Medium Voltage Distribution
Catalogue | 2014

FBX

Gas insulated switchgear up to 24 kV

Schneider Electric

General contents

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Introduction

PE58600

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).

PE58604

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.

PE58549

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, 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.

PE58605

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 1
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.

Product description

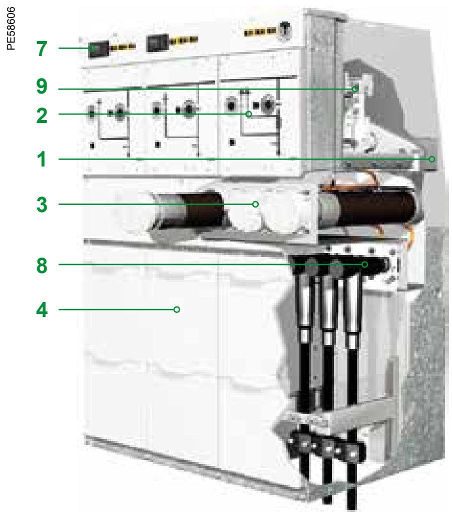


Illustration of an FBX-C
C-C-T1 function, protection by fuses

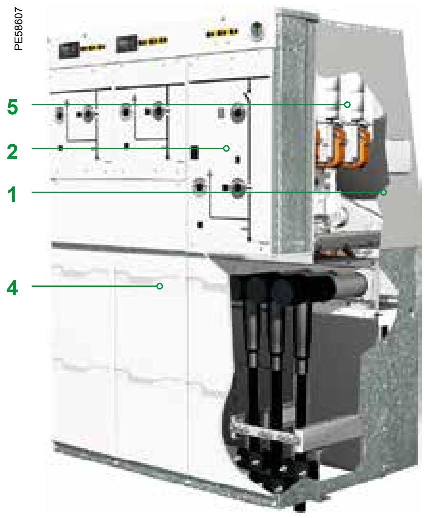


Illustration of an FBX-C
C-C-T2 function, protection by vacuum circuit-breaker

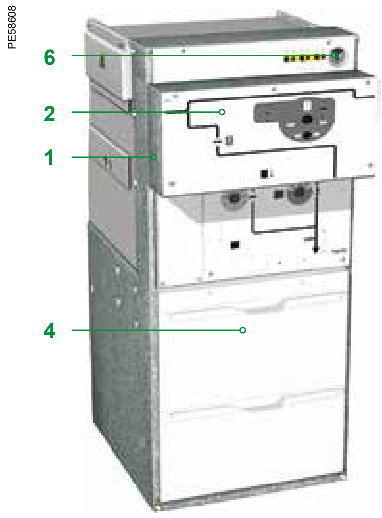


Illustration of an FBX-E
Vacuum circuit-breaker function

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 (FBX)
Version: (C)
C = Compact
E = Extensible

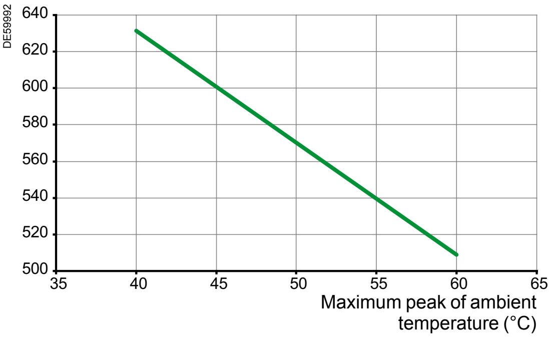
Rated voltage: 12 kV (12)

Short circuit current:
25 kA (1s) (25)

Functions (C-C-T1)
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
- Typical maximum altitude for installation above sea level is 1,000 m. However, much higher altitudes are possible on request but with limitations when Metering or HV fuse-holders functions are requested.
- 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.

■ **FBX-DE:** Double Extensible version
FBX switchboard can be extended on either or both left and right sides.

■ **FBX-SE:** Single Extensible version
FBX switchboard can only be extended on the right side.

These versions offer 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:
□ 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.

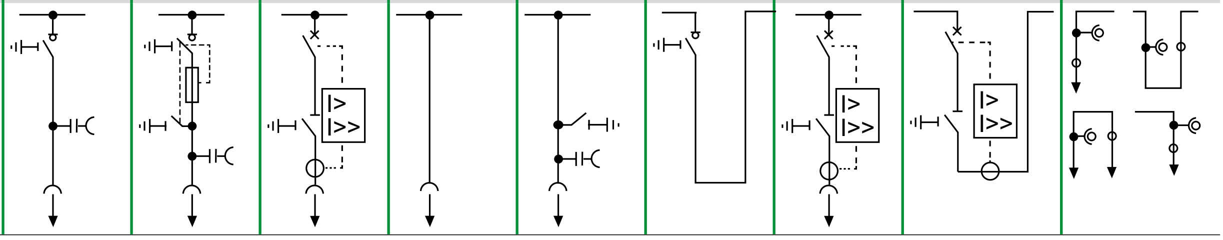
Main functional units:

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

(*) Please consult us for availability.

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									

(*) Please consult us for availability.

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 two autonomous relays can be integrated behind the front cover with the current transformers fitted on cable plug-in connections: DPX-1 and WIC.
□ 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.

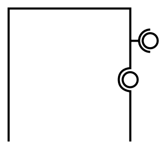
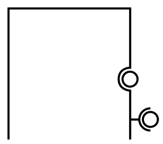
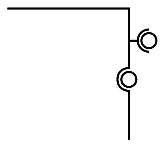
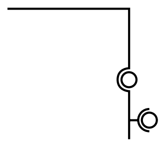
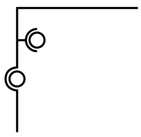
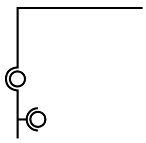
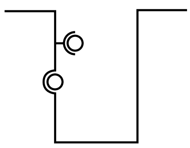
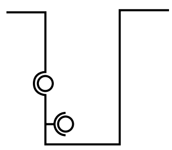
CBb function (*)

■ 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 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.

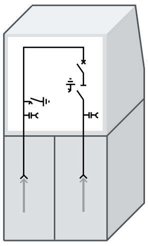
For 12 kV and 24 kV			
M1 Version		or	
M2 Version		or	
M3 Version		or	
M4 Version		or	

Available configuration

FBX-C, compact version (non extendable)

2 functions

DE59972

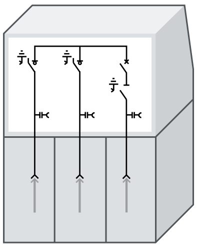


Versions

C	C
C	T1
C	T2
RE	T1
RE	T2

3 functions

DE59973

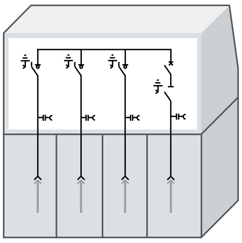


Versions

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

4 functions

DE59974

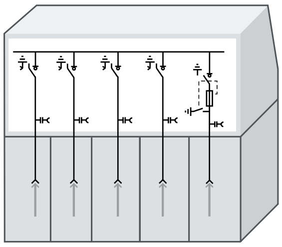


Versions

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

5 functions

DE59975



Versions

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

FBX-E, extendable version

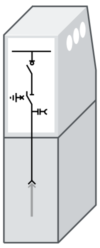
FBX-DE: Double Extensible version
FBX switchboard can be extended on either or both left and right sides.

FBX-SE: Single Extensible version
FBX switchboard can only be extended on the right side.

