Mimimum height: 1,800 mm

2) Walk-in corridor:

FBX-C: ≥ 800 mm for operations

FBX-E: ≥ 950 mm to facilitate the installation of extensible switchboards

3) Clearance under ceiling:

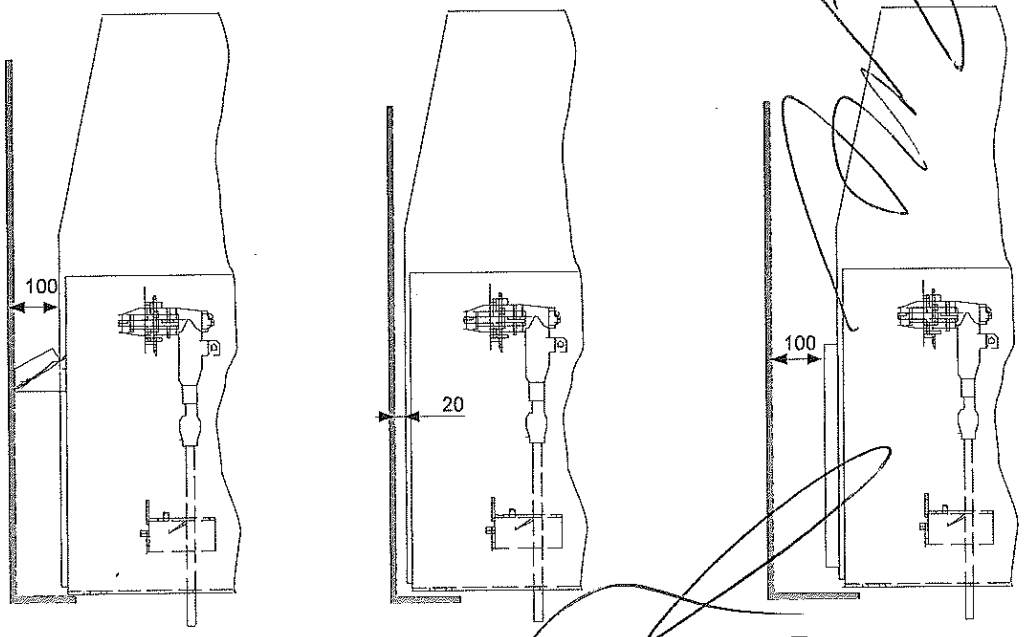
Without LV cabinet: ≥ 2,000 mm

With LV cabinet (200 mm): ≥ 2,000 mm

With LV cabinet (600 mm): ≥ 2,100 mm

With 1,250A busbar: ≥ 2,100 mm

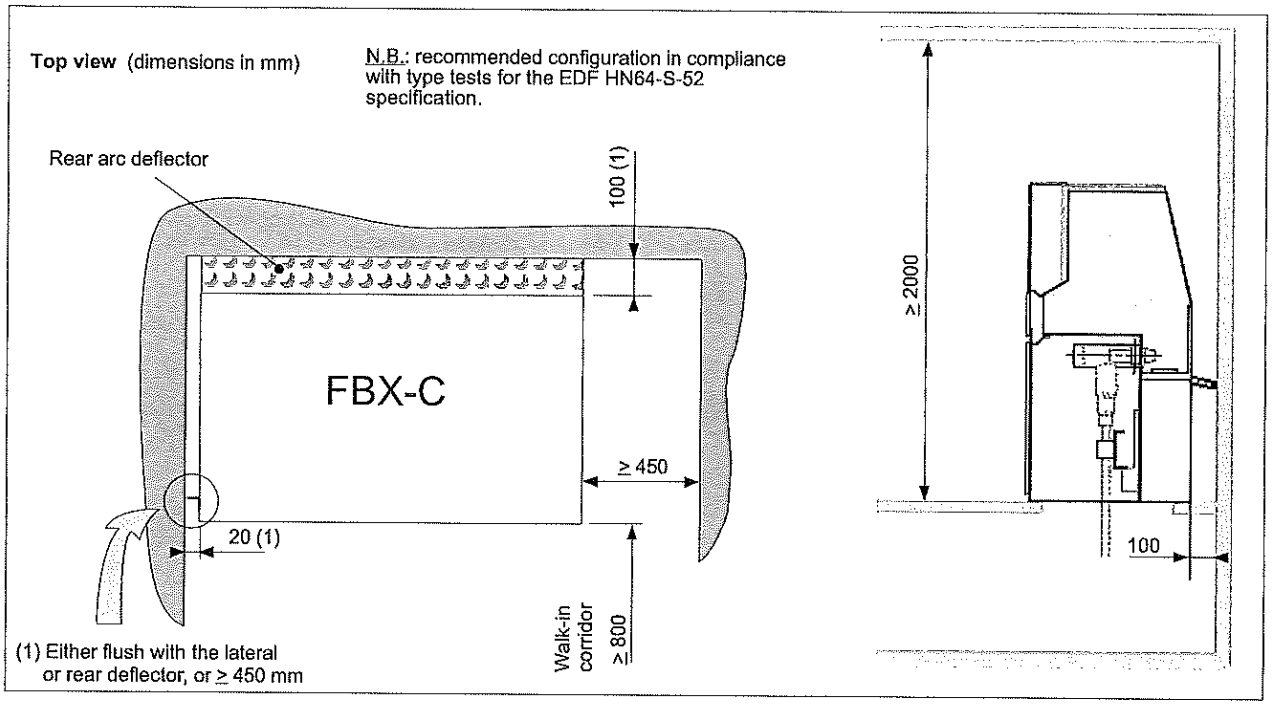
* + 38,5 mm with cooler



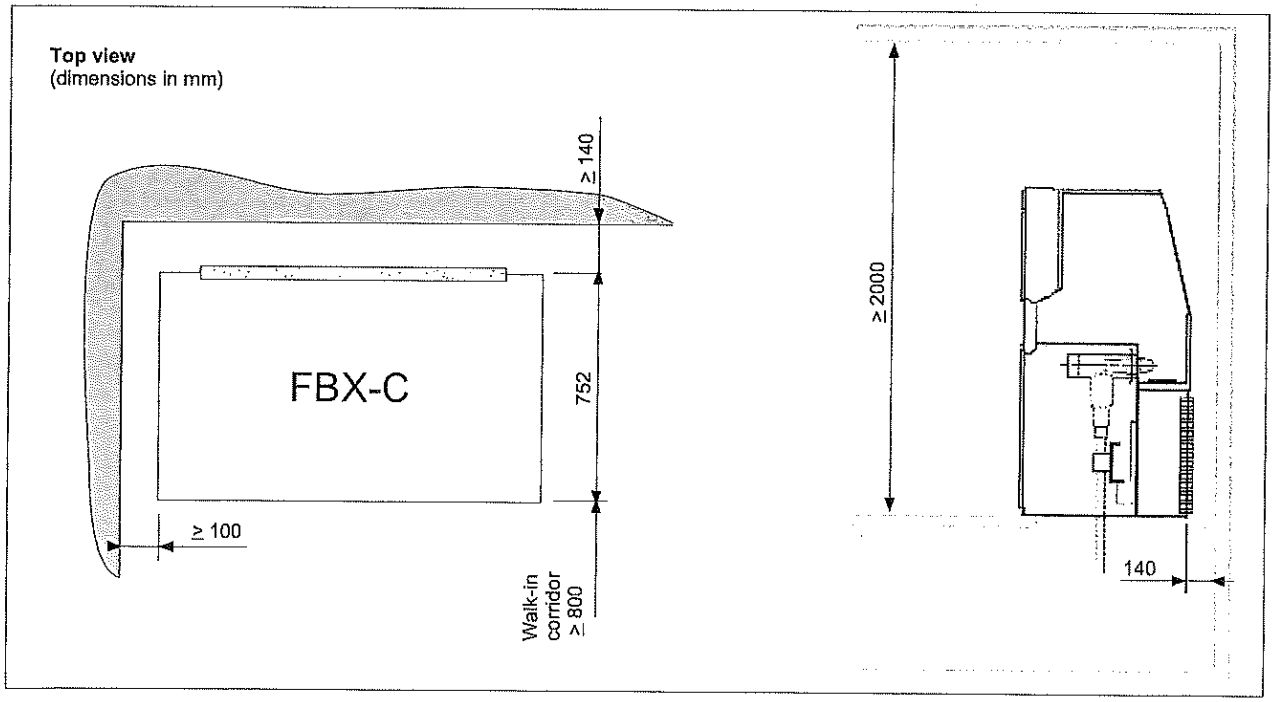
With rear deflector | Without rear deflector | With rear cooler

5 Installation of an FBX-C switchboard

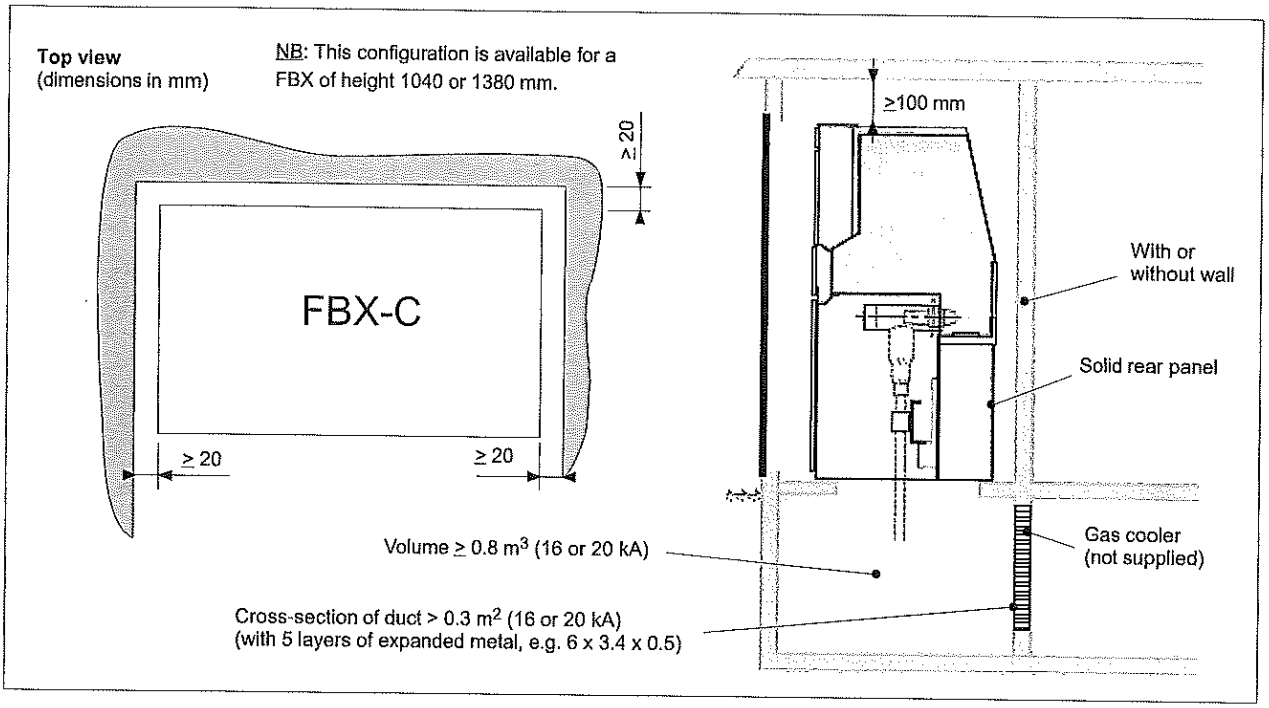
5.1 Switchboard up to 20 kA (AF - 1 s) - Rearward evacuation - Standard Installation



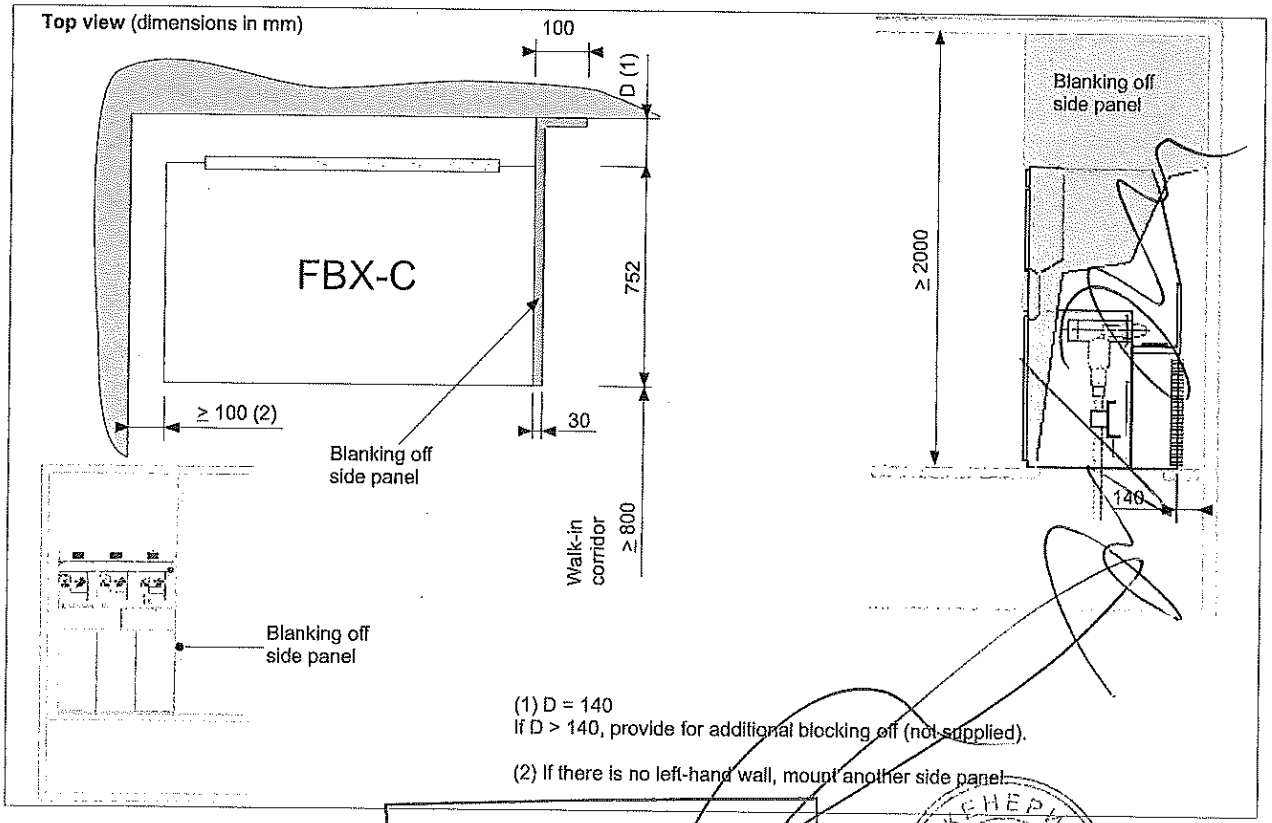
5.2 Switchboard up to 20 kA (AF - 1 s), with gas exhaust cooler towards the rear



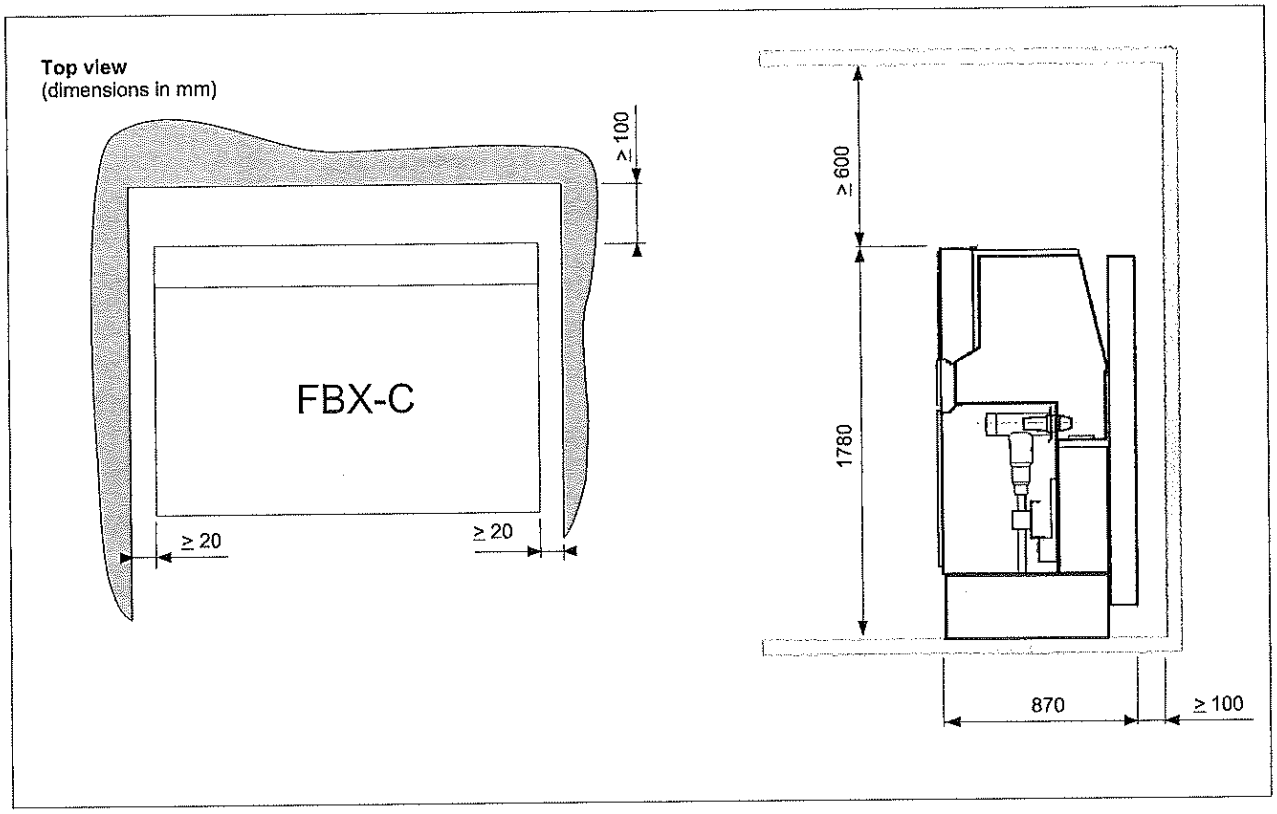
5.3 16, 20 and 25 kA Switchboards (AF/AFL - 1 s), with solid rear panel and gas exhaust towards the bottom