NEW

1 function

DE59976

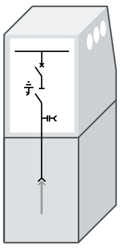


Versions

C
R
RE

1 function

DE59977

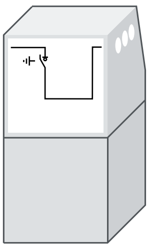


Versions

T1
T2

1 function

DE59978

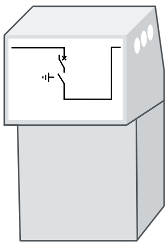


Version

Sb

1 function

DE59979

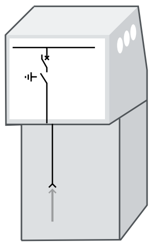


Version

CBb (*)

1 function

DE59980

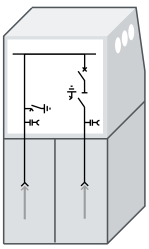


Version

CB

2 functions

DE59981

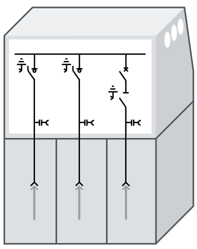


Versions

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

3 functions

DE59982

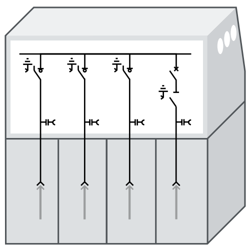


Versions

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

4 functions

DE59983



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.

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		1380 (option 1040)			550
C-C-T1-C-T1		1380 (option 1040)			550
C-T1-C-T1-T1		1380 (option 1040)		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		1380		1005	490
M3		1380			490
M4		1380		1010	490
C	1	1380 (option 1040)	752	360	135
R		1380 (option 1040)			125
RE		1380 (option 1040)			135
T1		1380 (option 1040)		490	160
T2		1380			190
CB		1380	873	490	220
CBb		1380		625	250
Sb		1380	752	680	200
C-C	2	1380 (option 1040)	752	680	210
C-T1		1380 (option 1040)			210
C-T2		1380			240
T1-T1		1380		1000	310
T2-T2		1380			370
RE-T1		1380 (option 1040)		680	220
RE-T2		1380			250
C-C-C	3	1380 (option 1040)	752	1000	330
C-C-T1		1380 (option 1040)			340
C-C-T2		1380			370
C-RE-T1		1380 (option 1040)			330
C-RE-T2		1380			360
R-RE-T1		1380 (option 1040)			330
R-RE-T2		1380			360
C-C-C-C	4	1380 (option 1040)	752	1320	450
C-C-C-T1		1380 (option 1040)			460
C-C-C-T2		1380			490
C-T1-C-T1		1380 (option 1040)			480
C-T2-C-T2		1380			510

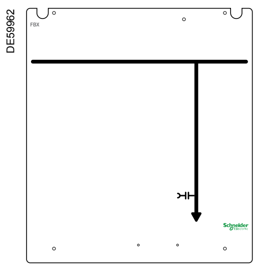
(1) With a 1250 A busbar on the top, add 217 mm.
(2) Add 17.5 mm for the busbar protective covers (right or left) at the extremity of the switchboard.
(3) To calculate the total width of several connected FBX-E switchboards, add 9 mm between each extension.

Contents

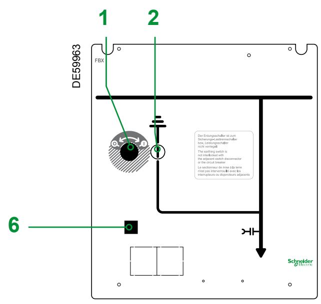
User interface

User interface description

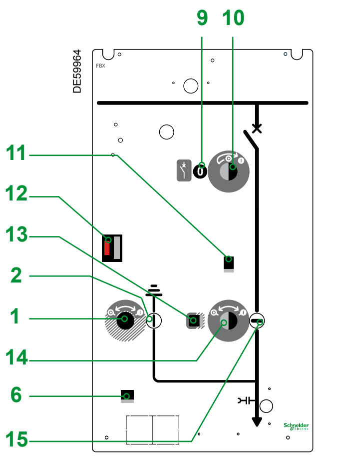
Thanks to its clear mimic diagram, the user interface makes it easy and safe to operate FBX.
Each switching device is equipped with an access point for the control lever and an indicator of the mechanical position.
The two earthing switches, both upstream and downstream from the MV fuse holders on the 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.



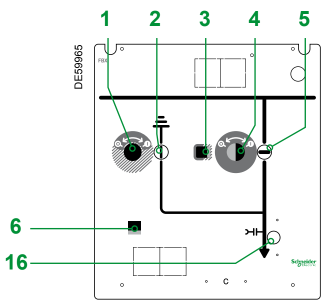
Direct incoming feeder without earthing switch (R)



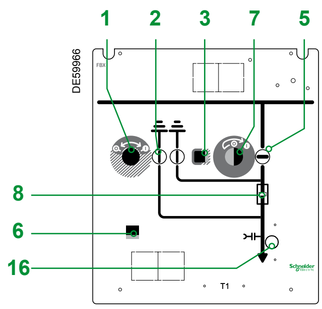
Direct incoming feeder with earthing switch (RE)



Transformer protection with vacuum circuit-breaker T2



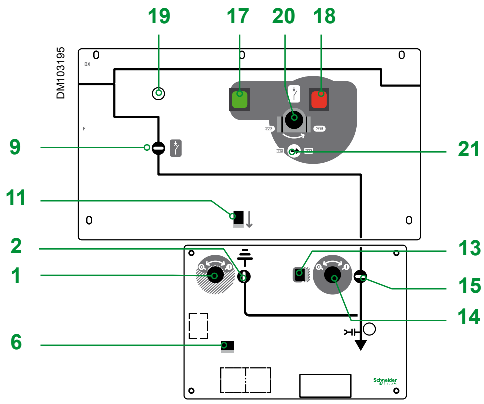
Incoming/outgoing feeder with switch-disconnector (C)



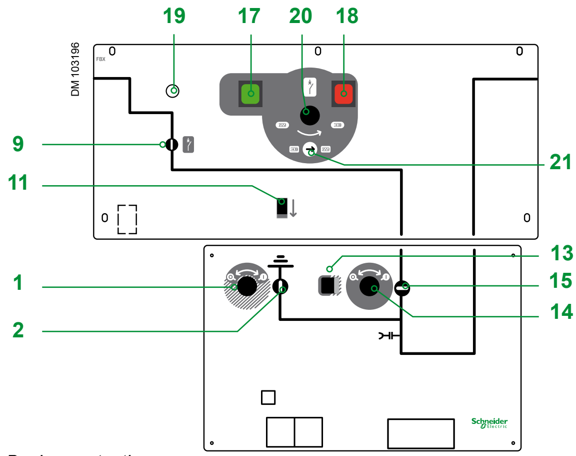
Outgoing feeder with T1 switch-disconnector fuse combination

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 showing the status of the spring (primed or released)

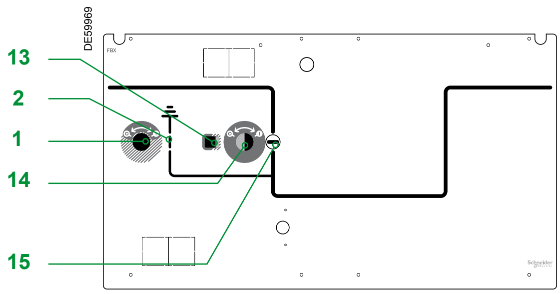
User interface



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

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.

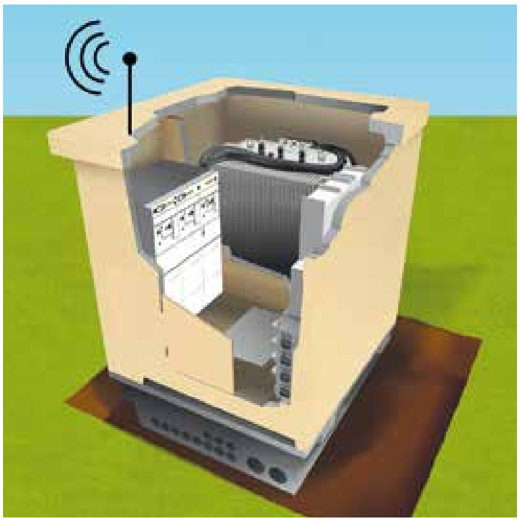
During the assembly of an extension cubicle, an additional space of at least 450 mm is necessary to allow for handling.

PE58534

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

Remote control

PE58610



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

PE56311

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

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)

Cable compartment

The cables connection compartment has been designed to accept connection systems that are:

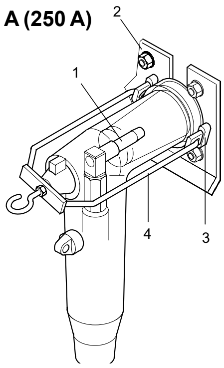
- Completely insulated
- In metallic housing
- Partially insulated.

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:

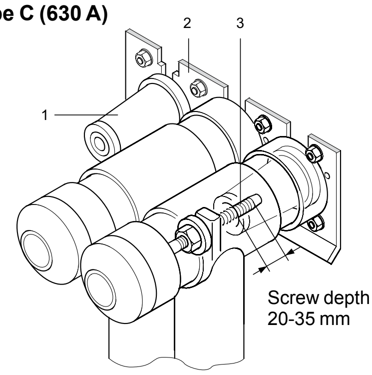
Switchboard function	R / RE	C	T1	T2 / CB
Connector cone Type A (250 A)	–	–	■	–
Connector cone Type C (630 A)	■	■	■ (optional)	■

Type A (250 A)



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

Type C (630 A)

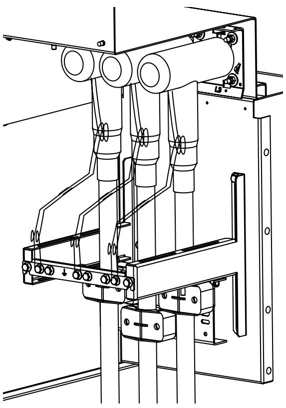


1 - Cross member - Male
2 - Support plate
3 - Screw contact

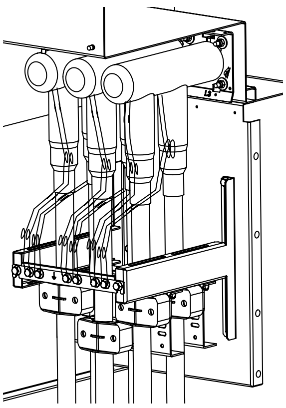
Type of connection

FBX cable compartment is spacious and allows for various connections (cf. § Selection of cables):

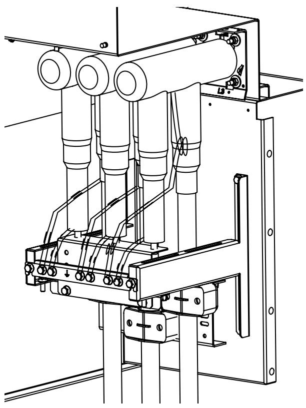
- Single cable per phase
- Two cables per phase
- Single cable per phase + surge arresters
- A triple cable per phase connection is also available (please consult us)
- No cable - bushing protected by insulating plug.



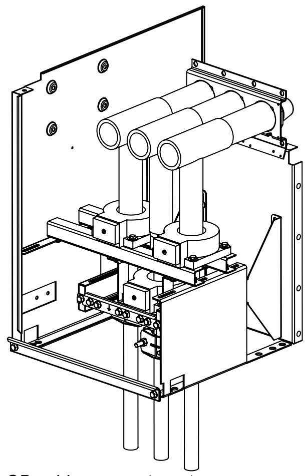
Single cable per phase connection



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

PE58615

FBX with fuse protection

PE58616

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

PE58617

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

PE58618

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/M0			1000			1000		1000	
Electrical: Rated current	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				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	
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/M0	1000				1000		1000	
Electrical: Rated current		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.

T2 function

Characteristics of the T2 function (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										
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	
Rated operating time										
Opening with tripping release		ms		25 to 60			25 to 60		25 to 60	
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 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

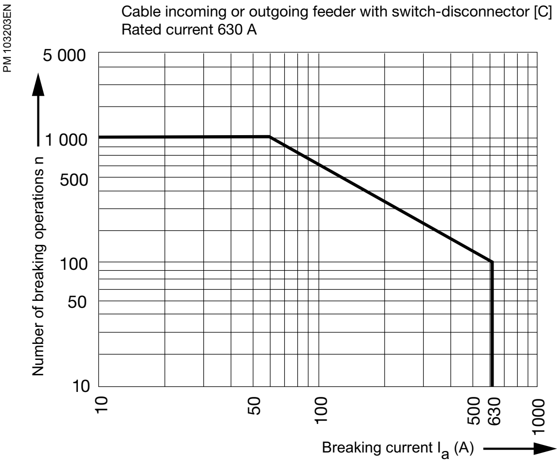
Characteristics of the CB, CBb functions (vacuum circuit-breaker)

Characteristic	Item	Condition	Unit	12			17.5		24	
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			kA	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	25 to 60			25 to 60		25 to 60	
	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 / M2	2000 / 10000			2000 / 10000		2000 / 10000	
	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	

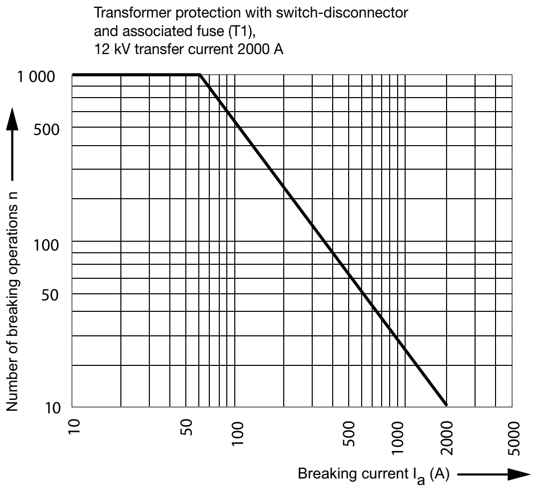
(1) Spring-loaded current making and breaking mechanism with stored energy and motor.
(2) For the first cable test on a new unit. Later tests can be carried out at 67 kV.
(*) Please consult us for availability.

Maximum number of mechanism operations

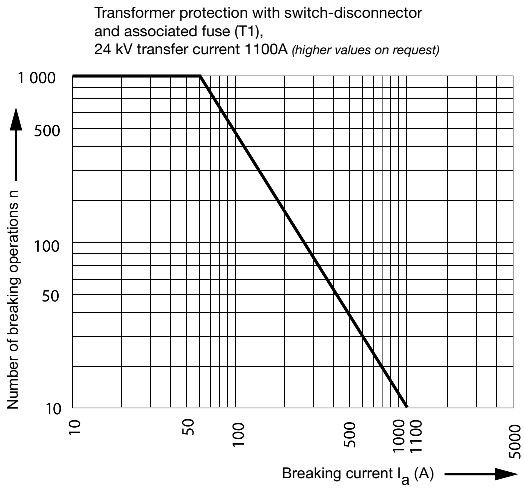
C function



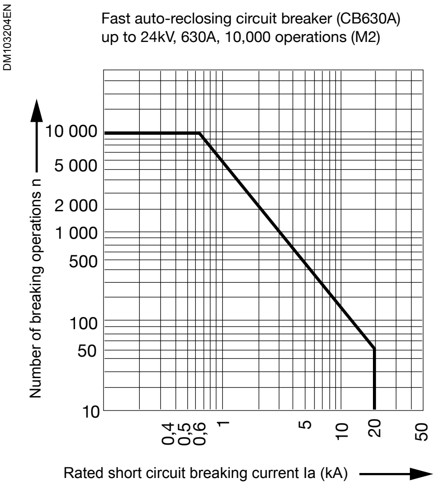
T1 function



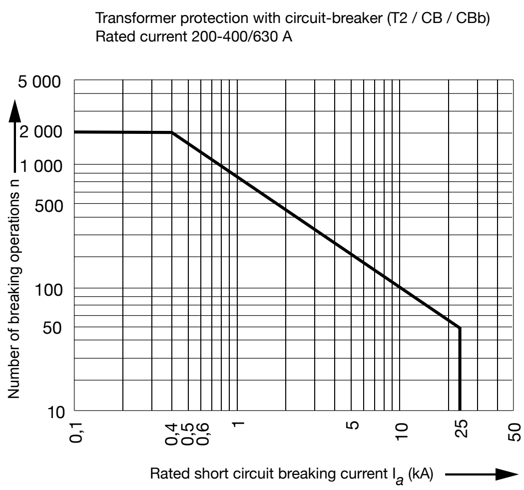
T1 function



CB630A function (M2)



T2 / CB630A (M1) / CBb functions



Choice of mechanisms and equipment

Mechanism operating principles

SFU (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 (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	■ SFU	–	■ SFU	–	–	■ SFU	■ SFU	■ SFU
	SF	□	■	–	–	–	–	–	□
Earthing switch	SU	■ SU	■ SU	■ SU	–	■ SU	■ SU	■ SU	■ 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.