5.4 16 and 20 kA Switchboards (AFL - 1 s), with gas exhaust towards the rear

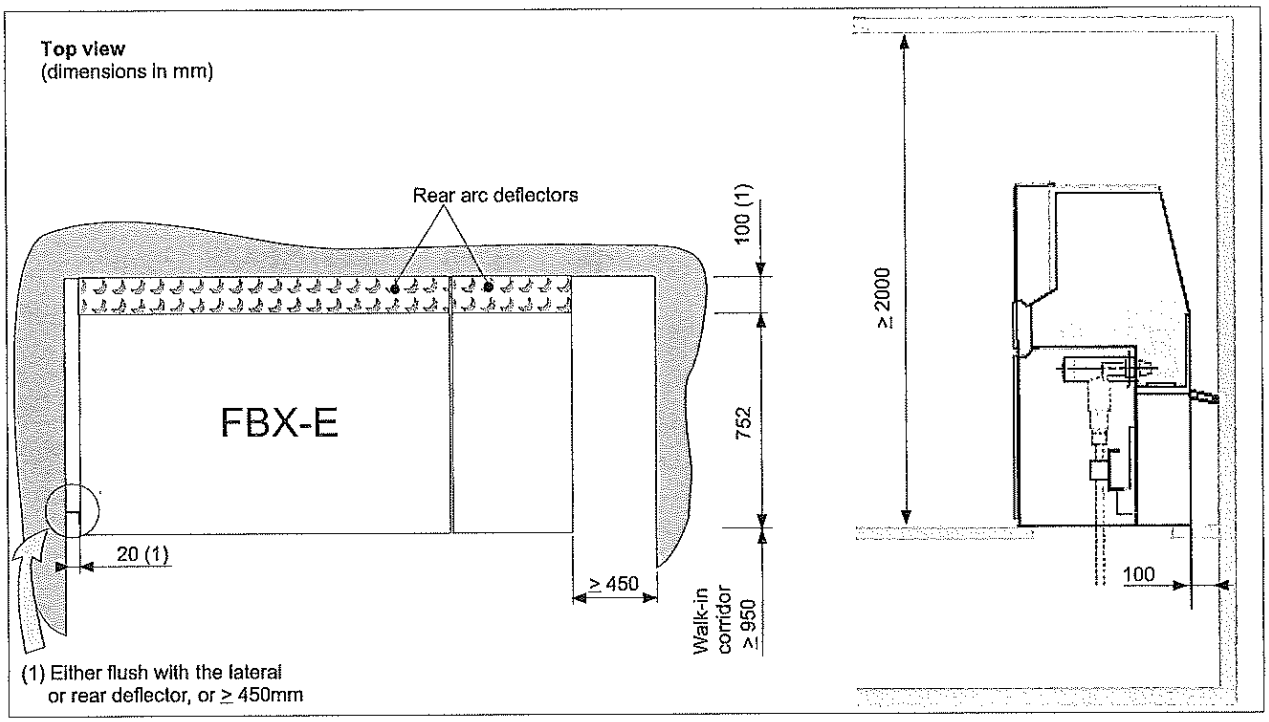


5.5 16 and 20 kA switchboards (AFL - 1S) with rear-mounted chimney

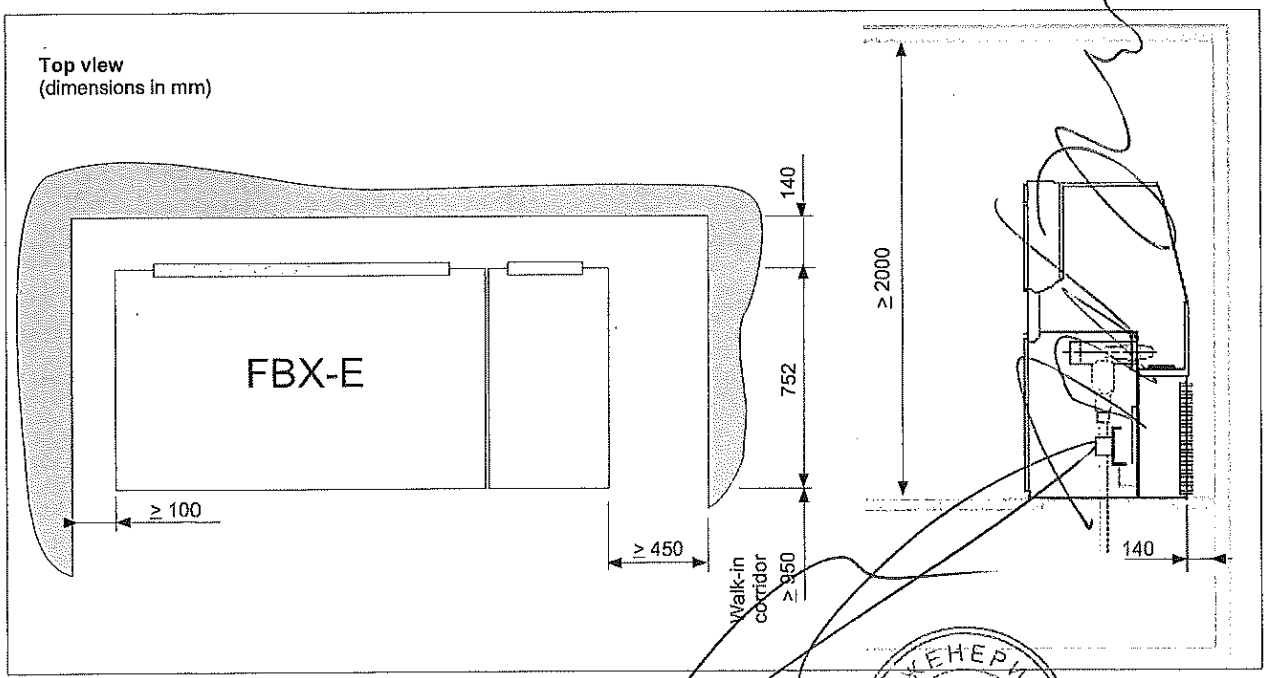


6 Installation of an FBX-E switchboard

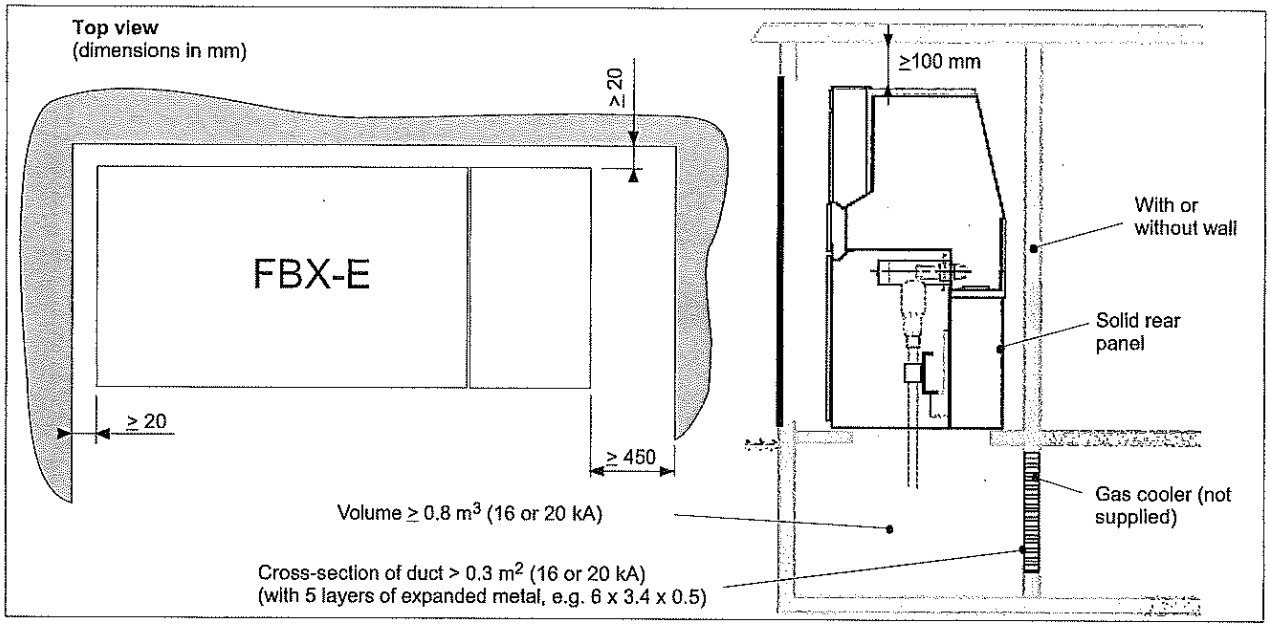
6.1 Switchboard up to 20 kA (AF – 1 s) [except if M or CBb function] - Rearward evacuation - Standard Installation



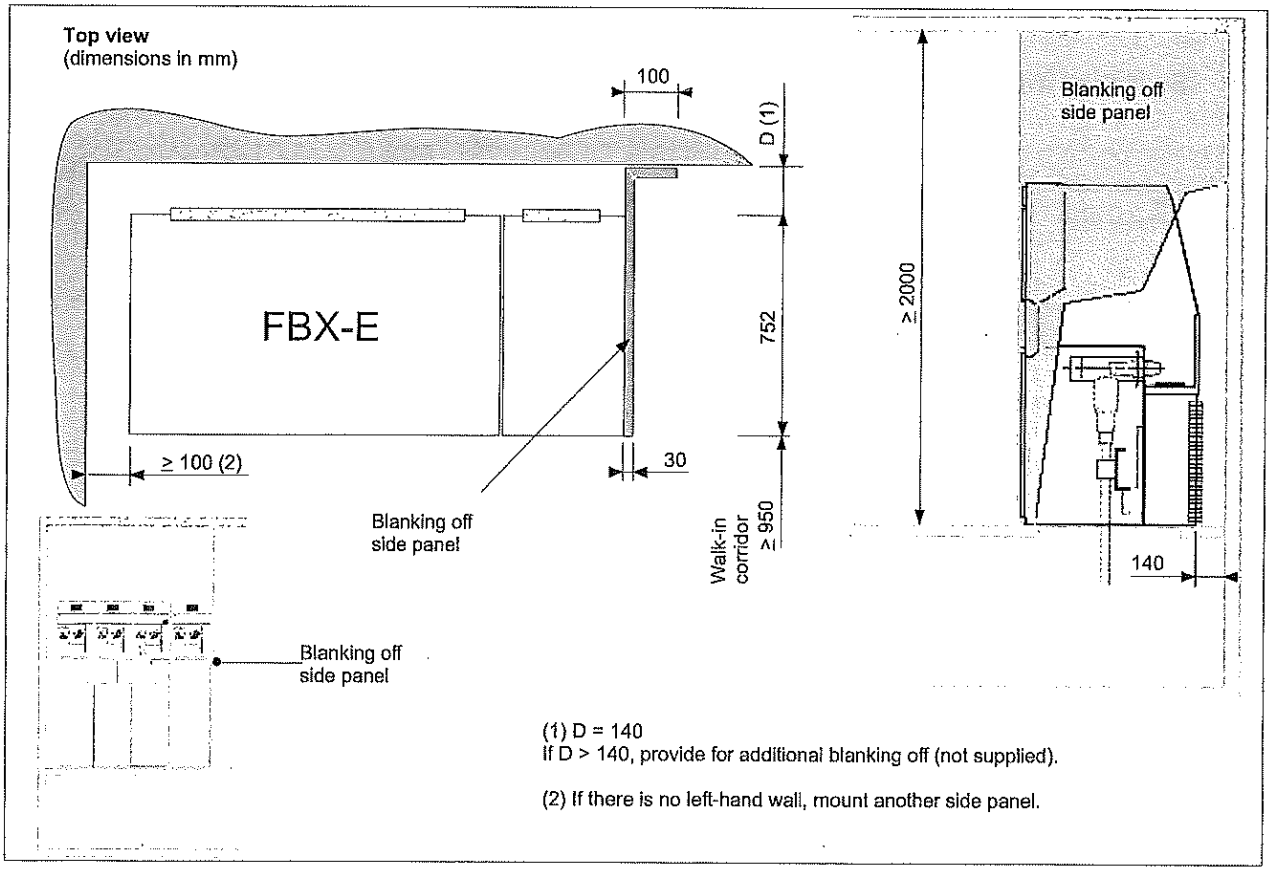
6.2 Switchboard up to 20 kA (AF - 1 s), with gas exhaust cooler towards the rear



6.3 16, 20 and 25 kA Switchboards (AF/AFL - 1 s), with solid rear panel and gas exhaust towards the bottom



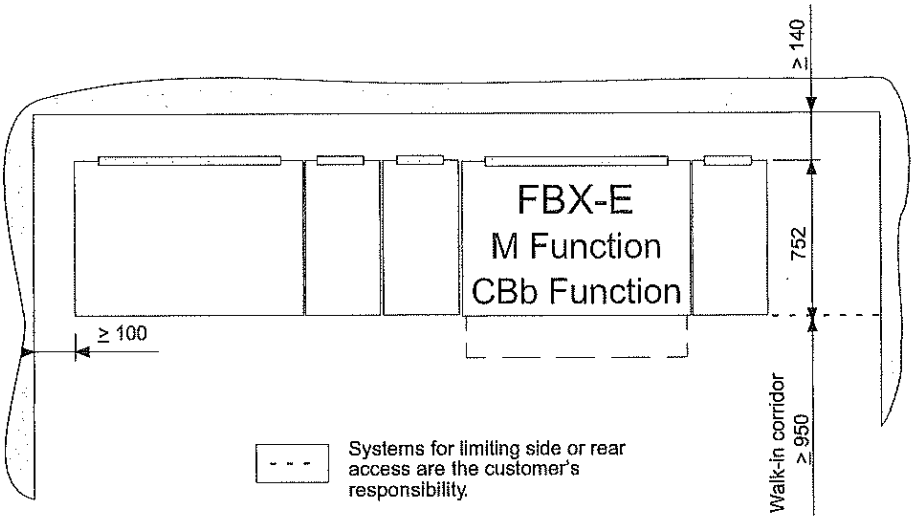
6.4 16 and 20 kA Switchboards (AFL - 1 s), with gas exhaust towards the rear



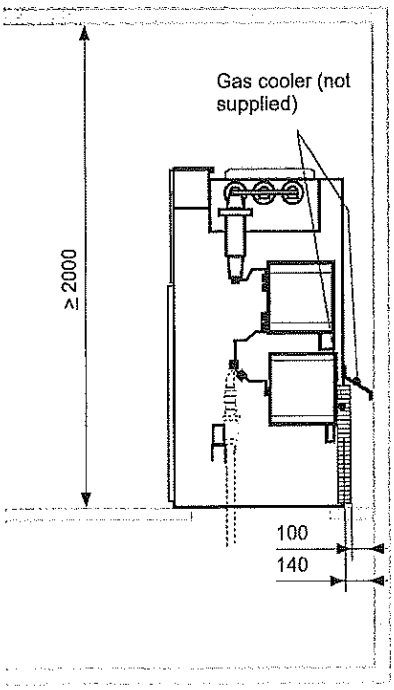
7 Installation of an FBX-E switchboard with M or CBb Function

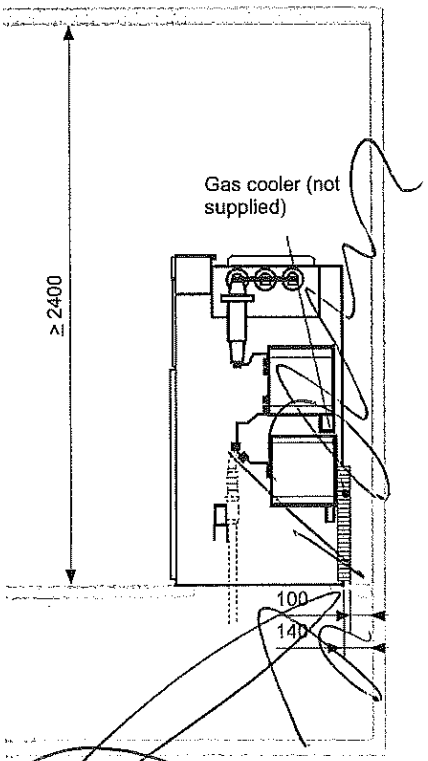
7.1 16 kA and 20 kA Switchboards (AF - 1 s), with gas exhaust towards the rear

Top view
(dimensions in mm)

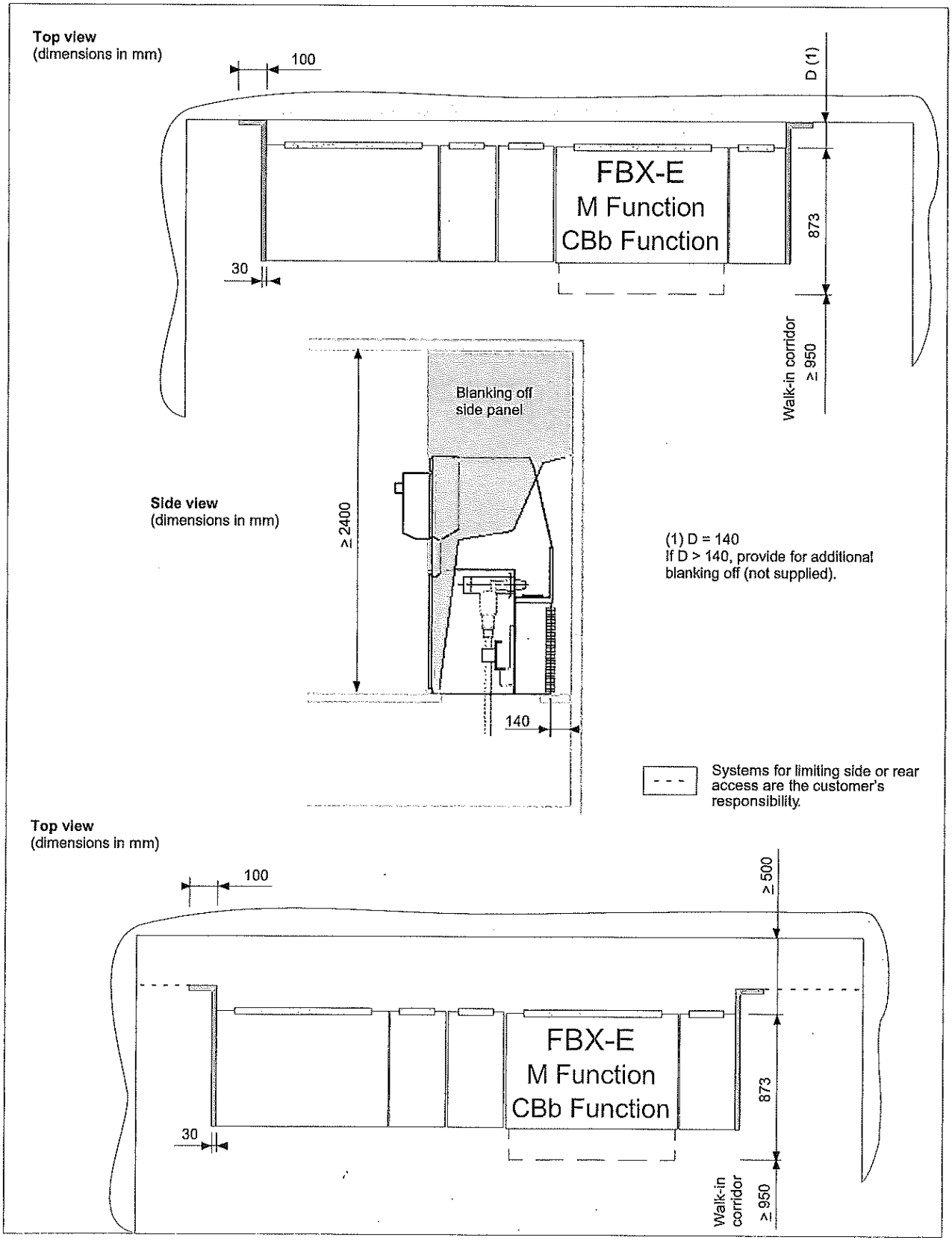


Side view
(dimensions in mm)



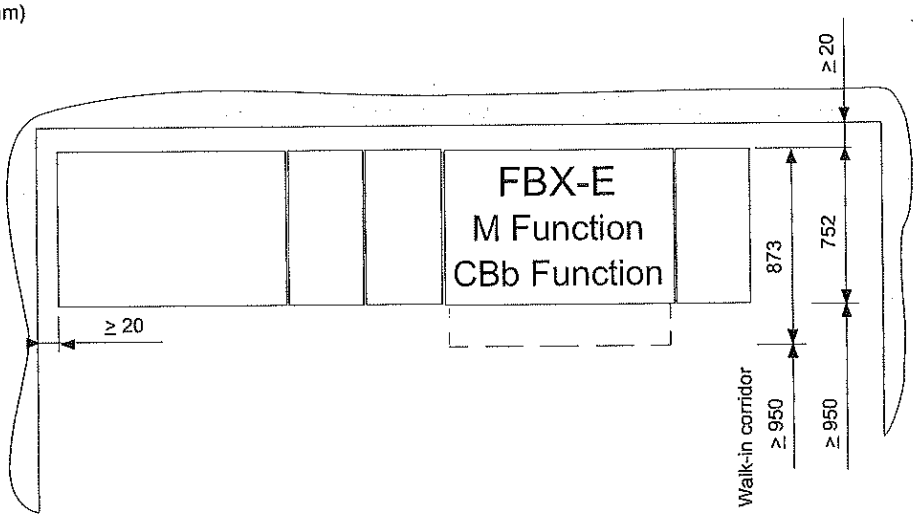


7.2 16 and 20 kA Switchboards (AFL - 1 s), with gas exhaust towards the rear

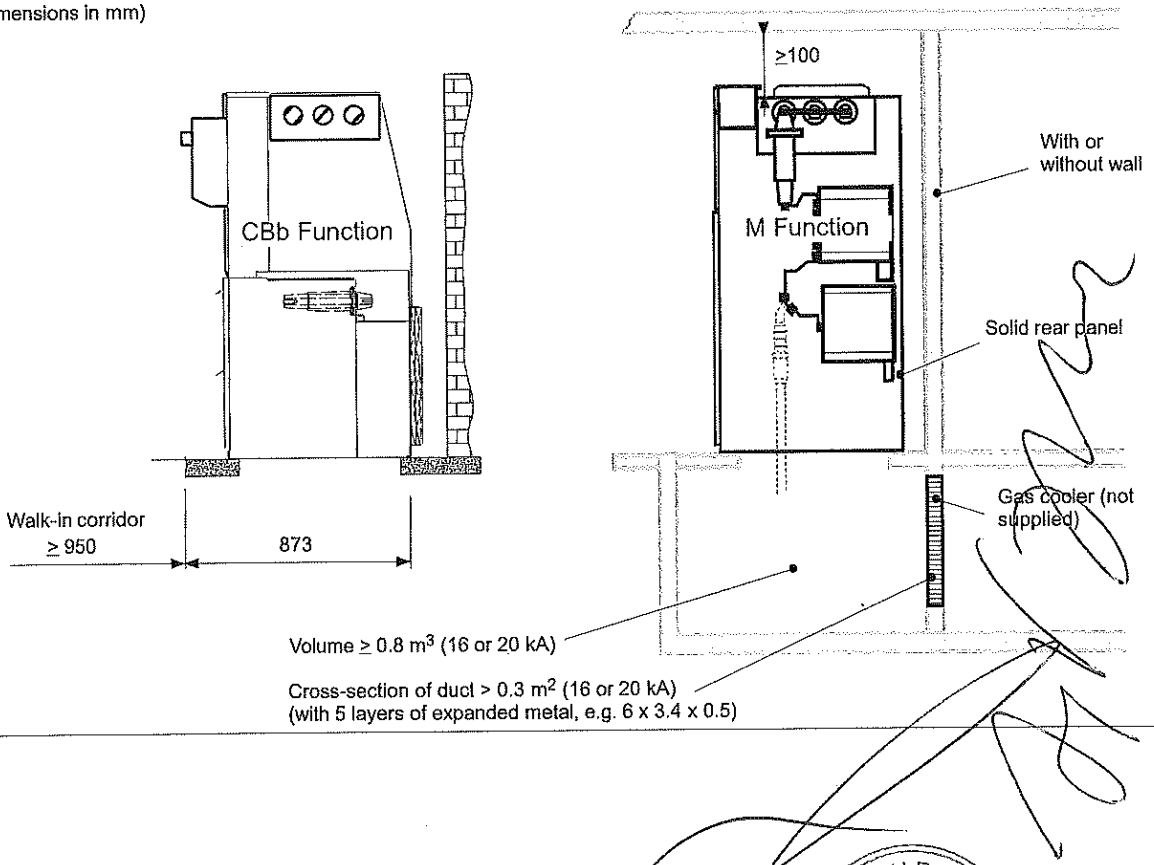


7.3 16 kA and 20 kA Switchboards (AF/AFL - 1 s), with gas exhaust towards the bottom

Top view
(dimensions in mm)



Side view
(dimensions in mm)



758

8 Installation of an FBX switchboard C or E

8.1 Dimensions for switchboards

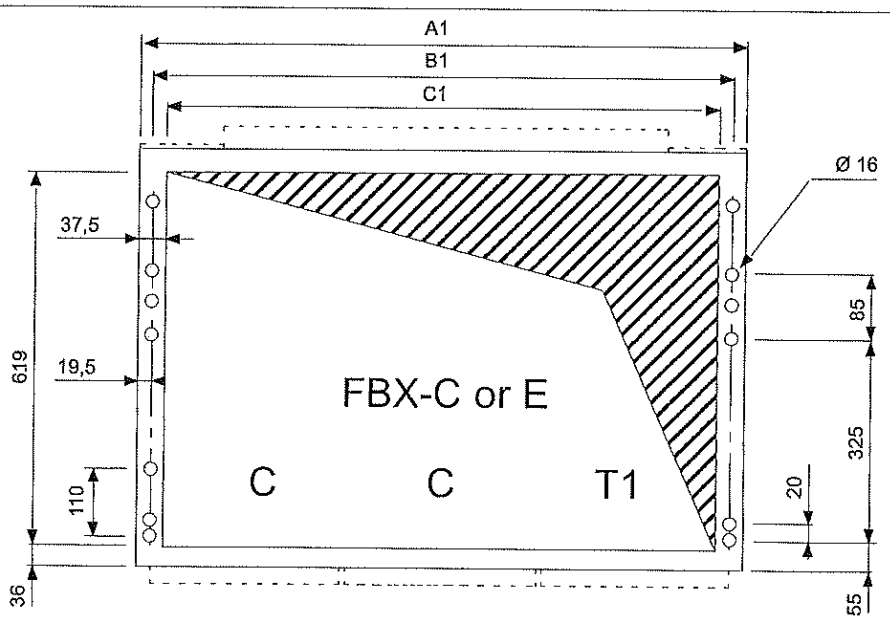
FBX Widths (mm)	A1	B1	C1
C-C	680	641	605
RE-T1	680	641	605
RE-T2	680	641	605
C-C-T1	1000	961	925
C-C-T2	1000	961	925
C-C-C	1000	961	925
C-RE-T1	1000	961	925
C-RE-T2	1000	961	925
R-RE-T1	1000	961	925
R-RE-T2	1000	961	925
C-C-C-T1	1320	1281	1245
C-C-C-T2	1320	1281	1245
C-T1-C-T1	1320	1281	1245
C-T2-C-T2	1320	1281	1245
C-C-C-C	1320	1281	1245
C-C-C-C-C	1675	1636	1600
C-C-C-C-T1	1675	1636	1600
C-C-T1-C-T1	1675	1636	1600
C-T1-C-T1-T1	1805	1766	1730
C-T1-T1-T1-T1	2080	2041	2005

8.2 Geometry of the switchboard and civil engineering structure

Top view
(dimensions in mm)

The profiles, seen from the top, represent the surface of the switchboard borne on the floor.

All the fixing points (standard or optional) are located.



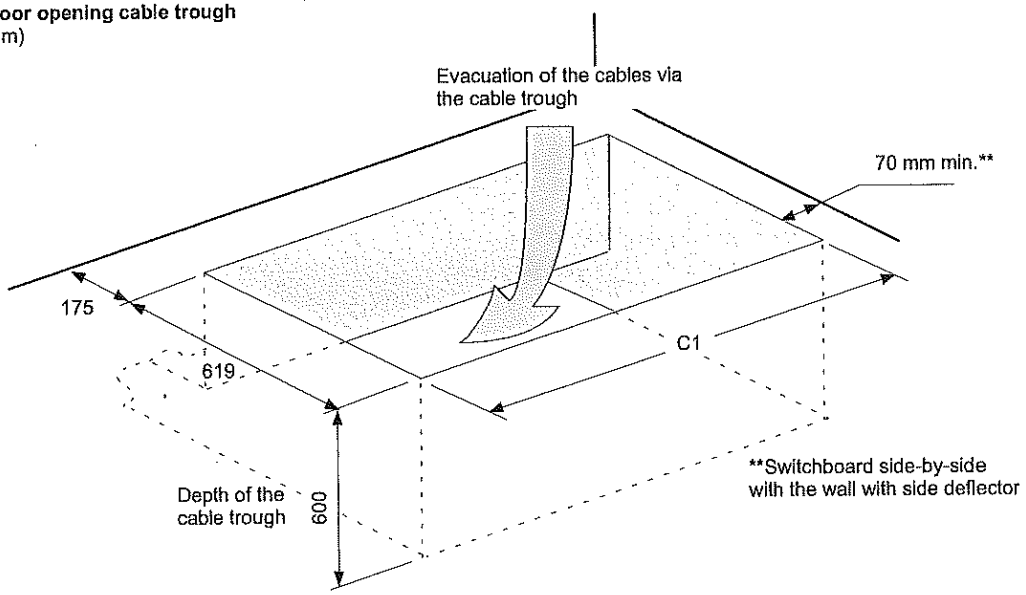
8.3 Installation on the floor (refer to table § 8.1)

The location of the cable trough is defined as a function of the type of FBX to be installed and the position of this switchboard in the room.

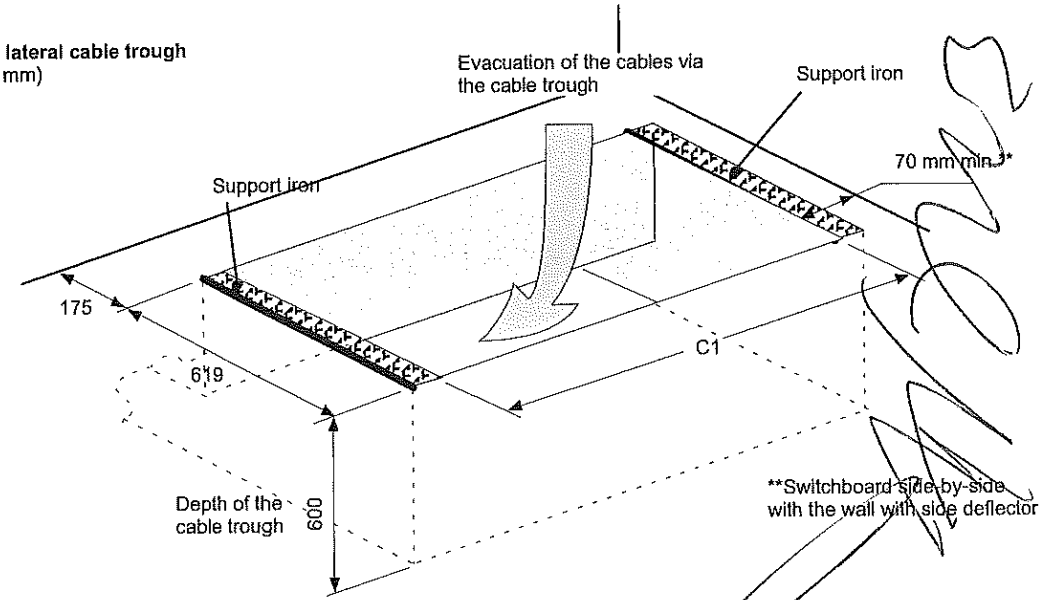
In case of a lateral cable trough, fit longitudinal irons to support the right and left-hand uprights of the switchboard.

The support irons to be used are of the 100 mm min. IPN type.

Example for a floor opening cable trough
(dimensions in mm)



Example for a lateral cable trough
(dimensions in mm)



8.4 Layout and fixing of the FBX-C or E to the floor

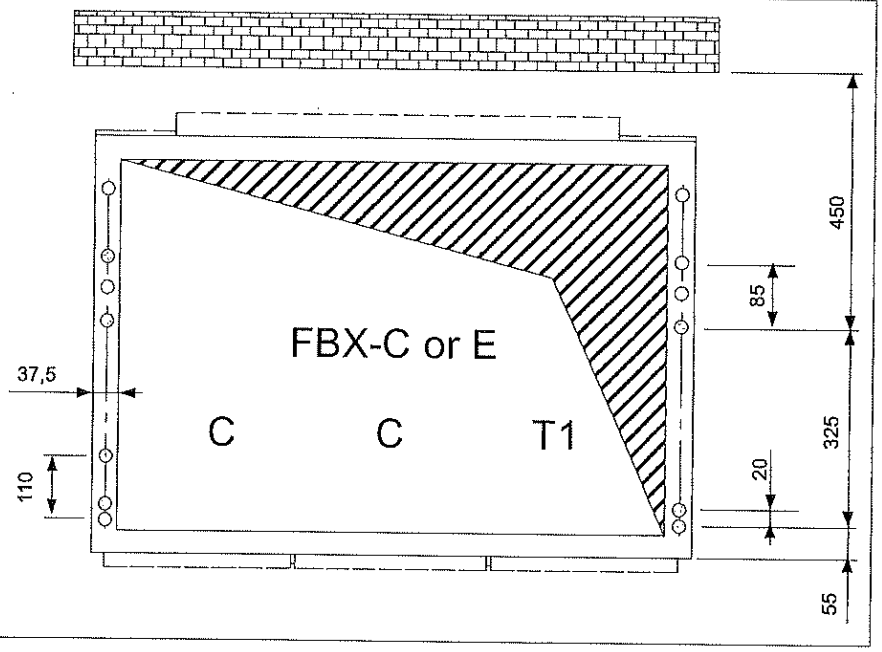
Before any installation of the FBX switchboard in the room in accordance with mounting instructions, check:
- the passages for HV cables, LV cables, and possibly the cable ducts,
- the load limit for the fixing points. It must be compatible with the weight of the switchboard (for indication of the weights, see § 3.4).

Check the evenness of the floor at the fixing points level. Any irregularities on the floor must not exceed 1 mm. If they are greater than that, install sheet metal shims just beside the fixing points.

8.5 Positioning of fixing points

Top view
(dimensions in mm)

Positioning of fixing points in relation to the rear wall



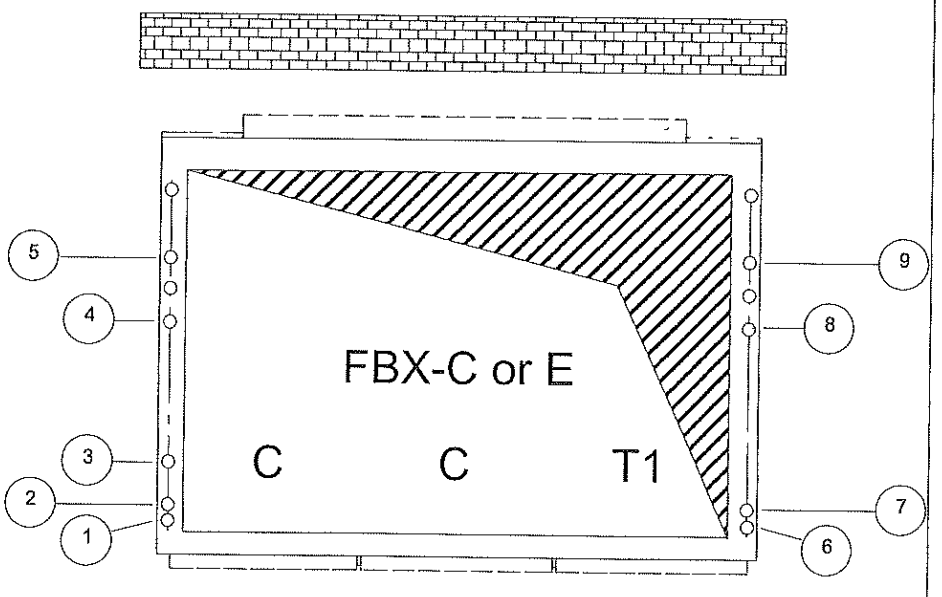
8.6 Fixing to the floor

Top view

1. Fixing to the floor by 4 points:

Fixing	Fixing point
Standard	1 or 3 ; 4 ; 6 ; 8
Option	2 ; 5 ; 7 ; 9
FBX-M	1 ; 4 ; 6 ; 8

2. Fasteners *(not supplied)*
4 H M10x30 bolts (class 8.8)
+ 4 flat washers Ø 30 mm on the exterior, 3 mm thick.



9 Installation of an extension function

9.1 Dimensions for extensions

Refer also to table § 8.1.

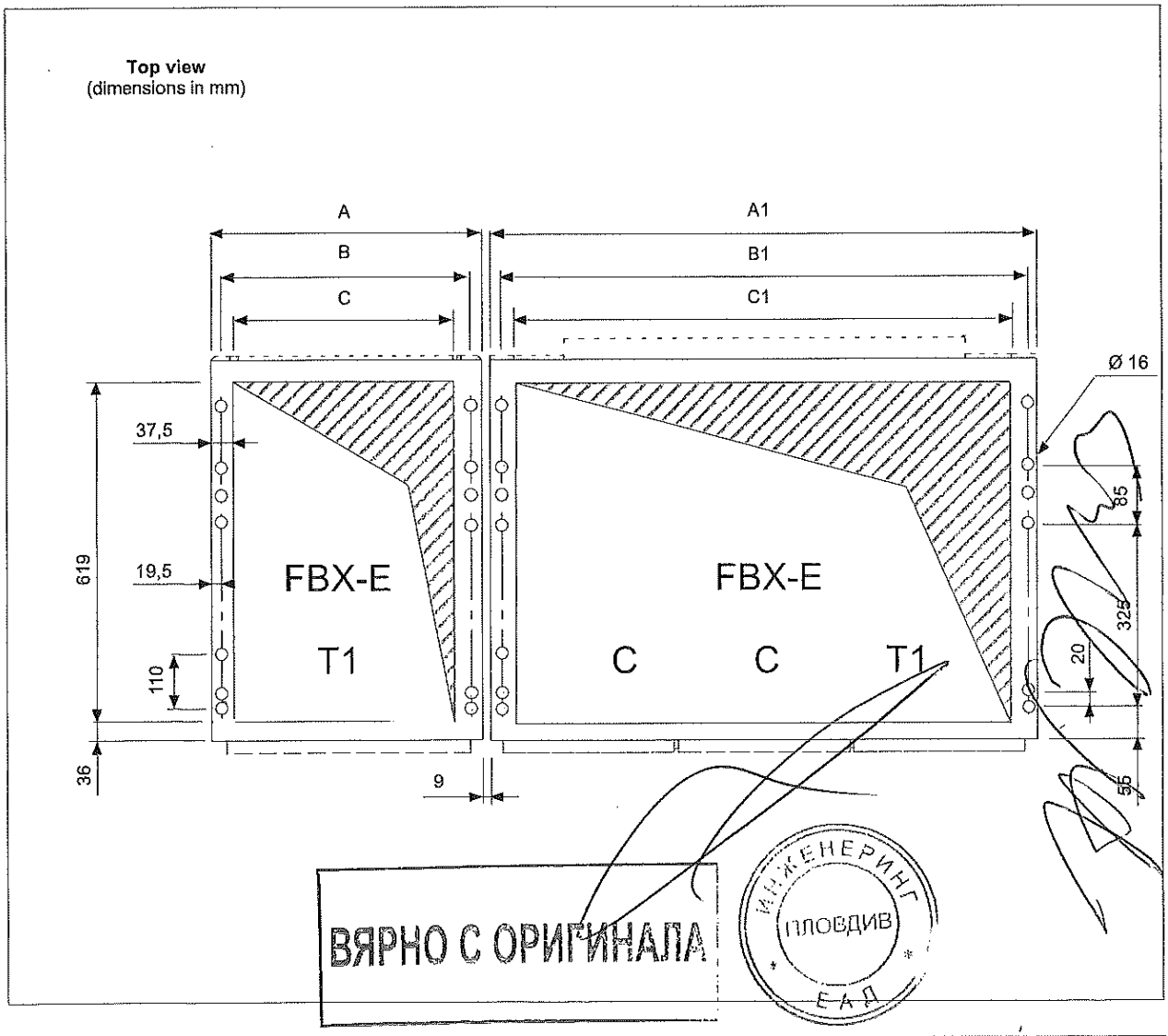
FBX Widths (mm)	A	B	C
Extension C	360	321	285
Extension T1	490	451	420
Extension T2	490	451	420
Extension CB	490	451	420
Extension CBb	625	586	550
Extension R	360	321	285
Extension RE	360	321	285

9.2 Geometry of the switchboard and civil engineering structure (see Tables § 8.1 & 9.1)

The profiles, seen from the top, represent the surface of the switchboard borne on the floor.

All the fixing points (standard or optional) are located.