SFU/SU, SF/SU operating mechanisms

Electrical characteristics of the SFU/SU, SF/SU 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
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
Rearm time	SFU/SU or SF/SU drive	s	< 6						< 6		
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 U ≤ 230 Vac (resistive)	SFU/SU or SF/SU drive	A	–						10		

C 150 operating mechanisms

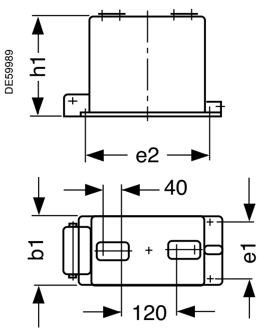
Electrical characteristics of the C 150 operating mechanisms

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	(*) / 24 Vdc 14.7 A / 48 Vdc 10.9 A / 60 Vdc 6.6 A / 110 Vdc 5.1 A / 125 Vdc 3.3 A / 220 Vdc	8.5 A / 110 Vac 4.7 A / 230 Vac 5.6 A / 125 Vac
	Absorbed current	A	(*) / 24 Vdc 5.1 A / 48 Vdc 3.4 A / 60 Vdc 1.7 A / 110 Vdc 2.0 A / 125 Vdc 1.0 A / 220 Vdc	3.5 A / 110 Vac 1.8 A / 230 Vac 2.1 A / 125 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 480 W / 48 Vdc 450 W / 60 Vdc 620 W / 110 Vdc 521 W / 125 Vdc 373 W / 220 Vdc	620 VA / 110 Vac 521 VA / 125 Vac 407 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 - 4.7 W / 24 Vdc 256 W - 4.7 W / 48 Vdc 248 W - 7.0 W / 60 Vdc 173 W - 4.4 W / 110 Vdc 166 W - 4.3 W / 125 Vdc 194 W - 3.5 W / 220 Vdc	173 VA - 4.4 VA / 110 Vac 166 VA - 4.3 VA / 125 Vac 194 VA - 3.5 VA / 220 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 480 W / 48 Vdc 450 W / 60 Vdc 620 W / 110 Vdc 521 W / 125 Vdc 373 W / 220 Vdc	620 VA / 110 Vac 521 VA / 125 Vac 407 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 for current value	

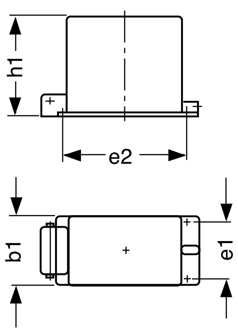
Characteristics of the M1, M2, M3, M4 functions

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	
Rated current									
Outgoing feeder		A	630			630		630	
Rated peak current		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

Characteristics of the current and voltage transformers



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



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

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 HV fuses that 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

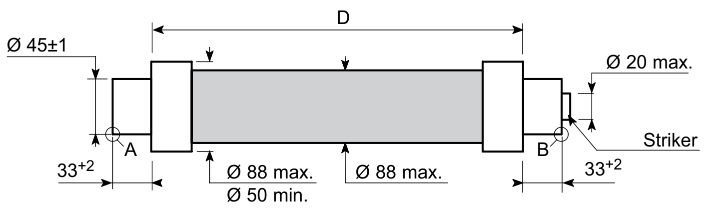
The fuses meet the following standards:

- 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. Temperature must be considered when calculating fuse power losses. 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.

HV fuse

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

DM103205EN



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, radius A and B < 3 mm.
- "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 table

HV fuses (SIBA) selection table with integrated thermal limitation

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
Rated voltage (kV)	Service voltage (kV)	Uk = 4%													Uk = 6%						
		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	–	–	–
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

1250 A busbar

Busbar – 1250 A on top of unit

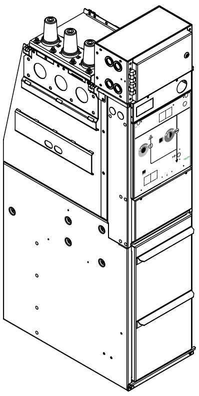
■ The top-mounted busbar is used to increase the electrical distribution capacity of the equipment up to 1250 A.

■ Available for the following FBX-E functions: C, 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.

DM100100

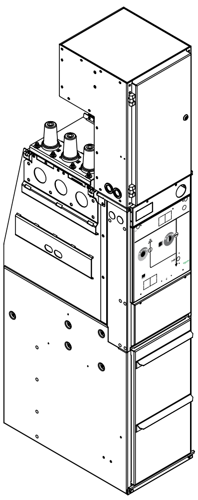


200 mm high LV cabinet for top busbar FBX

PE58619

View of the busbars

DM100101



600 mm high LV cabinet for top busbar FBX

PE58602

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

PE58622

VDS HR and its removable luminous indicator

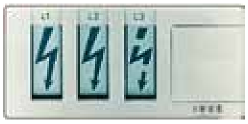
PE58177

VPIS v2, Voltage Presence Indicator System

PE58144

VPIS-VO

PE58621



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

PE57787

VD23 Voltage Detector relay

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.

VPIS v2: voltage presence indicating system

Description:

■ The VPIS V2 is a self-powered voltage presence indicating system, in compliance with the IEC 62271-206 standard
■ Connectors on the front panel allow the use of a phase comparator
■ Extended lifetime of LEDs on the front panel
■ Compatibility with existing MV network devices for replacement.

VPIS-VO:

■ VPIS v2 can be fitted with a voltage output cable to interface with the Flair fault passage indicator range or VD23 voltage detection relay, and in particular for power source changeover.

IVIS : voltage detection system

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).

VD23: Voltage detection relay

VD23 provides information of presence or absence of voltage.
Associated with VPIS-Voltage Output, VD23 is typically used in critical power and safety applications.

Various combinations of voltage detection are possible:

■ 3 Ph-N and residual voltage: V1 + V2 + V3 + V0
■ 3 Ph-N or Ph-Ph voltage: V1 + V2 + V3 or U12 + U13 + U23
■ 1 Ph-N or Ph-Ph or residual voltage: V1, V2, V3, U12, U13, U23, V0.

VD23 can display the MV network voltage (in % of service voltage), active the relay output R1 to monitor a loss of voltage on 1 phase at least and active the relay output R2 to monitor a presence of voltage on 1 phase at least.

■ Auxilary power supply: from 24 to 48 Vdc
■ Assembly: compact DIN format, mounted in the same place as fault passage indicator (format DIN, integrated in switchgear), terminal connexion fi tted with VPIS-Voltage Output
□ Compatible with all neutral earthing systems.

PE57783

Flair 21D

PE57784

Flair 22D

PM103928

Flair 23D

PM103929

Flair 23DM

PE58624

Compass B directional fault passage indicator

Fault passage indicators

To improve your power availability and manage your network load, FBX can be fitted with a variety of fault passage indicators integrated in FBX Low Voltage front panel (non-exhaustive list):

■ Alpha, Sigma or Opto (Horstmann make)
■ IKI20 (Kries make)
■ Easergy Flair 21D, 22D, 23D & 23DM (Schneider Electric)

Main characteristics of Easergy Flair 21D and Flair 22D fault passage indicators:
The new version of Easergy **Flair 21D** and **Flair 22D** provides a high visibility flashing led and gives detailed information via the digital display. An outdoor lamp on option can give the fault passage indication without entering the substation.