Top view
(dimensions in mm)



ВЯРНО С ОРИГИНАЛА

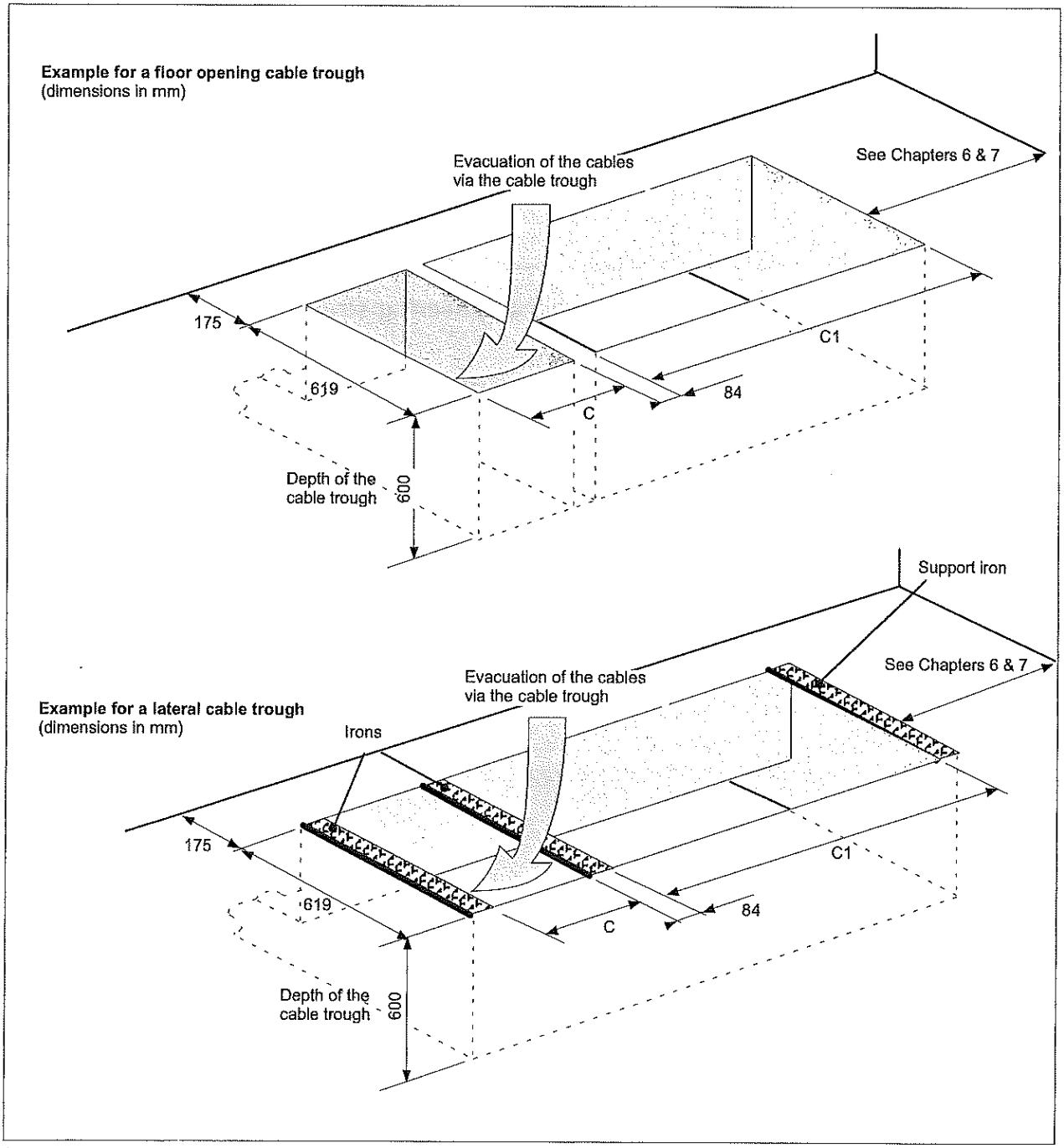
ИНЖЕНЕРИНГ ПЛОВДИВ ЕАД

9.3 Installation on the floor (see Tables § 8.1 & 9.1)

The location of the cable trough is defined as a function of the position of the extension in the room.

In case of a lateral cable trough, fit longitudinal irons to support the right and left-hand uprights of the extension.

The support irons to be used are of the 100 mm min. IPN type.

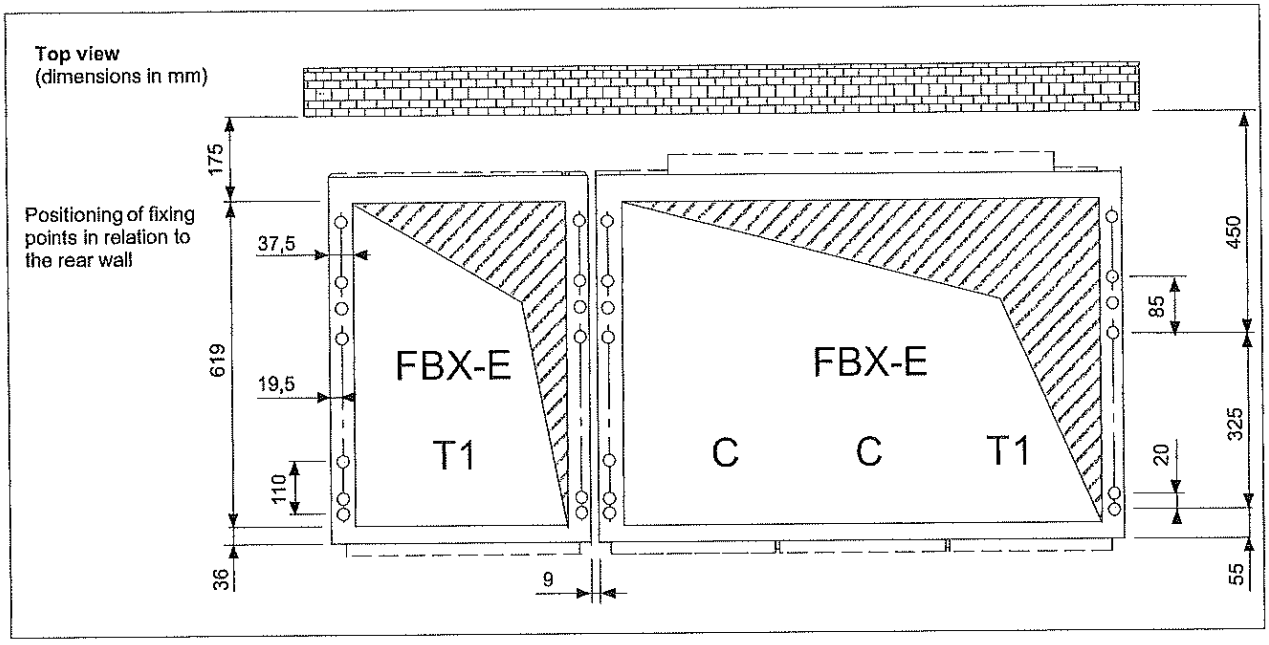


9.4 Layout and fixing of the FBX-E to the floor

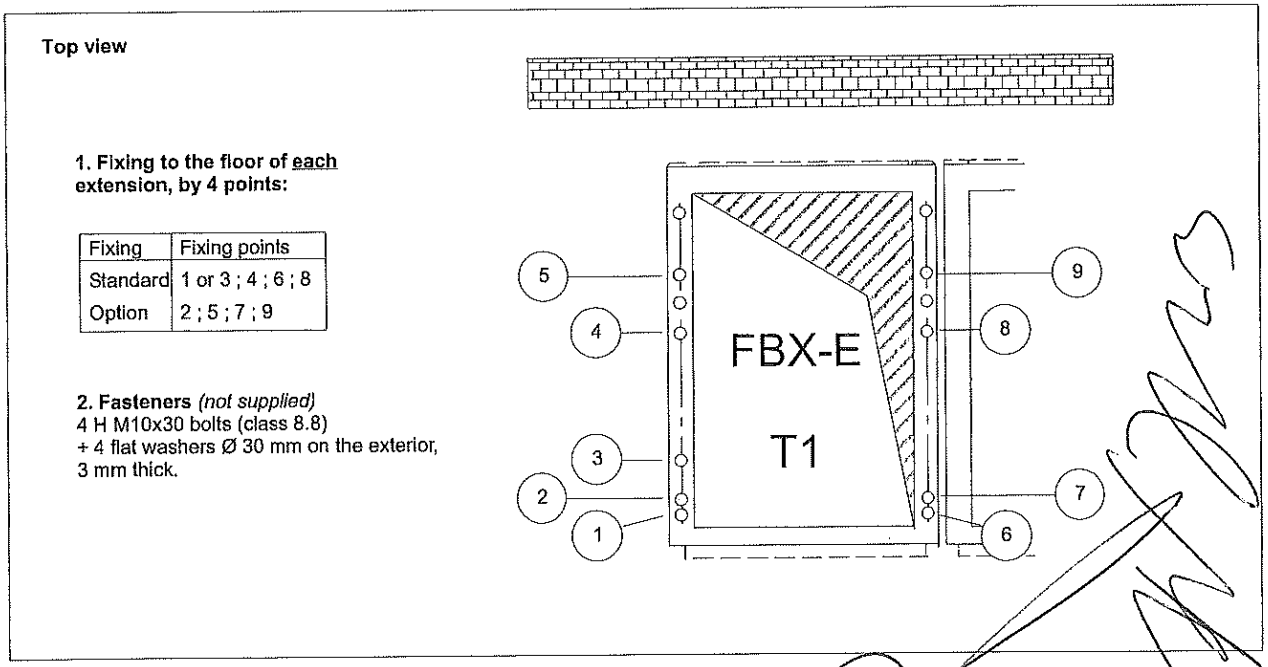
Check than the load limit for the fixing points is compatible with the weight of the extension (for indication of the weights, see § 3.6).

Check the evenness of the floor at the fixing points level. Any irregularities on the floor must not exceed 1 mm. If they are greater than that, install sheet metal shims just beside the fixing points.

9.5 Positioning of an extension and of its fixing points



9.6 Fixing to the floor



761

10 Work on the Civil Engineering structure

10.1 Characteristics of the work on the Civil Engineering structure

Overall evenness:
A 2 m rule, moved along the base should not highlight any irregularity of greater than 5 mm.

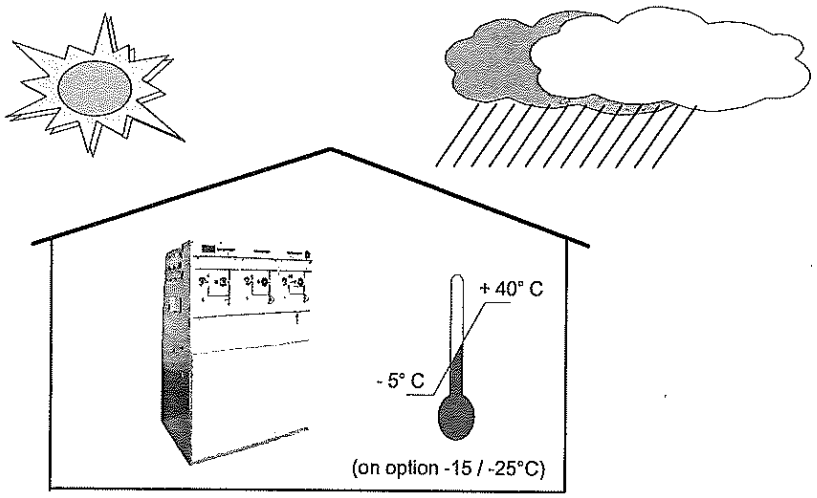
Local evenness:
A 20 cm rule, moved along the base should not highlight any irregularity or deflection of greater than 2 mm.

Any possible rabbets and closing slabs are the responsibility of the supplier of the Civil Engineering work.

10.2 Characteristics of the installation room

The room must be capable of protecting the equipment against any degradation agents such as:

- Water or water vapour.
- Salt-laden air.
- All types of pollution.
- Micro-organisms.



10.3 Characteristics of the storage area

The place of storage, before installation, must respect the same criteria as that for the installation room, with the exception of the temperature: + 50°C, - 25°C.

Contact Schneider Electric for any derogations to these criteria.

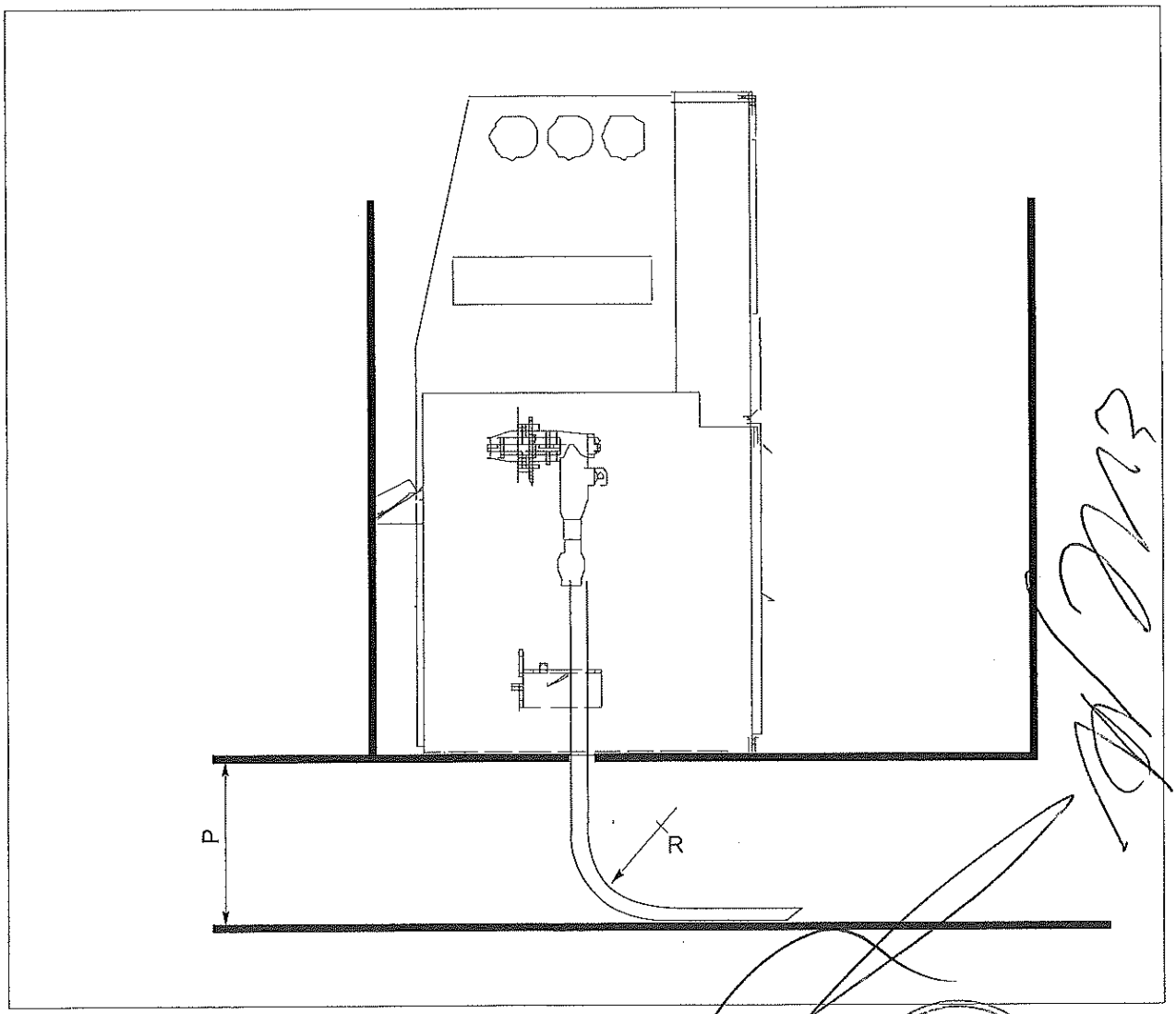
10.4 Geometry of the cable trough

The depth of the cable trough depends on the cross-section of the HV cables.
Generally, this depth [P] is at least equal to (generally higher) than the bend radius of the cables [R].

The length of the cable is calculated as a function of the altitude of the connecting point [see chapter 11].

Refer to the cable manufacturer's recommendations (ambient temperature, etc.).

Cable sections (mm^2)	Depth for a single pole cable P (mm)	Depth for a three-pole cable P (mm)
50	450	600
95	450	700
150	600	800
240	600	900
300	600	-
400	600	-

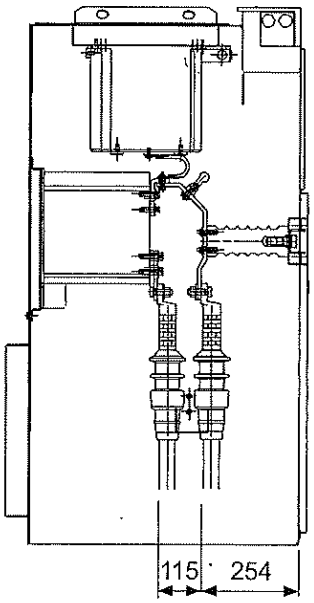


762

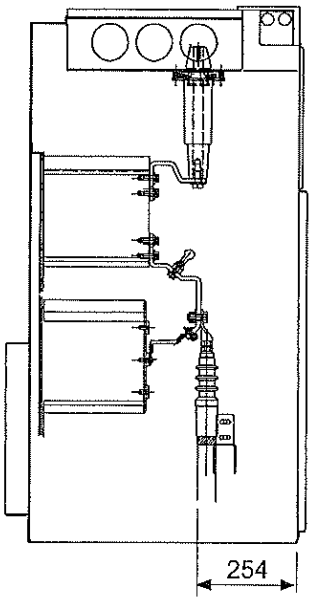
11.4 Disposition of connection point in M functions

Side views
(dimensions in mm)

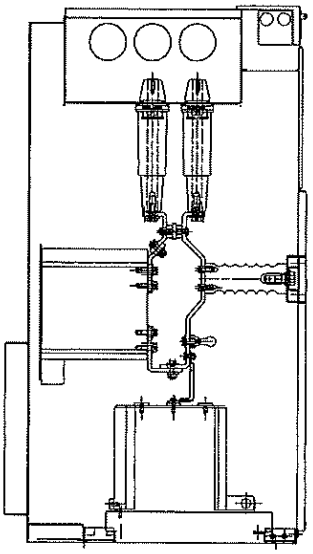
M1



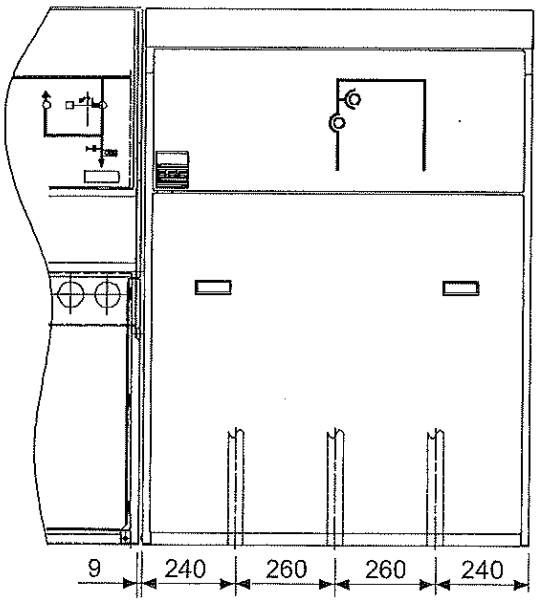
M2-M3



M4



Front view
(dimensions in mm)



If you have any comments on the use of this document or on the use of the equipment and services that are described in it, please send us your remarks, suggestions and wishes to:

Schneider Electric Technical Department BP 84019 F-71040 Mâcon Cedex 9 FRANCE

Fax: 33 (0)3 85 29 36 36

Schneider Electric Energy France
35, rue Joseph Monier
CS 30323
F - 92506 Rueil-Malmaison Cedex

RCS Nanterre 511 746 356
Capital social 6 909 620 €
www.schneider-electric.com

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

Design: Schneider Electric
Photos: Schneider Electric

AMTNoT110-02 revision: 10

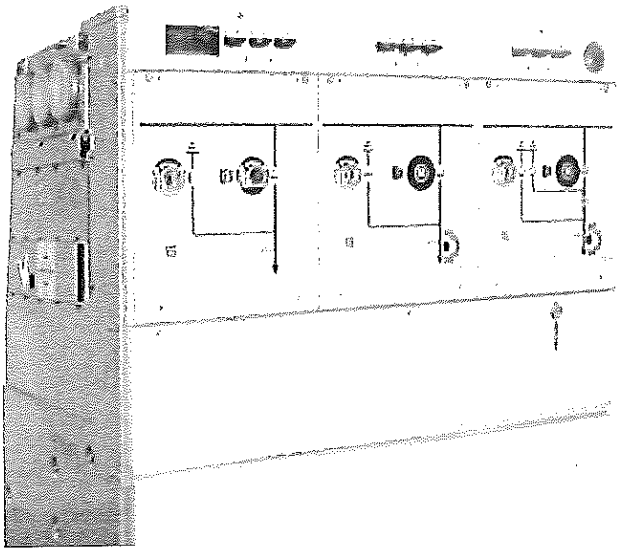
01-2011

Апаратура за комутация за вторично разпределение

FBX

SF6 газово – изолирани табла

Ръководство за Експлоатация



Съдържание

1 Шнайдер Електрик на вашите услуги

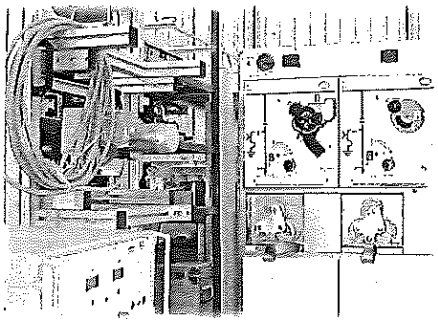
Експлоатацията и поддръжката могат да се извършват само от персонал, получил подходящо разрешение за експлоатация и маневри, за които са отговорни.