Overcurrent detection
■ Automatic mode for automatic adjustment-free calibration of detection thresholds
■ Manual mode possible to perform special override settings:
□ Flair 21D: 4 detection thresholds from 200 A to 800 A, in 200 A increments, selectable via microswitch.
□ Flair 22D, Flair 23D and Flair 23DM: 15 detection thresholds from 100 A to 800 A, in 50 A increments (configurable via the front panel keypad).
■ Fault acknowledged time:
□ Flair 21D: 60 ms
□ Flair 22D, Flair 23D and Flair 23DM (configurable via the front panel keypad):
  • from 40 to 100 ms in 20 ms increments
  • from 100 to 300 ms in 50 ms increments.
Note: On Flair 23DM, the parameter settings can also be modified remotely via the Modbus link.

Earth fault detection
Principle: the detector checks on the 3 phases the current variations (di/dt).
A time delay of 70 s is applied for fault confirmation by the upstream protective device.
■ Automatic mode for automatic, adjustment-free calibration of detection thresholds
■ Manual mode possible to perform special override settings:
□ Flair 21D: 6 detection thresholds from 40 to 160 A, selectable via microswitch
□ Flair 22D, Flair 23D and Flair 23DM (configurable via the front panel keypad):
  • Type A setup:
  from 20 to 200 A, in 10 A increments (in resistive neutral system), and
  from 5 to 30A in 5 A increments and from 30 to 200 A, in 10 A (in an isolated and compensated neutral earthing system)
  • Type B setup:
  from 5 to 30 A in 5 A increments, and
  from 30 to 200 A in 10 A increments
■ Inrush function: to prevent unwanted detection in the event of load switch-on. Incorporates a 3 s time delay for fault filtering at network power up.

Configurable at 70 s or disabled on Flair 22D, 23D and 23DM.

Fault indication
■ Signalling
As soon as a fault is confirmed, the indication device is activated.
□ Fault indication via a red LED on the front panel
□ Indication of the faulty phase (earth fault) on LCD display
□ Optional remoting of indication to external flashing lamp
□ Activation of a contact for retransmission to the SCADA system.

■ Indication reset
□ Automatic reset upon load current recovery (configurable time delay on Flair 22D)
□ Manual reset via front panel button
□ Reset via external Reset input
□ Reset by time delay: fixed (4 hr) for Flair 21D and adjustable using front panel keypad (2 hr to 16 hr) for Flair 22D.

■ Communication
□ F23DM provides Modbus communication whilst also acting as a Voltage Detector

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).

Low voltage equipment

PE58625

Relative pressure gauge

PE58626

Absolute pressure gauge

PE58627

DPX-1 autonomous protection relay

PE58628

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

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).

Protection relays

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

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.

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.

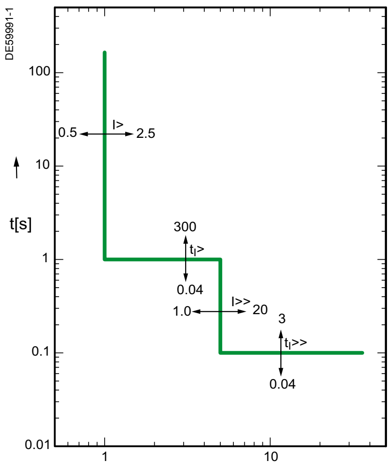
Standard current transformer

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

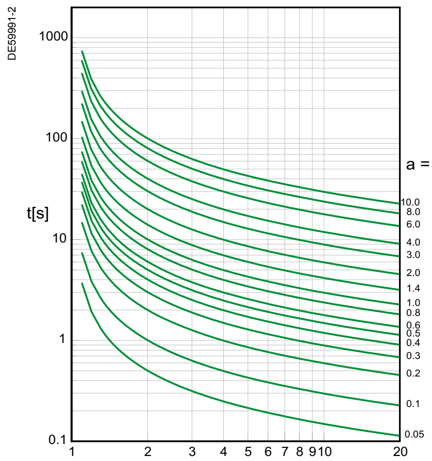
These standard current transformers are available in these versions.

DPX-1 characteristics curves

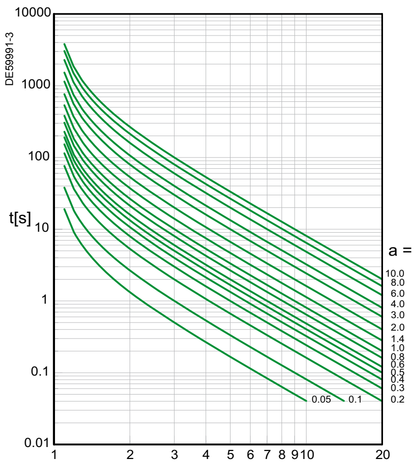
Pre-defined time



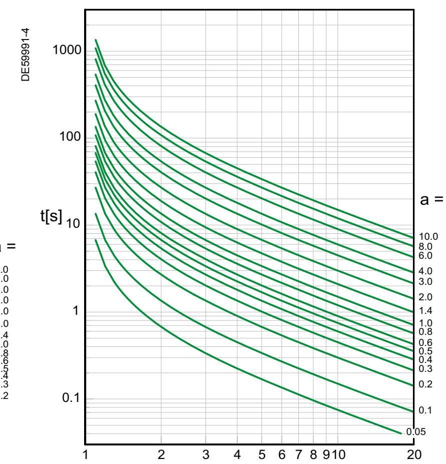
Normal inverse



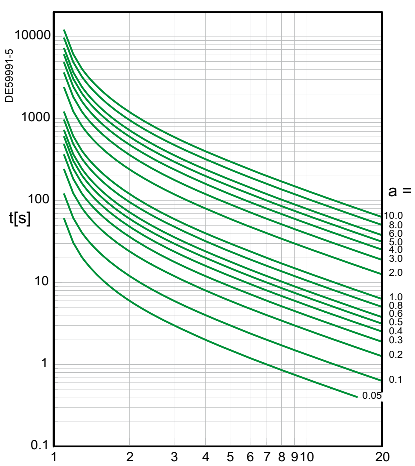
Extremely Inverse



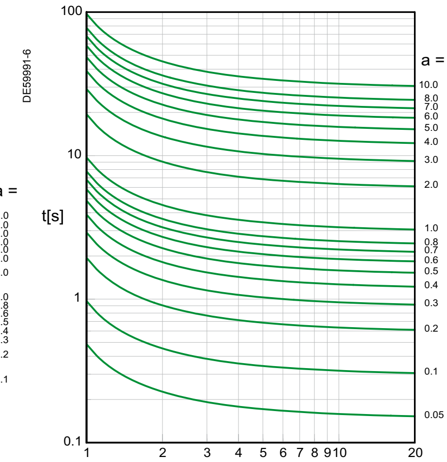
Very Inverse



Long Inverse



RI Inverse



Accessories

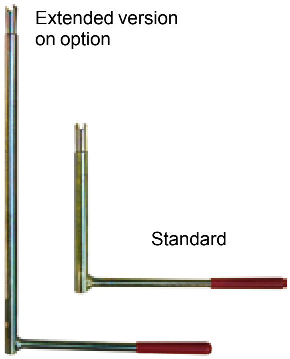
Accessories

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.

PE58629

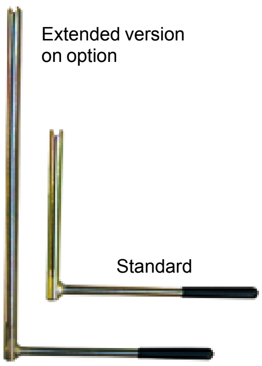


Operating lever for the earthing switch

PE58630

Operating lever for the CB and CBb circuit-breaker

PE58631



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

PE58632

Key with a double bit

PE58633

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

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.