В противен случай, моля да се обърнете към отдела по Обслужване или Центъра за обучение.

Всички операции по заключване (блокиране) следва да бъдат извършвани съгласно "Брошурата за Общи инструкции за Електрическо приложение " UTE C 18 510 (или негов еквивалент извън ФРАНЦИЯ).

1.1 Отделът ни по Обслужване : нашите специалисти, и подходящо адаптирани услуги....

- Договори за удължена във връзка с продажбата на ново об
- Надзор на HVA комутатрони инсталации
- Технически съвети, диагностика на съоръжения, експертиз
- Договори за поддръжка, адаптирани към експлоатационнит ограничения,
- Системна или условно профилактична поддръжка,
- Коригираща поддръжка в случай на частична или пълна по
- Доставка на резервни части
- Преразглеждане на оборудването и преквалификация на
- инсталациите,с оглед възползване от новите
- технологии и удължаване жизнения цикъл на
- вашите комутатори с ограничени инвестиции.



Контакти на Отдела за Обслужване на Шнайдер Електрик за диагноза и съвет :

Работни часове

Тел.: 33 (0)3 85 29 35 00
Факс : 33 (0)3 85 29 36 30
Или : 33 (0)3 85 29 36 43

1.2 Обучение на Шнайдер Електрик: Заедно да развием уменията си ...

Бихме могли да предоставим на ваше разположение професионалният опит на всички наши обучители, педагогическият опит на нашите екипи богатството на нашето оборудване, за да ви помогне да посрещнете предизвикателствата за насърчаване развитието на персонала чрез оптимизиране на уменията им.

Обучителния център на Шнайдер Еелектрик обучение има контрол над всички процеси на обучението, за да отговорина нуждите на всеки клиент, от няколко часа до няколко седмици

- Специфично обучение, пряко свързано с практическа работа с реални машини.
- Малки групи, с оглед улесняване на комуникацията.
- Баланс между теория и практика.
- Оценка и управление на уменията: измерване и оптимизация на знанията на обучаващите се.

Изправени пред преките и непреки разходи за обучени оперативните спирания и изключване, обучението е реална инвестиция

Шнайдер електрик Франция

Център за Обучения

Ул. Жозеф Моние 35 - CS 30323 - F-92506 Рюеьл Малмезон Седекс

www.schneider-electric.fr/formation

2 Относно настоящото Ръководство на потребителя

2.1 Отговорности

Нашите устройства са с контролирано качество и се тестват в фабриката в съответствие с действащите в момента стандарти и разпоредби.

Ефективността и жизненият цикъл на апаратурата зависят от съответствието с инструкциите за монтаж, пускане в експлоатация и работа, описани в настоящето ръководство на потребителя. Неспазване на тези указания е вероятност за обезсилване на която и да е гаранция.

Трябва да се спазват местните изисквания, особено тези за безопасност, и които са в съответствие с указанията в настоящият документ.

Шнайдер Електрик не носи никаква отговорност за последствията:

- поради на неспазване на препоръките в настоящето ръководство, които се позовават на международните правила в сила.
- поради на неспазване указанията на доставчиците на кабели и аксесоари за връзка, по време на инсталирането и монтажните операции,
- От всички възможни агресивни климатични условия (влажност, замърсяване и т.н.) действащи в непосредствената околна среда на материалите, които не са подходящо адаптирани, нито защитени срещу тези въздействия .

Настоящото ръководство на потребителя не съдържа процедурите по заключване, които трябва да се прилагат. Описаните операции (интервенции) се извършват при освободено от електрически заряди оборудване (в хода на монтажа) или заключено (не работещо).

2.2 Специфични инструкции за експлоатация и интервенции върху оборудване под електрическо напрежение

При въвеждане в експлоатация и работа с оборудването при нормални условия на експлоатация, трябва да бъдат спазвани Общите инструкции за безопасност при работа с електрически приложения (защитни ръкавици, изолационни стълба, и т.н.), в допълнение към стандартните инструкции за работа. Всички стартирани манипулации трябва да се бъдат завършени. Времетраенията (за завършване на горепосочените операции) , посочени в таблицата поддръжка са само за индикация и зависят от условията на място.

2.3 Други технически записки, които следва да бъдат консултирани

- AMTNoT131-02 FBX SF6 газово изолирани табла Монтаж – пускане в експлоатация
- AMTNoT170-02 FBX Функционално CB Монтаж - Пускане в експлоатация - Поддръжка

2.4 Инструменти *(не са предмет на доставка) необходими за описаните в настоящето ръководство на потребителя операции.*

плоска, тънка отвертка (4) + средна

Кожени ръкавици

2.5 Символи & конвенции

Код за продукт, препоръчан и маркиран от Шнайдер Електрик

Стойност на въртящ момент на затягане
Пример : 21 Nm

Знак отговарящ на ключ

ВНИМАНИЕ ! бъдете бдителни ! Да се вземат предпазни мерки за избягване на инциденти или наранявания

ЗАБРАНЕНО! Да не се извършва!

Спазването на това указание е задължително, неспазването на тази разпоредба само може да повреди оборудването.

ИНФОРМАЦИЯ – СЪВЕТ
Вашето внимание се насочва към конкретна точка или операция.

ВНИМАНИЕ!Останете бдителни!
Горещи компоненти и топлина

3. ФУНКЦИОНАЛНИ УСТРОЙСТВА ЗА БЛОКИРАНЕ

3.1 Функционални механични блокировки

Таблото FBX е оборудвано с вътрешни механични блокировки, наречени „функционални", предназначени за избягване на каквато и да е оперативна грешка.

Необходимо е да се познават тези блокировки с оглед правилната работа на апаратурата за комутация.

!

Функция Sb: операцията по разединяване или заземяване може да бъде изпълнявана само от вече подходящо адаптирани операции по заключване (блокиране) внедрени в мрежата.

3.2 Блокировки за функции C и T1

	Позиция	Прекъсвач на товар	Заземител	Люк за достъп да на предпазители за електроди или кабели
Прекъсвач на товар	затворен	-	Заключено отворен	Заключен затворен
	Отворен	-	Свободно	В зависимост от позицията на заземителния прекъсвач
Заземител	затворен	Заключен отворен	-	Free
	Отворен	Свободно	-	Заключено отворен
Люк за достъп да на предпазители за електроди или кабели	Отворен	Заключен отворен	Заключено затворен	-

3.3 Блокировки за функция T2 и CB

	Позиция	Прекъсвач на веригата	Ключ за разединяване	Заземител	Панел за достъп до отделението за кабели
Прекъсвач на веригата	Затворен	-	Заключен (затворен или затворен	Заключен отворен	Заключен затворен
	Отворен		Свободен	В зависимост от позицията на верижният прекъсвач	В зависимост от позицията на заземителя
Ключ за разединяване	Затворен	Free	-	Заключен отворен	Заключен затворен
	Отворен	Свободен (обичайно отворен)		Free	зависимост от позицията на заземителя
Заземител	Затворен	Свободен (обичайно отворен)	Заключен отворен		Свободно
	Отворен	Свободен (обичайно отворен)	В зависимост от позицията на верижният прекъсвач		Заключен затворен
Панел за достъп до отделението за кабели	Отворен	Свободен (обичайно отворен)	Заключен отворен	Заключен затворен	

3.4 Блокировки за функция Sb

	Позиция	Ключ за разединяване		Заземител	
Ключ за разединяване	затворен			Заключен отворен	
	Отворен			Свободен	
Заземител	Затворен	Заключен отворен			
	Отворен	Свободен			

4 Аксесоари за работа

4.1 Напомняне за ръчни операции

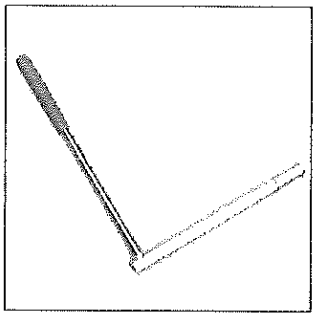
ВЯРНО С ОРИГИНАЛА

ИНЖЕНЕРИНГ ПЛОВДИВ ЕАД

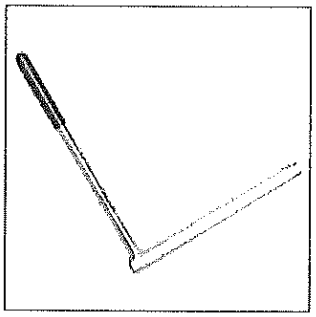
Оперативните маневри се изпълняват без особени усилия. Въпреки това необходимата сила е по-голяма за самозадържащите контроли (T1, T2, CB), отколкото за двупозиционните лостови превключватели (C).

4.2 Оперативни аксесоари

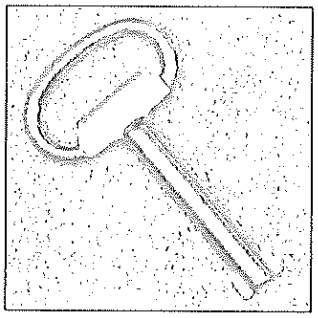
Всички движения на лоста следва да са чист и завършени.
Лоста се мести през приблизително 95°.



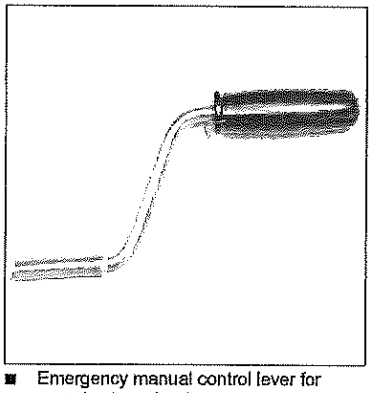
■ Стандартен работен лост за заземителния превключвател (червен край).



■ Стандартен работен лост за товаро прекъсвача (черен край)

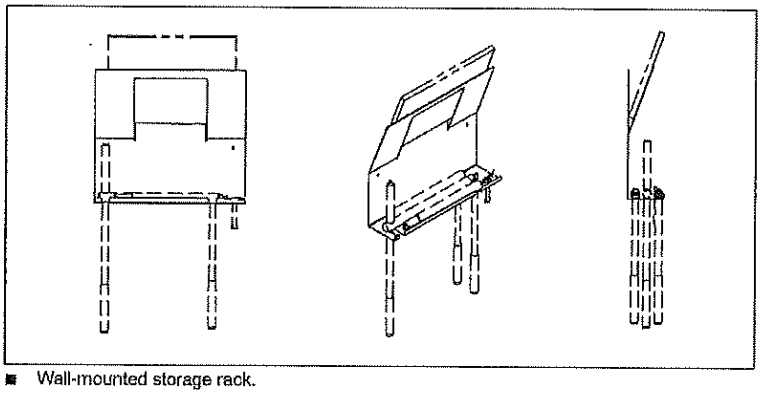


■ ключ за отделението за предпазител на електродите



■ Emergency manual control lever for motorised mechanisms.

■ Аварийен ръчен лост на контролните Моторни механизми .

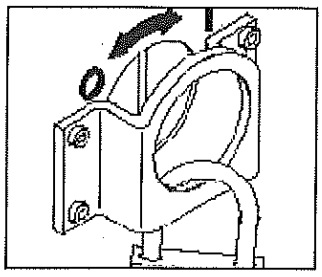


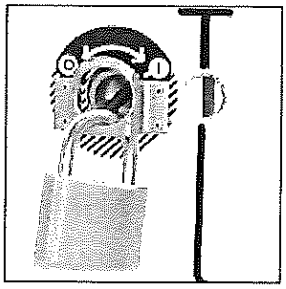
■ Wall-mounted storage rack.

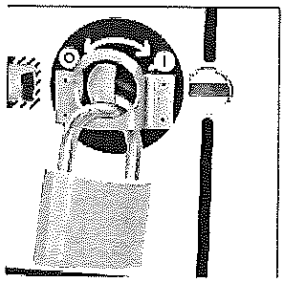
■ стойка за съхранение монтирана на стена

4.3 Блокировки използвайки катинари (опционално)

Опционално: Всеки хъб за механичен контрол може да бъде монтиран, така че да позволява да бъде заключен

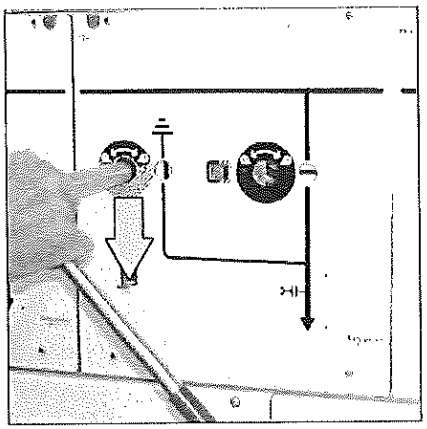


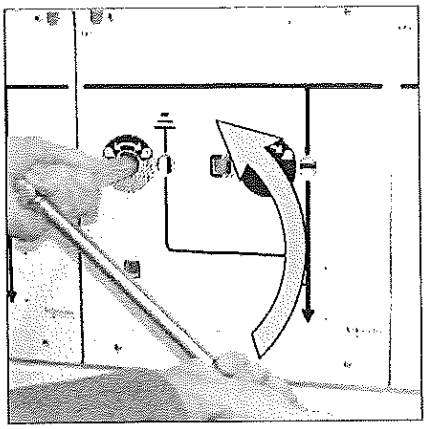


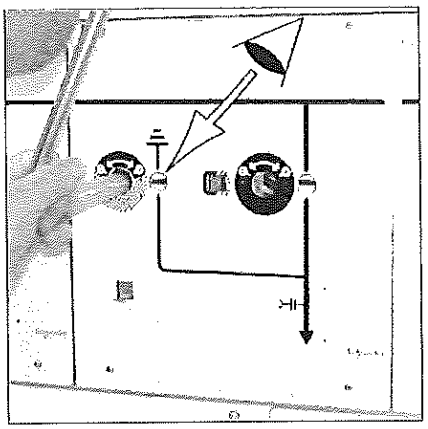


5 Използване на C функцията

5.1 Отваряне на заземителния превключвател







- Проверете, дали накрайника е изцяло спуснат . Ако не, хванете лоста с две ръце.
- Поставете съответният лост (червен край) в гнездото на заземителния превключвател.
- Повдигнете лоста – сега заземителя е в отворено положение.
- Отстранете лоста

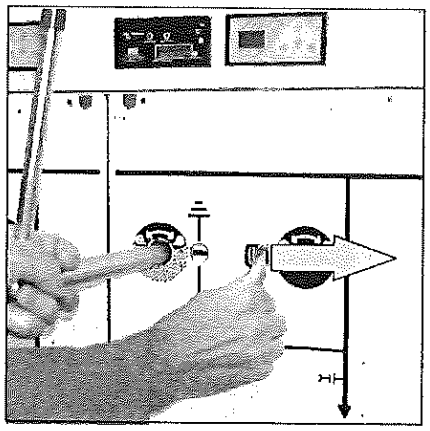
ВЯРНО С ОРИГИНАЛА

ИНЖЕНЕРИНГ ПЛОВДИВ ЕАД

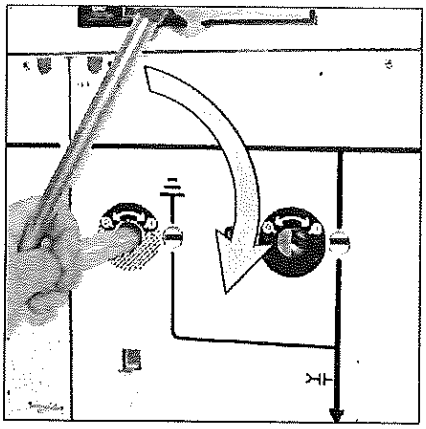
769

5.2 Затваряне на заемителния превключвател

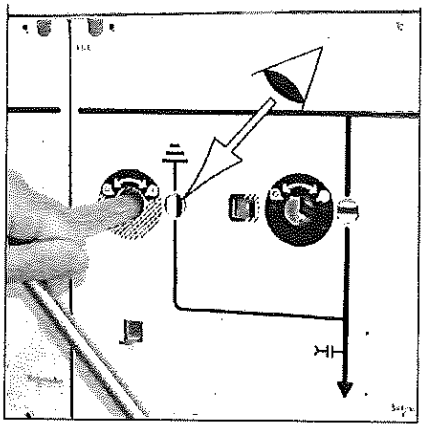
Преди да затворите заземителният превключвател, уверете се , че няма напрежение през индикаторните единици (вж. съответното ръководство - § 2.3).



■ Проверете, че накрайникът е напълно спуснат.
■ Задръжте отворен надясно бутона за заключване
■ Поставете съответният лост (червен край) в гнездото на заземителния превключвател..



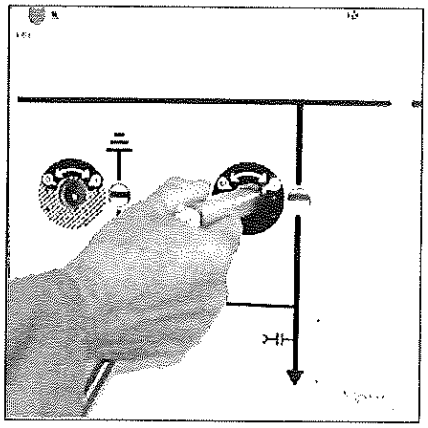
■Хванете лоста с две ръце hands.



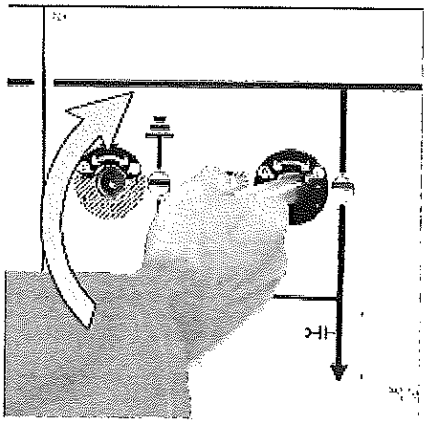
■ Спуснете лоста надолу – сега заземителя е в затворено положение.
■ Отстранете лоста

.