Selection of cables

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

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

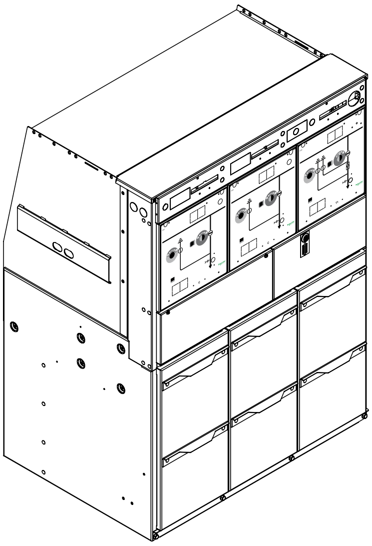
			12 kV		24 kV	
Type of cable	**Manufacturer**	**Rated current**	**Type of connector**	**For sections in mm²**	**Type of connector**	**For sections in mm²**
Complete insulation	nkt	630	CB 12/630 + CC 12/630	25 - 300	CB 24/630 + CC 24/630	25 - 300
	EUROMOLD	630	430 TB + 300 PB	35 - 300	430 TB + 300 PB	35 - 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 insulation – Double connection per phase for T2, CB functions

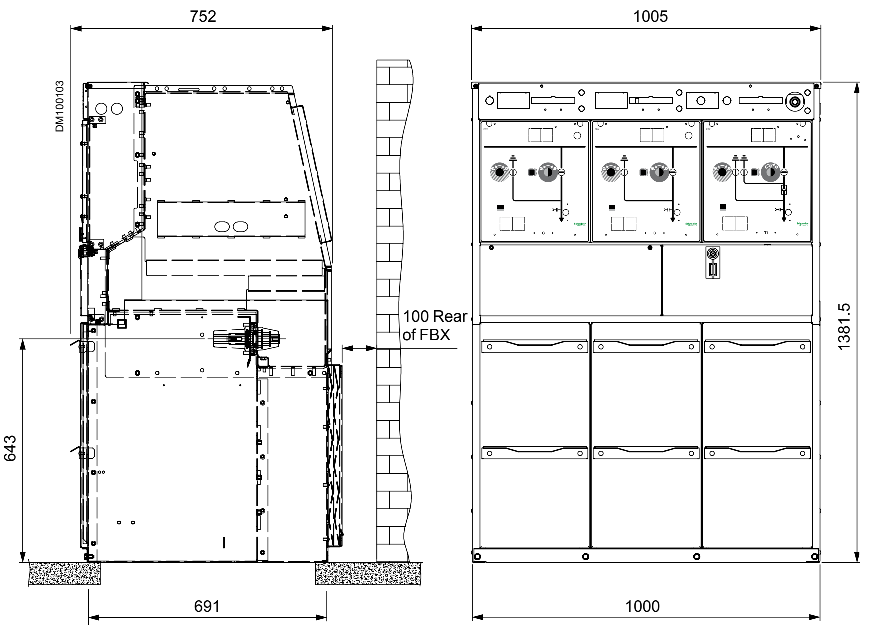
630 A connector, external cone as per EN 50181, C type connector, screw type contact with M16 x 2 internal threading

			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	–	–

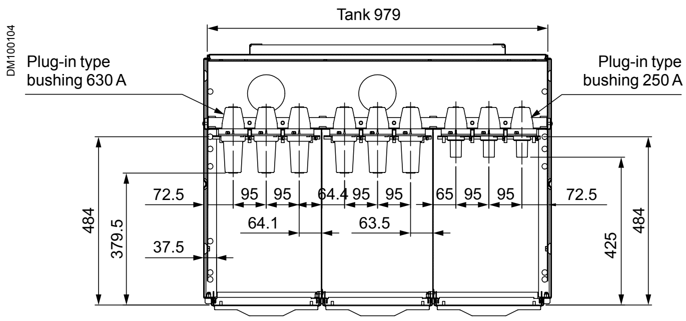
Overall dimension drawings



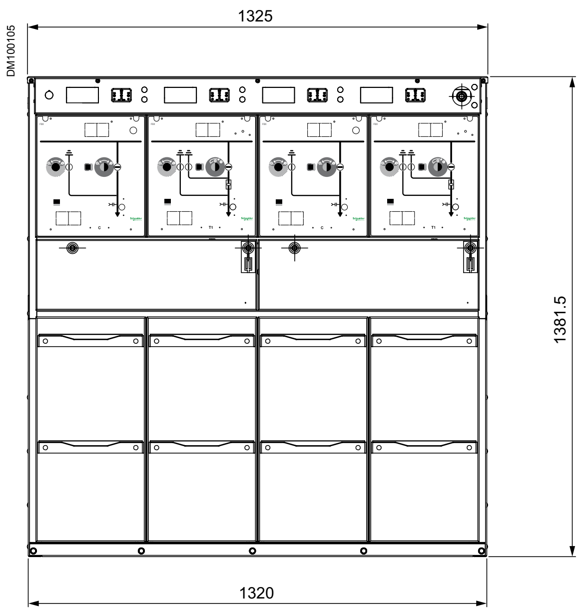
FBX-C, 3 functions switchboard C-C-T1 configuration



Cable compartment dimensions

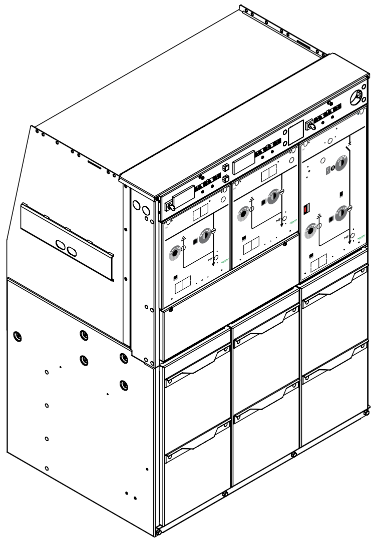


FBX-C, 4 functions switchboard C-T1-C-T1 configuration



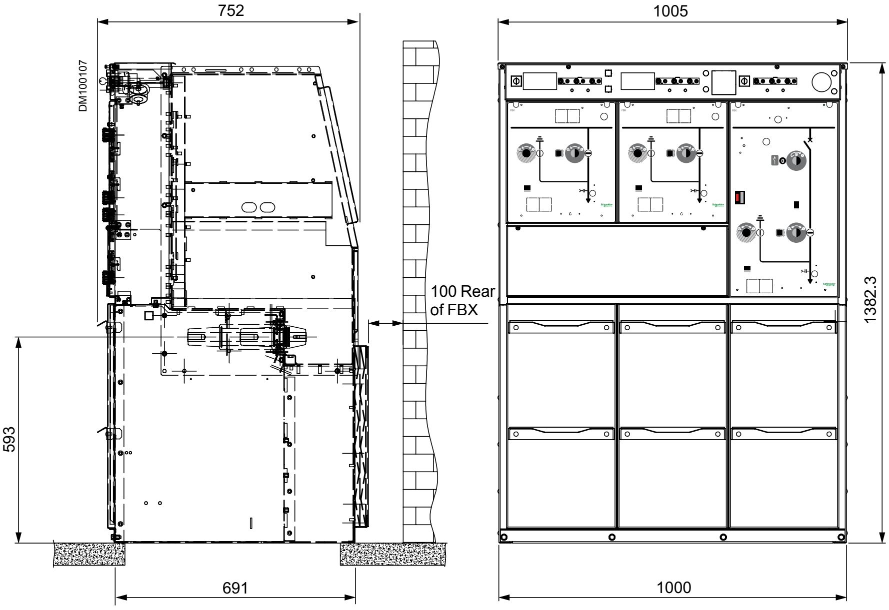
Overall dimension drawings

DM100106



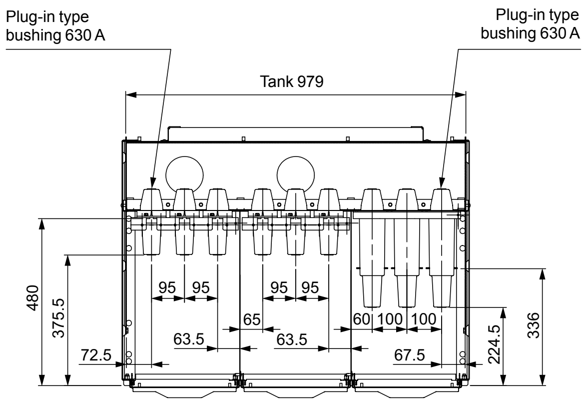
FBX-C, 3 functions switchboard C-C-T2 configuration