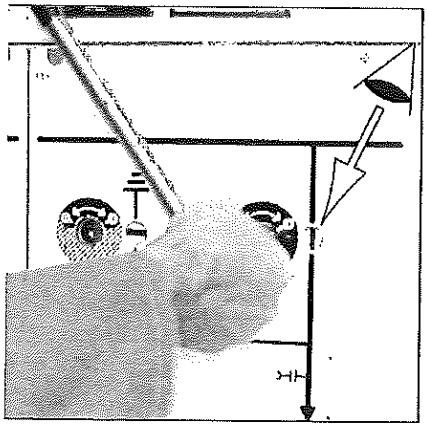
5.3 Затваряне на товаро прекъсвача



■ Поставете съответния лост (черен край) в гнездото на товаро прекъсвача.

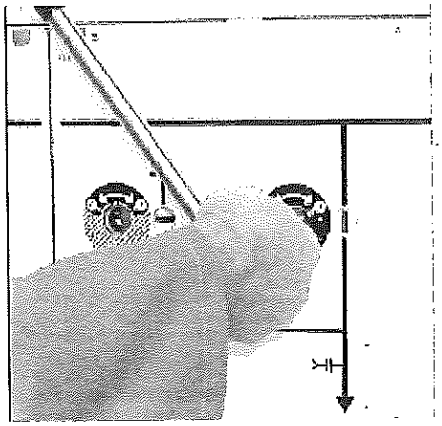


■ Хванете лоста с две ръце

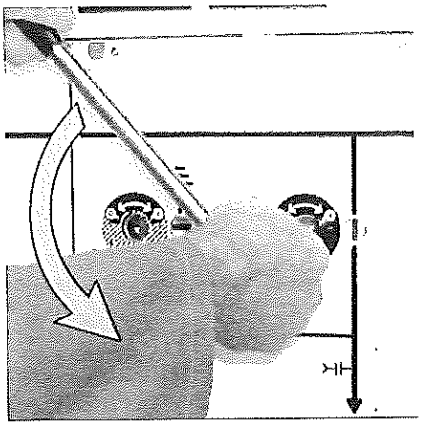


■ Повдигнете лоста — прекъсвача е затворен
■ Отстранете лоста .

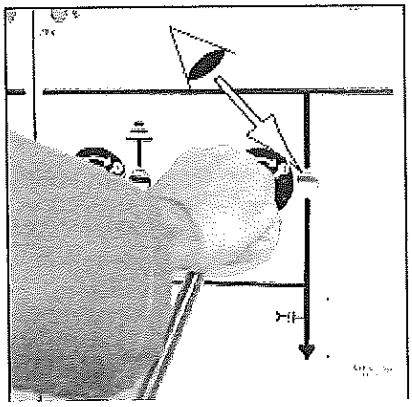
5.4 Отваряне на товаро прекъсвача



■ Поставете съответния лост (черен край) в гнездото на товаро прекъсвача



■ Хванете лоста с две ръце



Спуснете лоста надолу – сега прекъсвача е отворено положение.
■Отстранете лоста

5.5 Движения на моторните контролни механизми

Виж раздел 9.

6 Използване на T1 функция

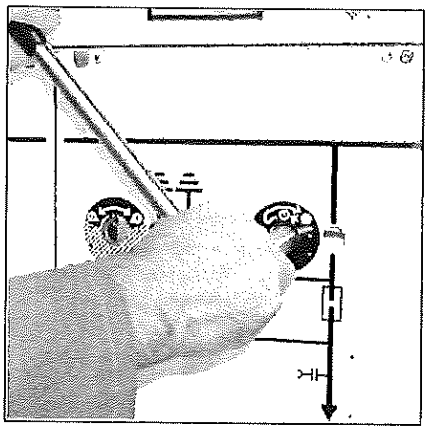
6.1 Отваряне на заземителния прекъсвач

Виж инструкциите на § 5.1.

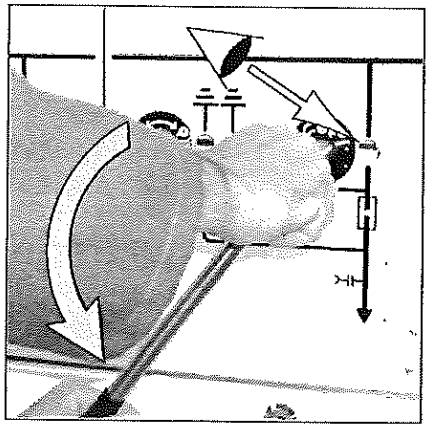
6.2 Затваряне на заземителния прекъсвач

Виж инструкциите от § 5.2.

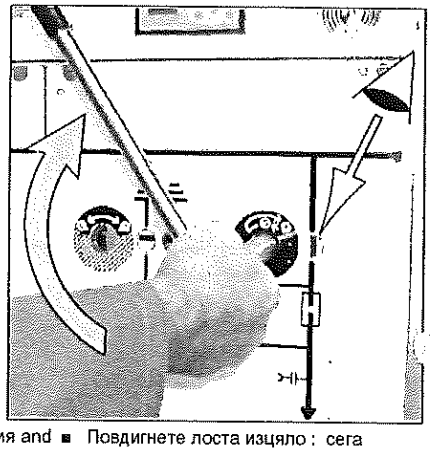
6.3 Затваряне на товаро прекъсвача



- Поставете съответния лост (черен край) в гнездото на товаро прекъсвача
- Хванете лоста с две ръце



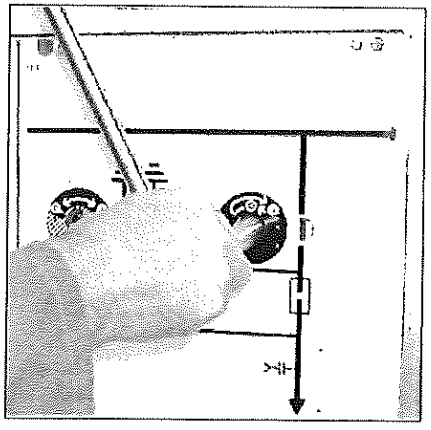
- Смъкнете лоста до най ниската му позиция and и бавно освободете (уверете се, че резето е Зацепено. Сега превкл. е постоянно отворен



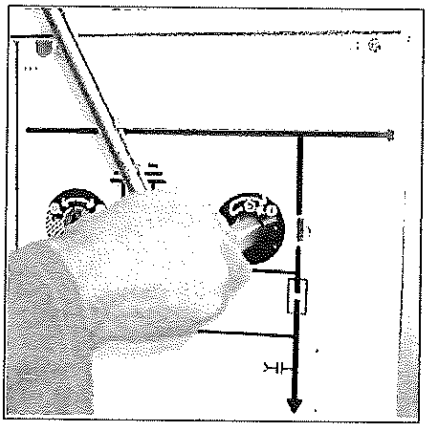
- Повдигнете лоста изцяло : сега превкл. е затворен .
- отстранете лоста .

6.4 Ръчно отваряне на товаро прекъсвача

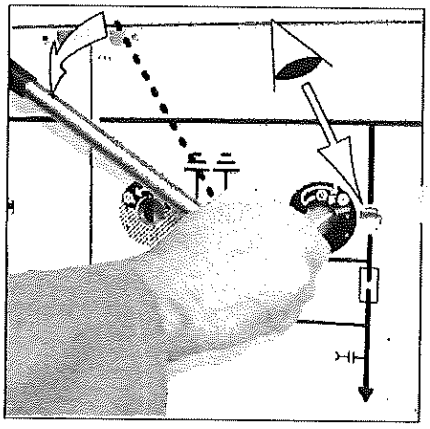
Забележка : Прекъсвача може да бъде отворен използвайки бутон (опционално) или чрез електрически контрол.



- Поставете съответния лост (черен край) в гнездото на товаро прекъсвача



- Хванете лоста с две ръце



- Спуснете лоста през прибл. 20° – сега прекъсвача е отворено положение.
- Отстранете лоста

6.5 Движения на моторните контролни механизми

Виж раздел 9.

7 Използване на T2 функция

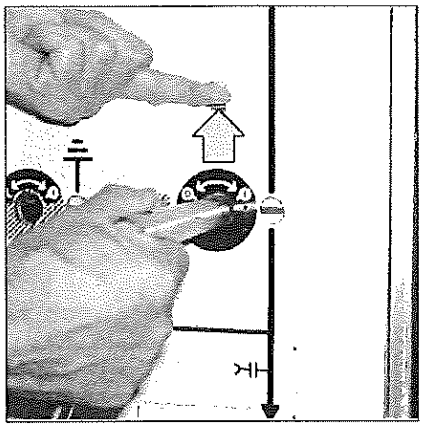
7.1 Отваряне на заземителния превключвател

Виж инструкциите от § 5.1.

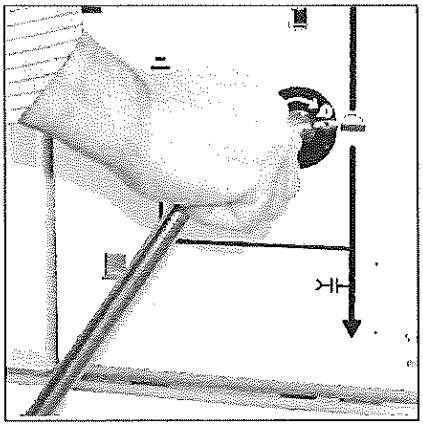
7.2 Затваряне на заземителния превключвател

Виж инструкциите от § 5.2.

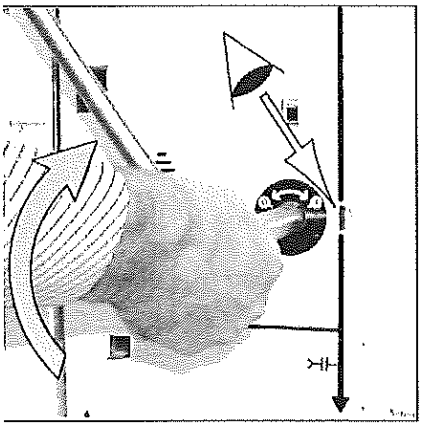
7.3 Затваряне на изолиращият линията прекъсвач [прекъсвач на веригата - отворен]



- Повдигнете заключващата клема.
- Поставете съответния лост в гнездото на разеденителя (черен край)

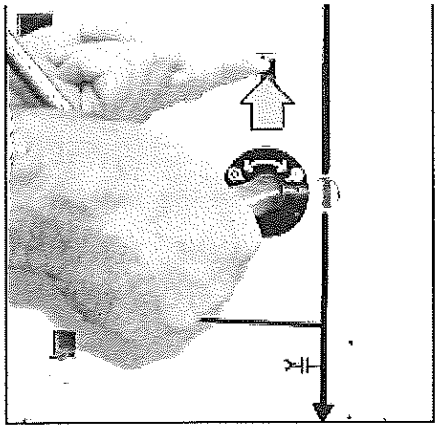


- Хванете лоста с две ръце .

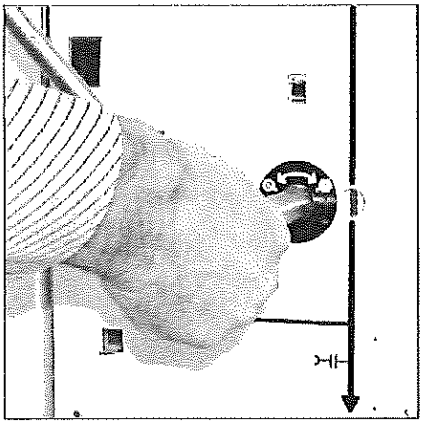


- Повдигнете лоста : прекъсвача на линията сега е затворен
- Отстранете лоста .

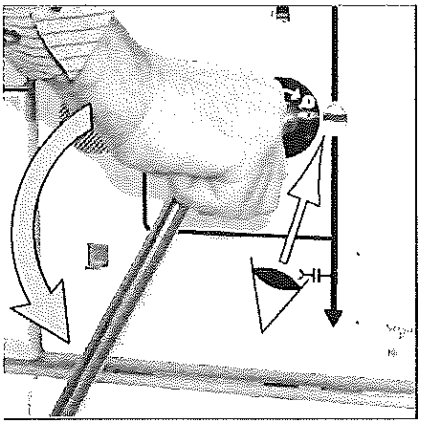
7.4 Отваряне на изолатора на линията [прекъсвач на веригата - отворен]



Поставете съответния лост в гнездото на разединителя (черен край) .



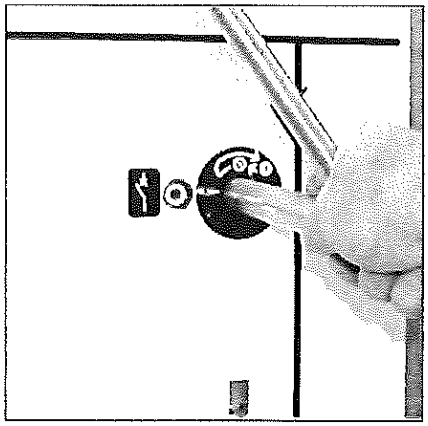
Повдигнете заключващата клема .



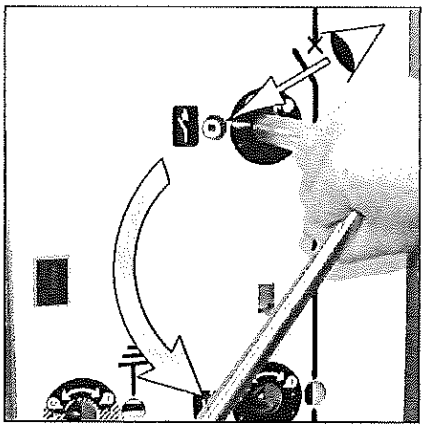
- Смъкнете лоста надолу : сега изолатора на линията е отворен
- отстранете лоста

771

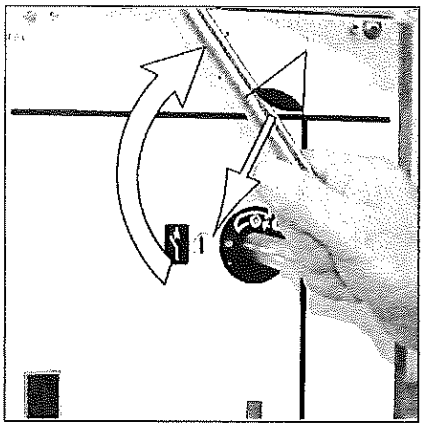
7.5 Затваряне на прекъсвача на веригата [Изолатор на линията затворен]



■Поставете съответния лост в гнездото на разеденителя (черен край)
■ Хванете лоста с две ръце



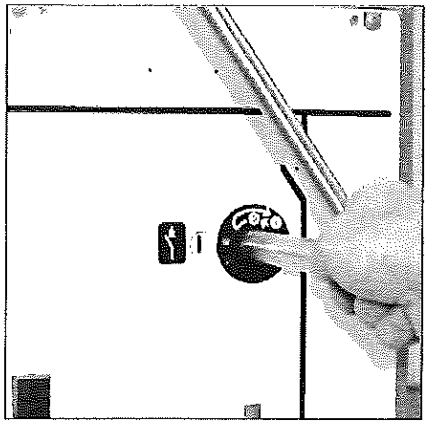
■Смъкнете лоста до най иската му позиция (уверете с е, че отворения отвор на резето е зацепен) -: превключвателя сега е постоянно отворен .



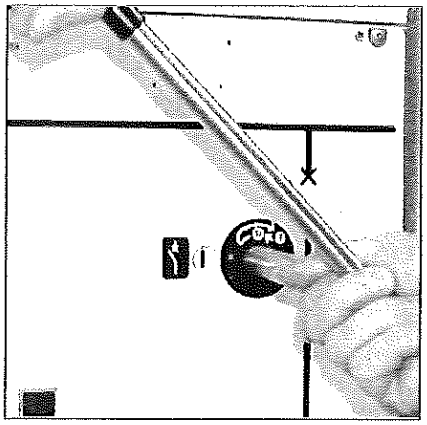
■Повдигнете изцяло лоста: сега верижният прекъсвач е затворен
■ отстранете лоста

7.6 Отваряне на прекъсвача на веригата [Изолатор на линията затворен]

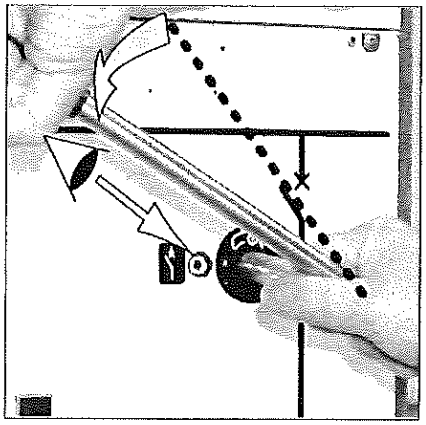
Забележка : Прекъсвача може да бъде отворен използвайки бутон (опционално) или чрез електрически контрол.



■ Поставете съответния лост в гнездото на прекъсвача на веригата (черен край)



■ Хванете лоста с две ръце



■Спуснете лоста през прибл. 20° – сега прекъсвача е отворено положение.
■Отстранете лоста

7.7 Затваряне на прекъсвача на веригата [изолатор на линията отворен]

Възможно е да се работи когато изолатора на линията е отворен.

Тази операция „ без товар" може да бъде използвана за тестване и за да се уверите, че прекъсвача на веригата функционира коректно.

7.8 Движения на моторните контролни механизми

Виж раздел 9.

8 Използване на Sb функция

8.1 Отваряне на заземителния превключвател

Следвайте инструкциите дадени в § 5.1.

8.2 Затваряне на заземителя

Операцията по разединяване или заземяване може да бъде изпълнявана само от вече подходящо адаптирани операции по заключване (блокиране) внедрени в мрежата

Преди затваряне на заземителния превключвател следва да се уверите, че няма наличие на напрежение (или електричество) през въпросната верига (виж съответноот ръководство - § 2.3).

Следвайте инструкциите дадени в § 5.2.

8.3 Затваряне на товаро прекъсвача

Следвайте инструкциите дадени в § 5.3.

8.4 Отваряне на товаро прекъсвача

Следвайте инструкциите дадени в § 5.4.

8.5 Движения на моторните контролни механизми

Виж раздел 9.

ВЯРНО С ОРИГИНАЛА

ИНЖЕНЕРИНГ ПЛОВДИВ ЕАД

772

9 използване на моторни функции

9.1 Движения на моторните контролни механизми [опционално]

Ако FBX таблото е оборудвано с моторизирани контроли (по избор), различните функции могат да бъдат захранени / изключени дистанционно в съответствие с диаграмата на веригата, предоставена като част от Договора

За функции, T1, T2 и CB, отварящите операции могат също да се задейства от бутон (по избор) или електрически контроли

! Функция Sb: Операцията по разединяване или заземяване може да бъде изпълнявана само от вече подходящо адаптирани операции по заключване (блокиране) внедрени в мрежата

9.2 Ръчни аварийни движения на моторизираните контроли

В случай на прекъсване на захранващите източници, може да се използва резервна за да завършите маневра/ ход или да се извършват ръчни операции

.

Позицията на индикаторите трябва да се проверява след всяка операция.
Ако захранването е възстановено докато се поставя лост то той ще бъде изтласкан от гнездото.

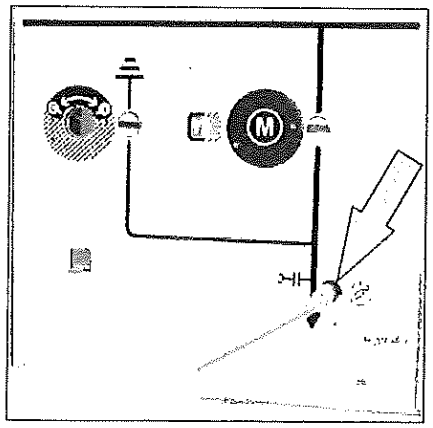
.

Когато е затворен параметъра заземителния превключвател, резервния лост за ръчен контрол не може да се поставят (с изключение за CB T2).

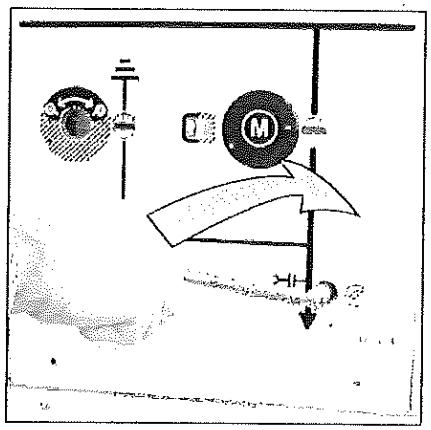
9.3 приблизителен брой на завъртания за резервните ръчни контролни лостове

	Разединителен прекъсвач		Прекъсвач на веригата	
	За да се отвори	да затвори	да отвори	да затвори
Функции C и Sb (виж § 8)	31 оборота	31 оборота		
Функция T1	7 оборота	50 оборота		
Функция T2	31 оборота	31 оборота	7 оборота	50 оборота

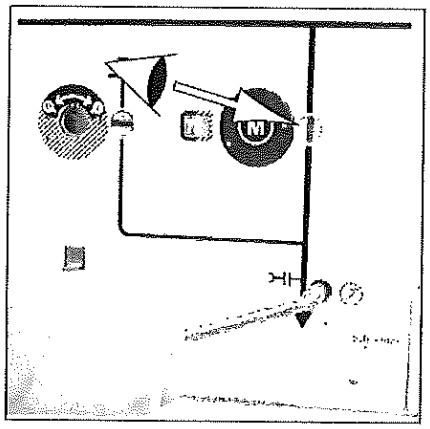
9.4 Ръчни операции включващи функции C, T1 и Sb [заземителен превключвател



- Поставете задната дръжка за превключвателя отвора



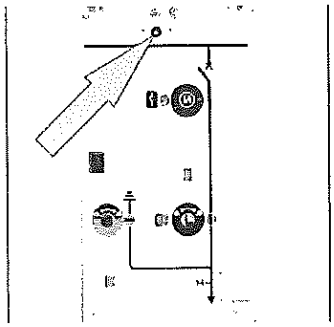
- за да отворите (или затворите) товаро прекъсвача , завъртете по часовниковата стрелка (виж § 9.3).



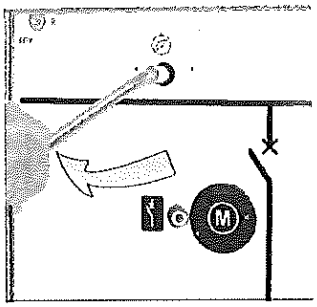
- продължете докато операцията е завършена (мимичната схема се смени
- Отстранете коляновата дръжка

отворен]

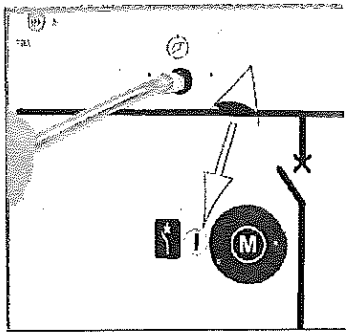
9.5 Ръчни операции включващи функции T2 [заземителен превключвател отворен]



- Поставете задната дръжка за превключвателя в отвора



- за да отворите (или затворите) товаро прекъсвача , завъртете по часовниковата стрелка (виж § 9.3).



- продължете докато операцията завършена (мимичната схема се смени
- Отстранете коляновата дръжка

793

10 Поддръжка

10.1 Нива на поддръжка

Описание	Нива
Операции, препоръчани в ръководството с инструкциите "инсталиране - операция - поддържане", извършвани от съответно квалифициран персонал, които са получили обучение, което им позволява да се намеси, като се спазват на правилата за безопасност.	1
Комплексни операции, изискващи специфична експертиза и внедряването на резервно оборудване в съответствие с процедурите на Schneider Electric. Те трябва да се извършват от Schneider Electric, или от специализиран техник, обучен от Schneider Electric (виж § 1.2) при започване на процедурите, с подходящото специфично оборудване	2
Всички превантивни и коригиращи операции по поддръжка, всички ремонтни дейности и работи по реконструкция се изпълняват от Шнайдер Електрик.	3

10.2 Профилактична поддръжка

Профилактична поддръжка	Честота	Нива		
Препоръчителни операции	6 години	1	2	3
Проверка на наличието и състоянието на аксесоарите (лостове и тн.)	X	~X~	~X~	~X~
Визуална външна инспекция (чистота, липса на окисляване , и тн.)	X	X	X	X
Почистване на външните компоненти с чист, сух парцал.	X	X	X	X
	X	X	X	X
	X	X	X	X
Визуално наблюдение на общия вид на връзките.	X	X	X	X

10.3 Поддръжка с коректива цел

Поддръжка с коректива цел		Нива		
Смяна или модификация	Виж §	1	2	3
Смяна на три предпазителя	10.4		~X~	~X~
Смяна на индикатор за напрежение [E.g.: тип VPIS]	10.5	X	X	X

10.4 Смяна на три предпазителя

Действие	Шина	Кабели	Товаро прекъсвач	Заземител
Нормално	Без напрежение	Без напрежение	Отворен	Затворен
Възможно	Под напрежение	Без напрежение	Отворен	Затворен

Заключване на функционалните единици	Необходими инструменти	Необходими части :
Всички операции по заключване следва да бъдат изпълнени	- кожени ръкавици	- 3 предпазителя със същата референция
Съгласно изискванията за съответната мрежа	- ключ за отделението	*(да се проверят стойностите в съответствие с мощността на трансформатора*
	- малка отвертка с плоска глава	

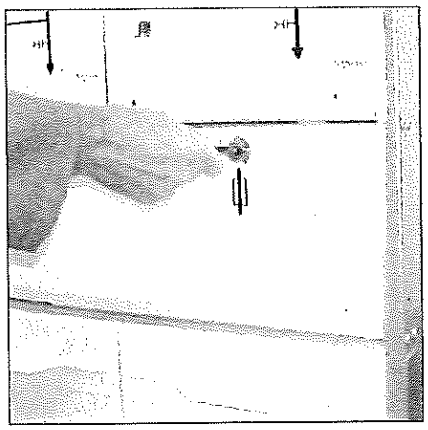
Да се види съответния раздел в Ръководството за монтаж за характеристиките на предпазителите (виж § 2.3).

Смяна на предпазител

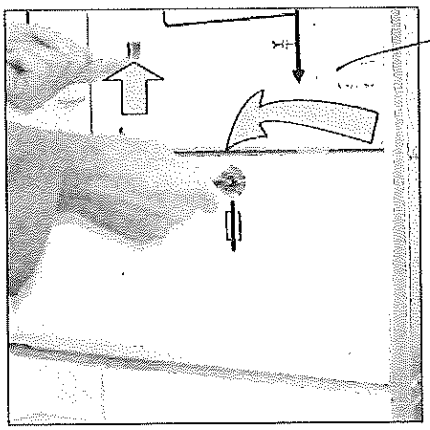
! Наложително да се сменят всички 3 предпазители, при отказ на очевидно една фаза

Корпусът на предпазителя може да стане много горещо след късо съединение. Трябва да се вземат предпазни мерки, стандартни (кожени) ръкавици преди започване на работа.

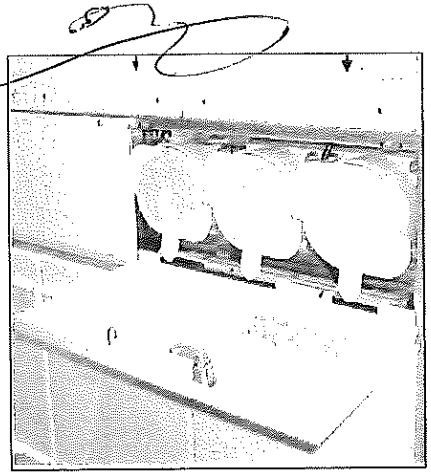
! Независимо дали се извършва смяна или монтаж предпазител, отделението следва да се затвори веднага след това, за да се избегне проникване на прах и влага.



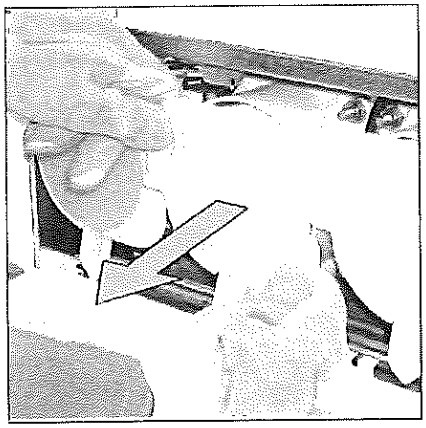
- уверете се, че функционалния заземител е затворен
- Отворете отделението използвайки съответният ключ



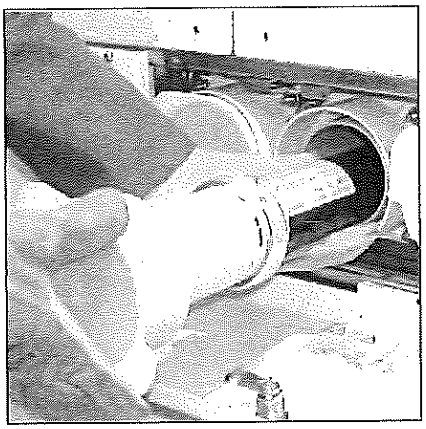
- Повдигнете резето и отворете панела .



- Накрайниците на държателите на предпазителите са достъпни accessible.

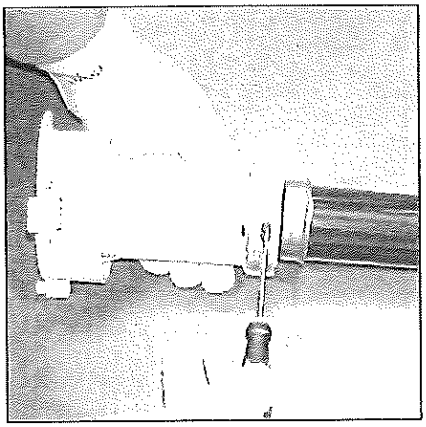


- Използвайте чисти кожени ръкавици
- Дръпнете гнездото на предпазителя към вас , без усукване.

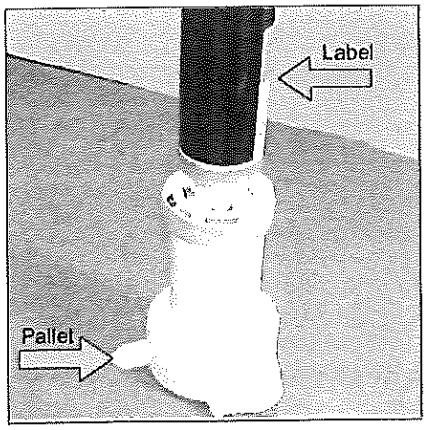


Бавно отстранете сглобката на гнездото/ предпазителя
Внимание!!! Може да е нагорещен. .

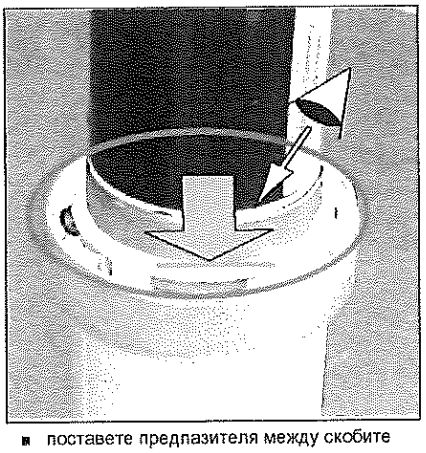
- Поставете сглобката на чиста, плоска повърхност. .



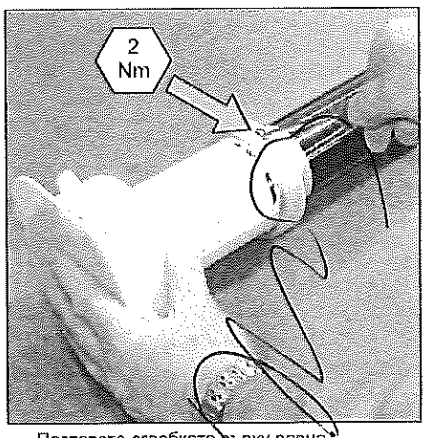
- Отвийте фиксиращия винт.
- отстранете изгорелият предпазител от гнездото.



- Сглобете предпазителя за смяна
  - Надпишете и повдигнете страната на гнездото
  - Надпишете противоположната страна на държателя на предпазителя.

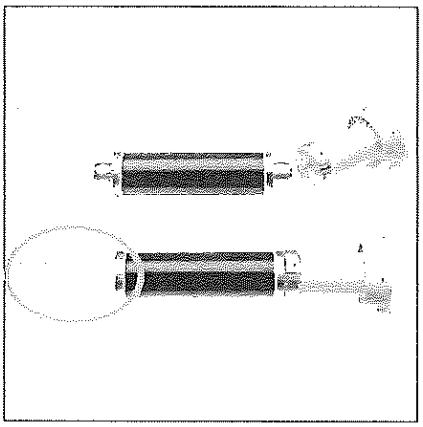


- поставете предпазителя между скобите колкото е възможно по далеч от носещия пръстен.

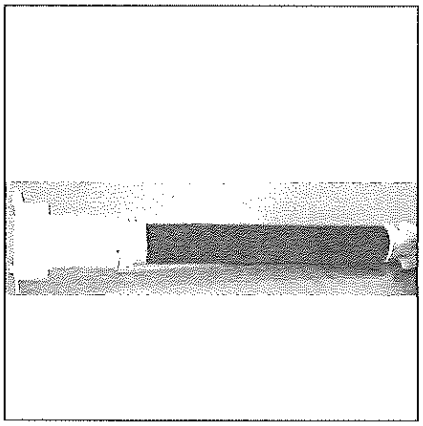


- Поставете сглобката върху равна повърхност за да улесните затягането на винта на скобата до необходимия въртящ момент на затягане.

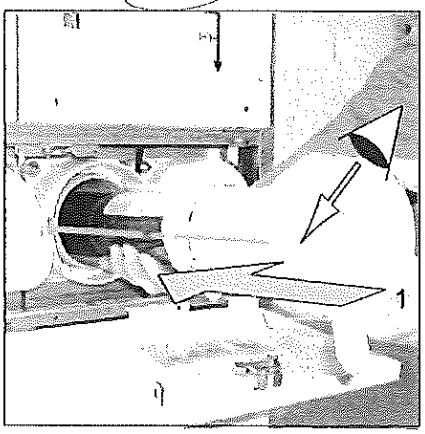
За предпазители до 12kV, да се възстанови адаптора включен отзад на предпазителя.



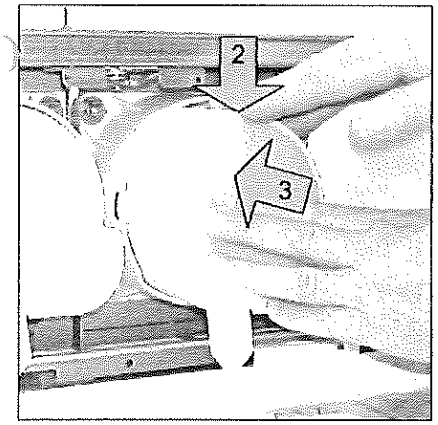
- За предпазители до 12 kV: за се монтира Адаптер на другия край на предпазителя



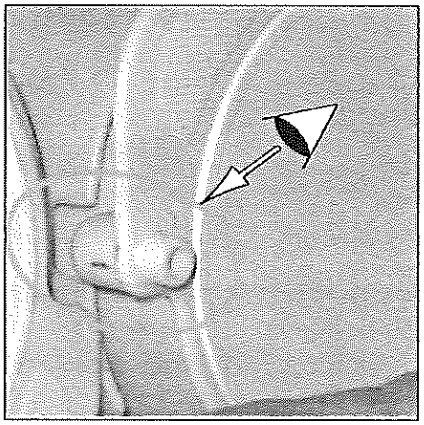
- уверете се , че сглобката куплунг и предпазител) е чиста.



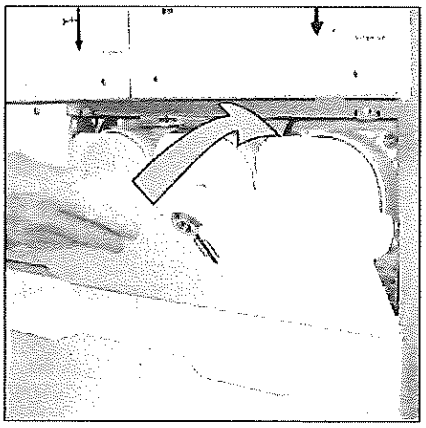
- плъзнете тази сглобка в гнездото на предпазителя като подравните пластинката на куплунга със слота в гнездото
- не усуквайте докато плъзгате



- **2. Когато сглобката е изцяло вмъкната** натиснете надолу куплунга .
- 3. Натиснете силно .



- Пластинката на куплунга ще заклини предпазителя в гнездото.



- За да затворите капака на предпазителя:
  - Повдигнете резето ,
  - натиснете капака обратно на мястото му
  - Заключете капака (използвайки ключа)

Сега монтирайте и другите два предпазителя.

Третиране на стари предпазители и опаковане

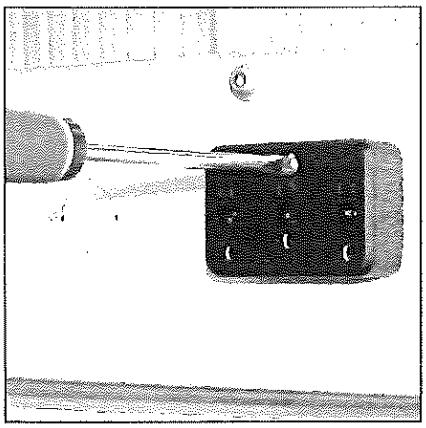
Предпазителите и опаковките трябва да се третират чрез Общите канали за промишлени отпадъци

775

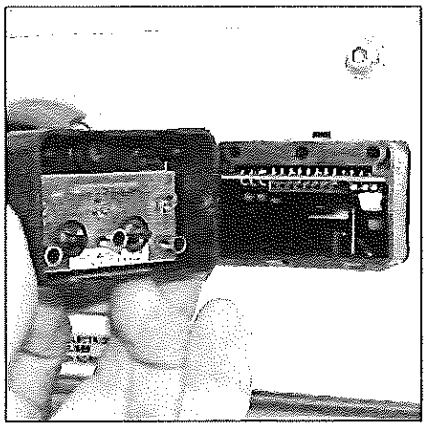
10.5 Смяна на индикатор за напрежение [E.g.: тип VPIS]

Действие	Шина	Кабели	Товаро прекъсвач	Заземител
Нормално	Без напрежение	Без напрежение	Отворен	Затворен
Възможно	Под напрежение	Под напрежение	Затворен	Отворен

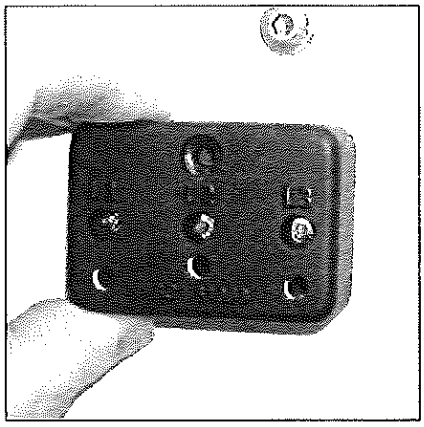
Заключване на функционалните единици	Необходими инструменти	Необходими части :
Всички операции по заключване следва да бъдат изпълнени Съгласно изискванията за съответната мрежа	- Плоска отвертка	- VPIS индикатор



- развийте двата странични винта (Отвертка с плоска глава).