DM100107



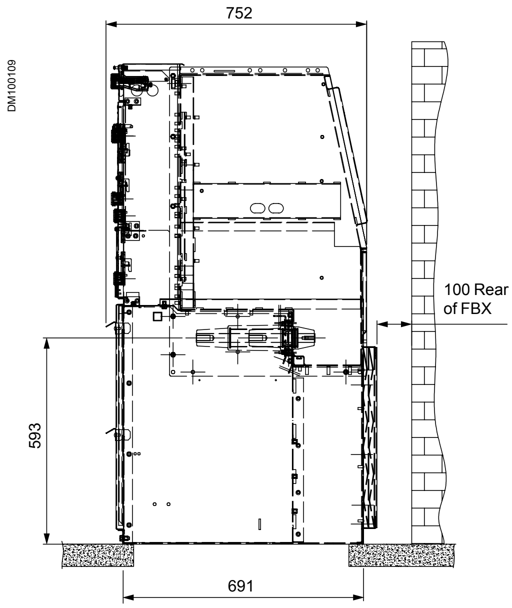
Cable compartment dimensions

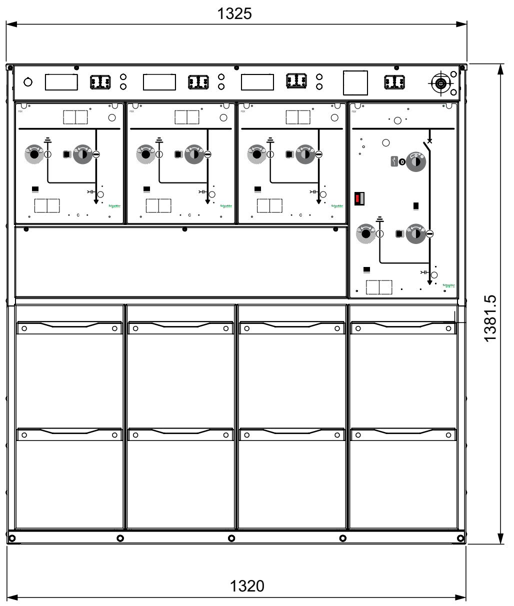
DM100108



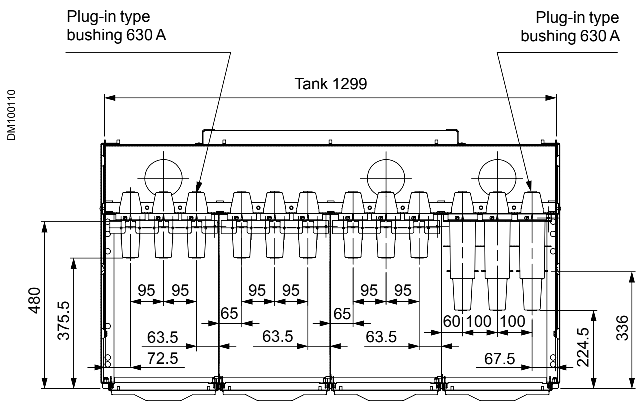
Overall dimension drawings

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



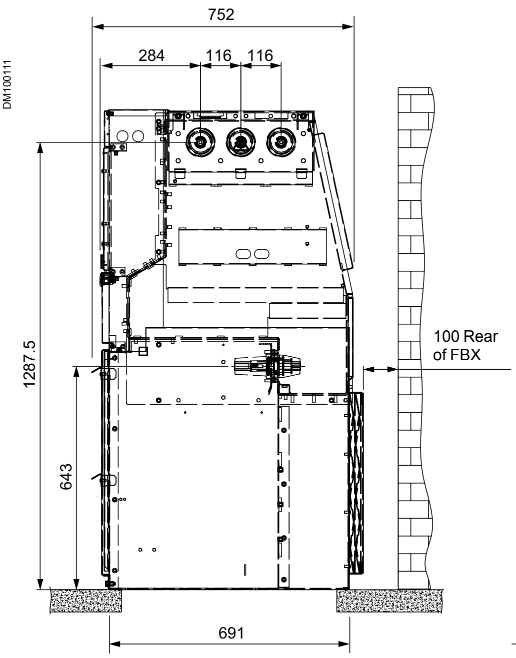


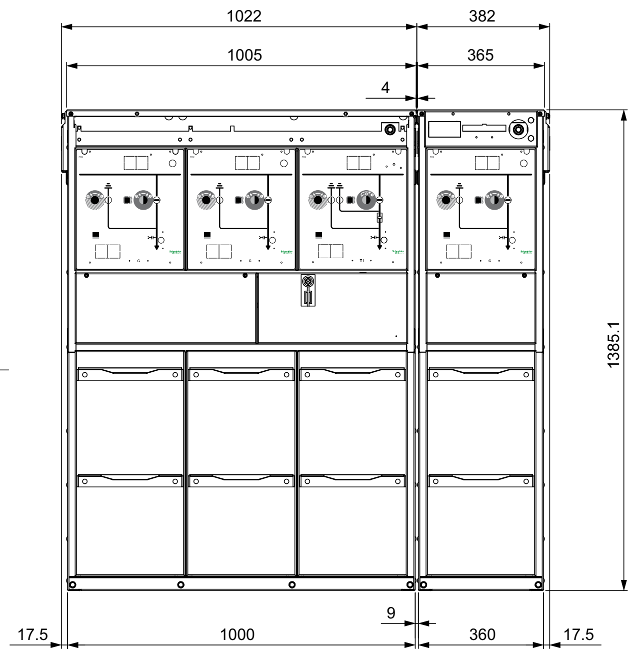
Cable compartment dimensions



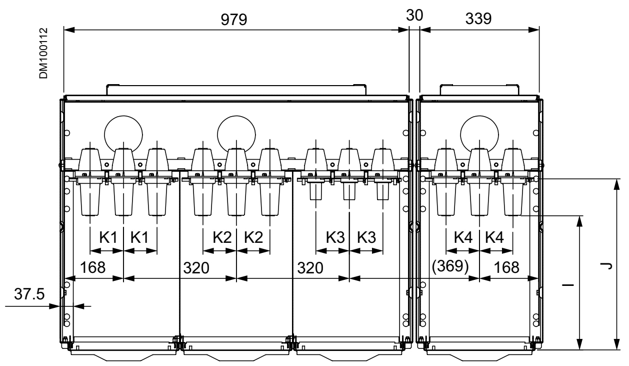
Overall dimension drawings

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





Cable compartment dimensions

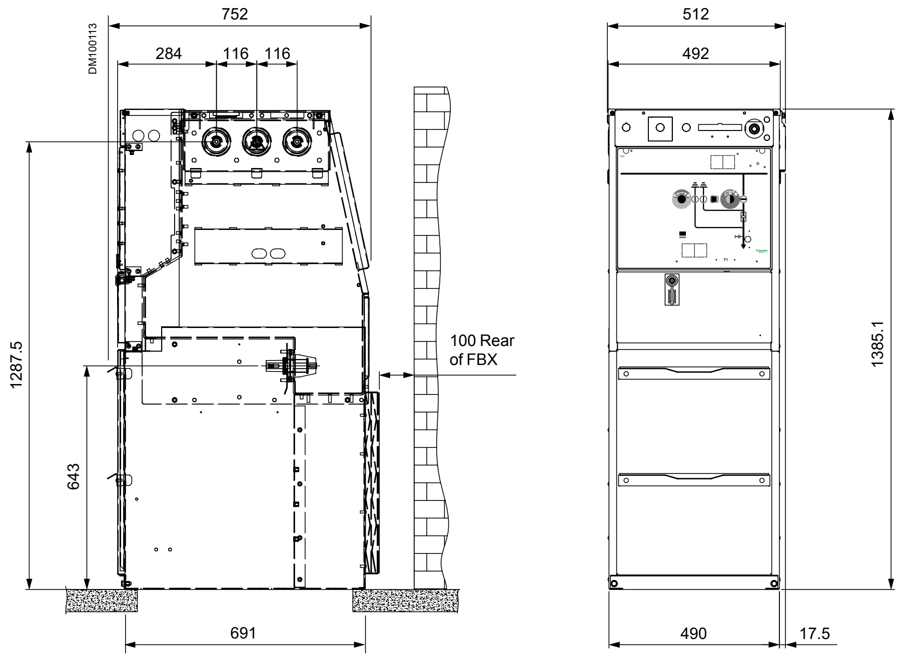


K = 95 mm
I = 381 mm (400 A)
379.5 mm (630 A)
J = 484 mm

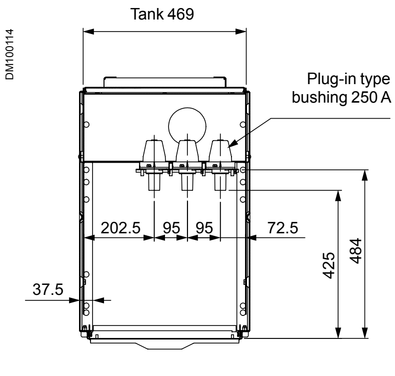
A minimum of 450 mm is required to install an extension unit to a FBX-E.