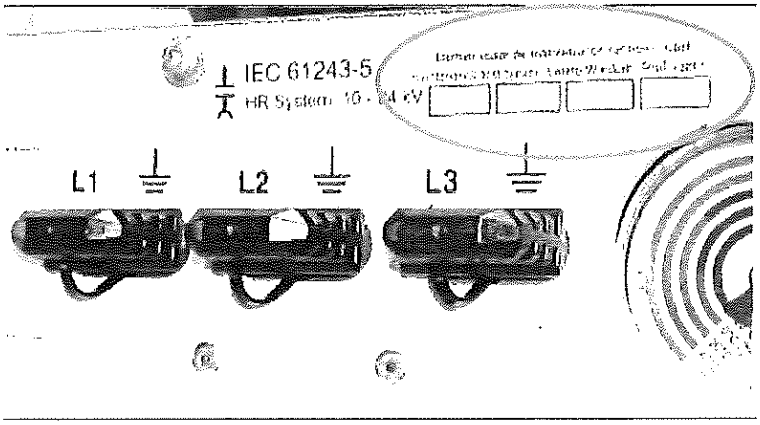
- Извадете индикатора за напрежение



- Свържете новия уред.
- леко затегнете фиксиращия винт .

10.6 Периодична честота на операциите по поддръжка на кутиите VDS

- В непосредствена близост до надписите за напрежение, на указателна табелка се упоменава датата на последната процедура по поддръжка и изпитване



11 Резервни части

11.1 Резервна част

Описва част, предназначена да замести съответната такава
До възстановяване на функционирането на оригиналната
Подмяната на тези части може да се извършва само от подходящо обучен и квалифицирано персонал за извършване на тези операции.
За обяснение на нивата на поддръжка моля се отнесете към § 10.1.

Планирана подмяна	Описание	Подмяна	Нива		
		Всеки	1	2	3
Това се отнася до износени части, предназначени да бъдат заменени след предварително определен брой употреби. Употреба: запаси за поддръжка, необходими за оптимална поддръжка на всеки 6 години	HV предпазители (по 3)	20 години	X	X	X

Н планувана подмяна	Описание	Нива		
		1	2	3
Описват се резервни части, чиито замяна се налага в хода на коригираща поддръжка	Светлинни индикатори	X	X	X

Подмяна по изключение	Denomination	Нива		
		1	2	3
Описва резервни части или възли, чиито очакван жизнен цикъл най-малко равен на този на оборудването. Използване: Резервни части или възли, съхранявани като гаранционен запас.	Натягане на кабели	X	X	X
	Манометър	X	X	X
	Мотор	X	X	X
	Спомагателни контакти	X	X	X
	Оперативен лост за заземител	X	X	X
	Лост за Товаро прекъсвач	X	X	X
	Авариен лост за ръчен контрол на моторизирани механизми	X	X	X
	Ключ за отделението за предпазителите на електродите	X	X	X
	Механичени контроли	X	X	X

11.2 Идентификация на материалите

For all orders for spare parts, it is necessary to enclose the equipment characteristics form.

11.3 Условия на съхранение

Компонентите трябва да се съхраняват далеч от прах, влажността или слънчеви лъчи. За да се улесни търсенето, те трябва да бъдат маркирани с референтен номер на Шнайдер Електрик. Някои компоненти са крехки, за предпочитане е те да се съхраняват в оригиналната им опаковка

ВЯРНО С ОРИГИНАЛА

ИНЖЕНЕРИНГ ПЛОВДИВ ЕАД

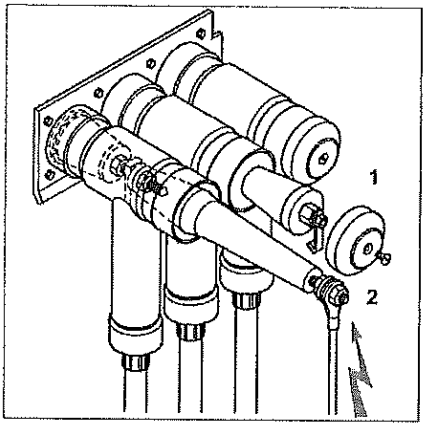
776

12 Тестване на кабели

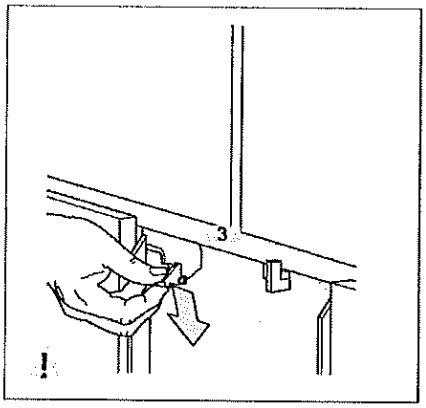
12.1 Подготовка на функцията

Въведете правила за блокиране съгласно разпоредбите, които са специфични за всяка мрежа.
Освободете от напрежение товаро прекъсвача и затворете заземителния превключвател. (виж съответната глава).
Отстранете панела за достъп до отделението за кабели .

12.2 тестване на кабели с куплунг T част конектори (шина под напрежение)

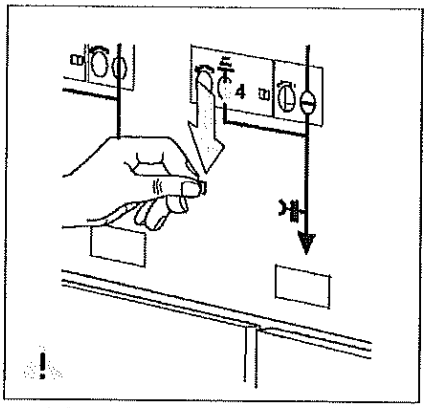


- 1 .Отстранете крайният капак на
- **2. Монтирайте адаптера .**



Симулирайте наличието на врата

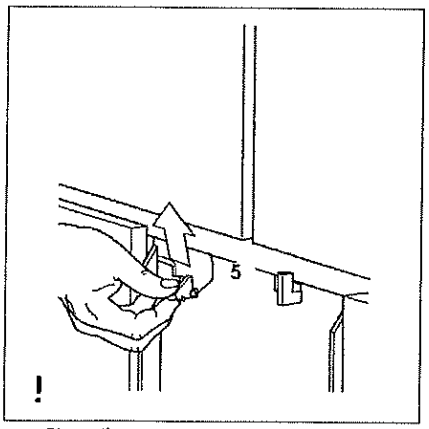
- 3. натиснете ключалката надолу : Сега заземителя не е заключен.
  - В тази позиция прекъсвача може да бъде местен, освен ако не е монтиран с допълнителна блокировка между кабелния панел и товаро прекъсвача (опционално).



- **4. Смъкнете заключващата тапа .**
- отворете заземителя (See § 5.1).

Извършете тестовете.

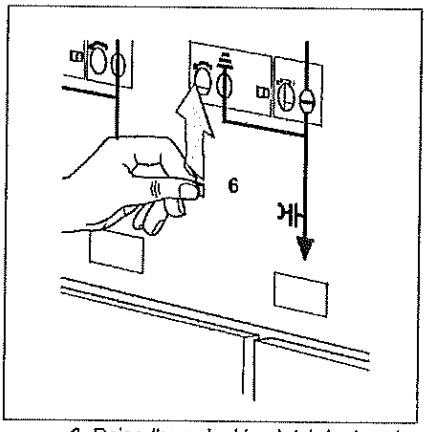
Затворете заземителя. (виж § 5. 2)
5. Дръпнете ключалката нагоре .



- Close the earthing switch (See § 5.2).

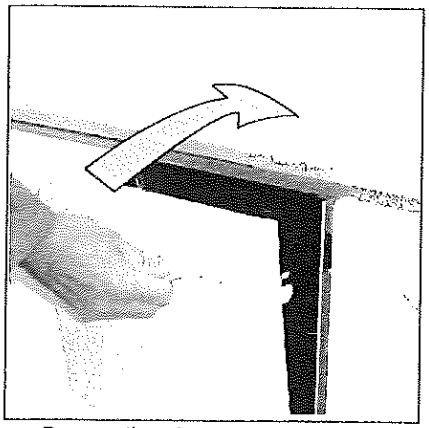
! 5. Pull the lock upwards.

6. Повдигнете с ръка отключващото резе



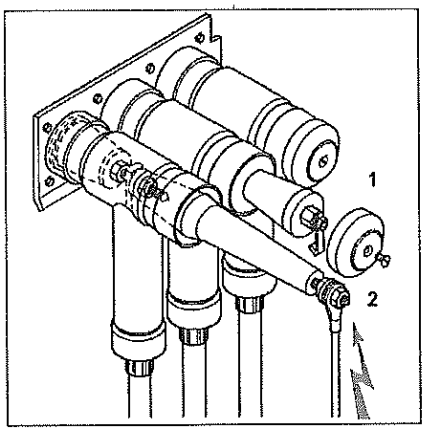
! 6. Raise the unlocking latch by hand.

Отстранете адаптерите
Завинтете капака от краищата
Монтирайте панела на кабелното отделение

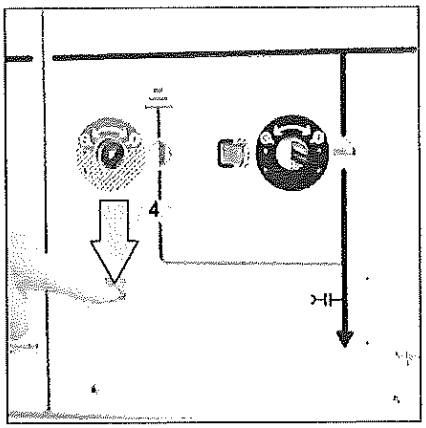


- Remove the adapters.
- Screw the covers onto each extremity.
- Re-fit the cable compartment panel.

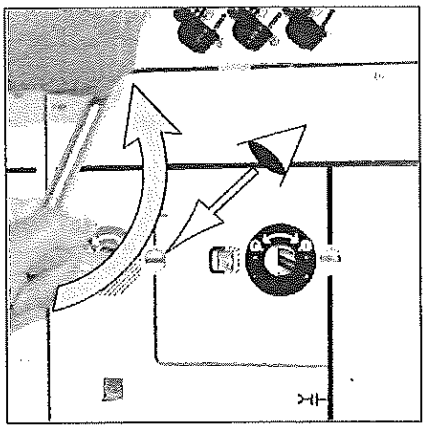
12.3 Кабелни тестове: EON спецификация със конектори 'Т' част [шина под напрежение)



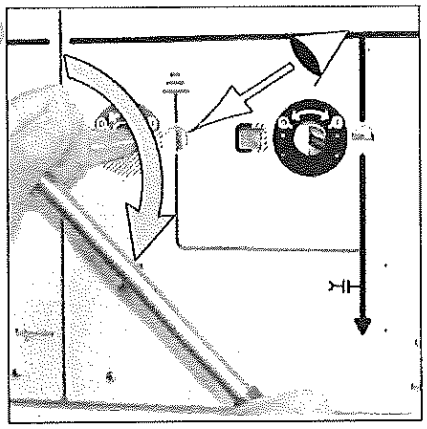
- 1 . отстранете капака на панела .
- 2. Завинтете адаптера за тестове .



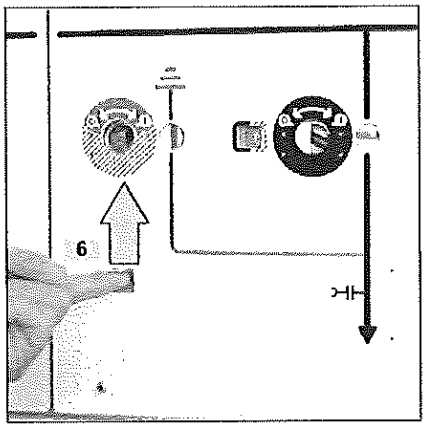
- 3. Смъкнете с ръка заключващото резе .



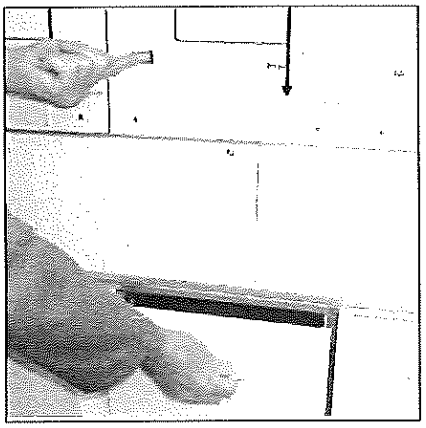
- Отворете заземителя .
- Проведете тестовете .



Затворете заземителя .



- 6. Повдигнете заключващото резе с ръка.

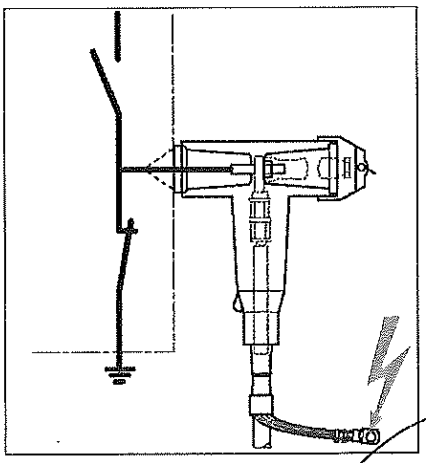


- Отстранете адаптерите.
- завинтете капака от всички страни .
- поставете и закрепете кабелния панел..

12.4 Тестване на корпуса на куплунга на конекторите

Обърнете се към доставчика на куплунгите за конектори за цялата информация и данни, свързани с това изпитание.

- За провеждане на изпитанието: Изключете функцията. . затворете заземителя. . разединете заземителната обшивка
- Пускането на ел.ток е през обшивката
- След теста , свържете отново заземителната обшивка към общата заземителна верига.



13 характеристика и обем на SF6 газ

13.1 Общи характеристики

Тип на изолиращия газ :
Серен хексафлуорид (SF6) - law IEC60376.

Всяко табло се състои от резервоар, напълнен с SF6 газ, предназначен за проектиран като херметична система под налягане в съответствие с изискванията на IEC62271-1.

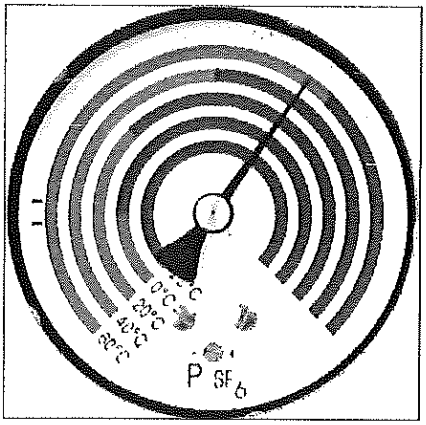
Никога не пробивайте резервоар под налягане

Никога не се опитвайте да отворите резервоара .

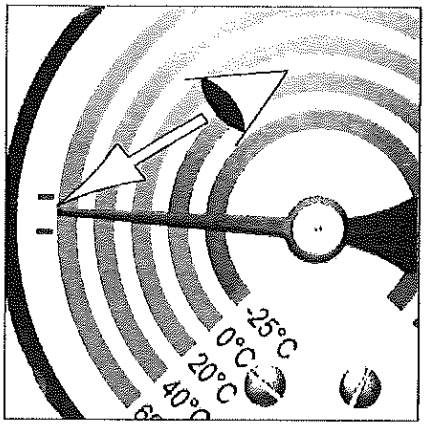
13.2 Налягане на пълнене

- при 20°C налягането на пълнене е 0.030 MPa (0.13 MPa абсолютно).

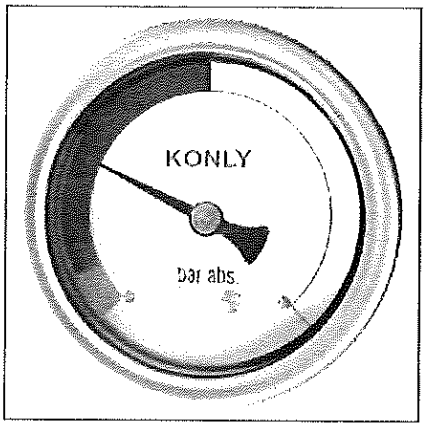
По време на очакваният жизнен цикъл на експлоатационен живот и при нормални работни условия, не би следвало да има необходимост от допълването на газ.



- манометър за налягане (по опция) позволява на газово налягане SF6 да бъде гарантирано, в зависимост от температурата (5 криви).



- 2 те черни линии от ляво ,съответстват на вътрешно налягане, равно на атмосферното налягане (0.1 MPa абсолютно).



- Специфичен манометър (по опция)за над морски височини по високи от 1000 m.

13.3 Оперативни прагове на контактните манометри

Прагове	Температура	Налягане
Високо	20°C	250 ± 30 mbar
Ниско	20°C	140 ± 50 mbar

13.4 FBX функции

Товаро прекъсвача може да бъде опериран само когато стрелката (иглата) е в зеления сектор (от дясно) отговаряща на температурата на околната среда.

В случай на наблюдение на аномалии (напр. стрелката е в червения сектор) моля да се свържете с най близкия представител на Schneider Electric

14 В края на жизнения цикъл на оборудването

14.1 Валоризация на оборудването

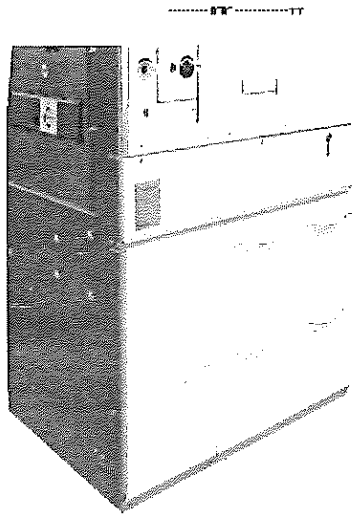
Нашите функционални единици са произведени от рециклиращи се материали. .

Таблица (§ 14.4) дава информация и цифри за типовете материали, тяхното качество и методи на валоризация

Те позволяват следното
- Да си изчисли капацитета на валоризация
- Оптимизиране на процеса на валоризация ,
- Оценка на разходите на валоризация .

Дадените показания в таблиците (§ 14.4) улесняват сътрудничеството между потребителите и Schneider Electric за валоризиране на изделието в края на жизнения цикъл.

FBX-C (IS) C-C-T1 (24 kV - 400 A)



14.2 Инструкции за безопасност

Да не се разглобяват пружините на механичните контролни механизми без устройството за освобождаване

Никога не се опитвайте на отворите херметичен резервоар на функционална единица

14.3 Изваждане на оборудването от работа

Консултирайте се с Schneider Electric относно всички услуги по извеждане от експлоатация
Възстановяване на SF6 и отваряне на резервоара, могат да бъде извършено само в определено помещение , оборудвано за този вид услуга.

Не се опитвайте да съберете SF6 без определените за това инструменти и в помещение , което не е специално предназначено за това.

14.4 Разпределение и валоризация на използваните материали за FBX (виж § 14.1)

Общо тегло : FBX-C (IS) C-C-T1 + 3 предпазителя =

Метали – вкл, вложки	Тегло (kg)	% of материали	Валоризация
Стомана	155.810 83.854		
Неръждаема стомана	26.5		Да
Мед и сплави базирани на мед	9.8		
Алуминий и сплави на основата на	0.051		
алуминий			Да
Сребро			
Общо	**276.015**	88.92	

Термореактивни части	Тегло (kg)	% материали	Валоризация
Епоксидна смола	12.141		**Не може да бъде валоризирано** (изпратено до технически центрове за зарявяне)
Total	**12.141**	3.91	

* основно силициев двуокис

Термо пластични материали	Тегло (kg)	% материали	Valorization
Полиестери	7.330		**Yes**
ароматни полиамиди	2.964		
полиамиди	1.198		
Други	0.152		
Total	**11.645**	3.75	

Еластомери	Тегло (kg)	% материали	Валоризация
EPDM	**0.095**	0.03	**Не може да се валоризира**

Газ	Тегло (kg)	% материали	Валоризация
SF6	**2.450**	0.79	**Да** (регенерация)

Други	Тегло (kg)	% материали	Валоризация
Силициев двуокис	3.000		**Да**
Порцелан	2.993		
Кордиерит	1.097		
Натриев алумосиликат	0.500		
Фенол хартия	0.430		
Грес	0.050		
Общо	**8.070**	2.60	

15 Бележки

Ако имате коментари относно използването на този документ или за използването на оборудването и услугите, които са описани в него, моля изпратете ни вашите бележки, предложения на :

ВЯРНО С ОРИГИНАЛА
779

ИНЖЕНЕРИНГ ПЛОВДИВ ЕАД