Overall dimension drawings

FBX-E, 1 function switchboard T1 configuration

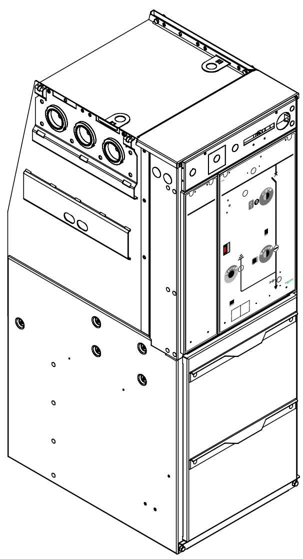


Cable compartment dimensions



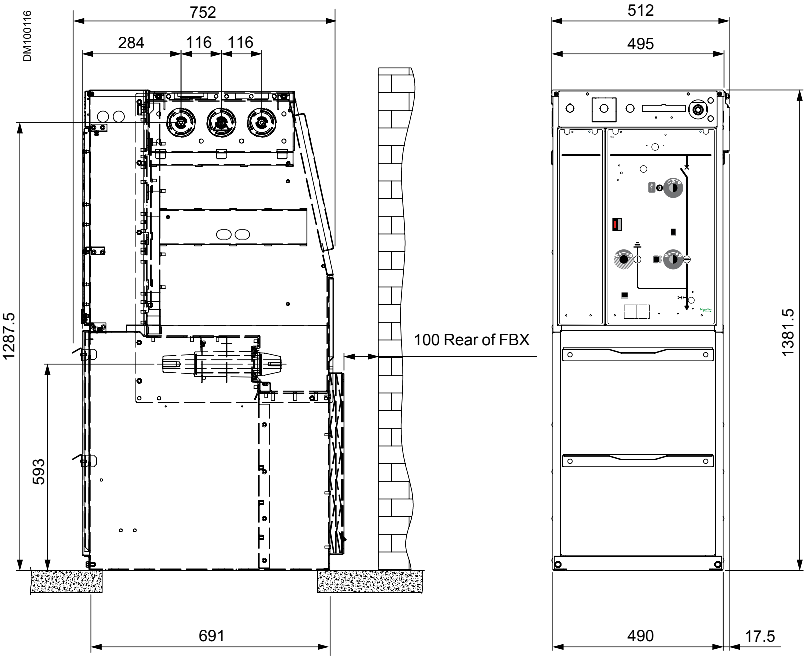
Overall dimension drawings

DM100115



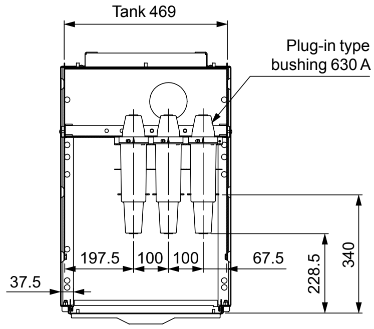
FBX-E, 1 function switchboard
T2 configuration

DM100116



Cable compartment dimensions

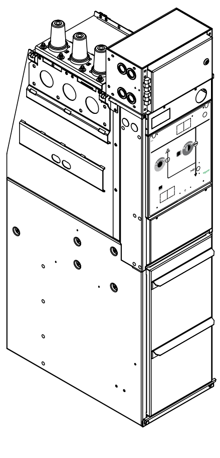
DM100117



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

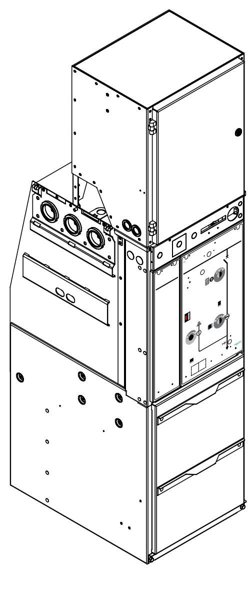
T2 with 200 mm LV cabinet

DM100118

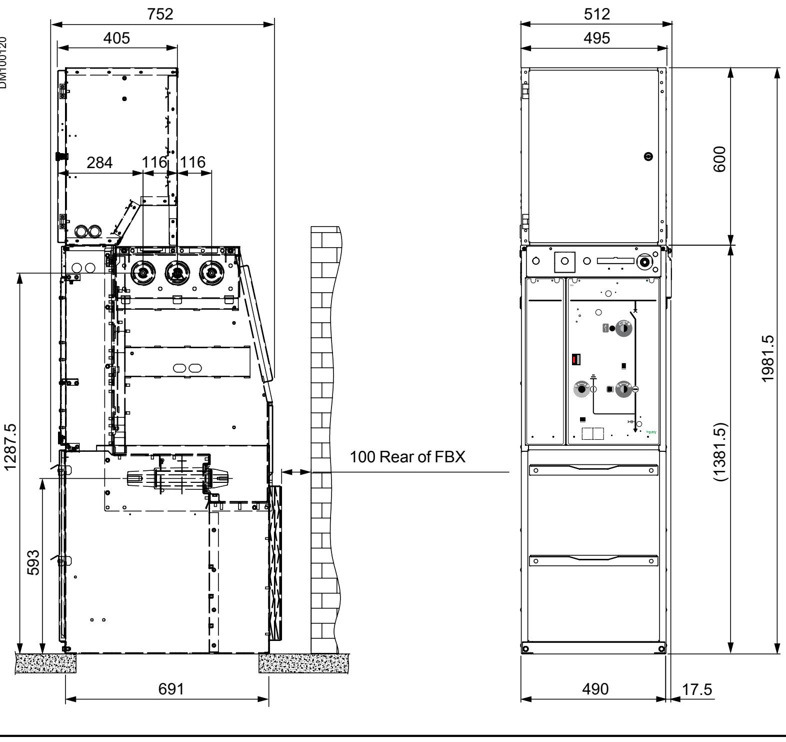


T2 with 600 mm LV cabinet

DM100119

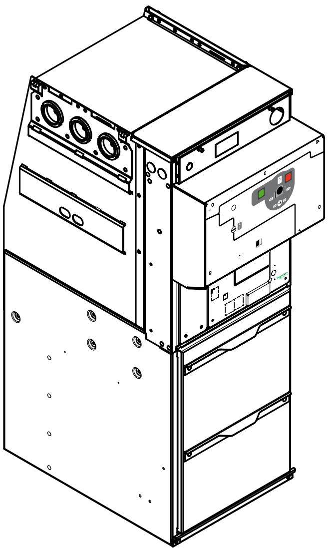


DM100120



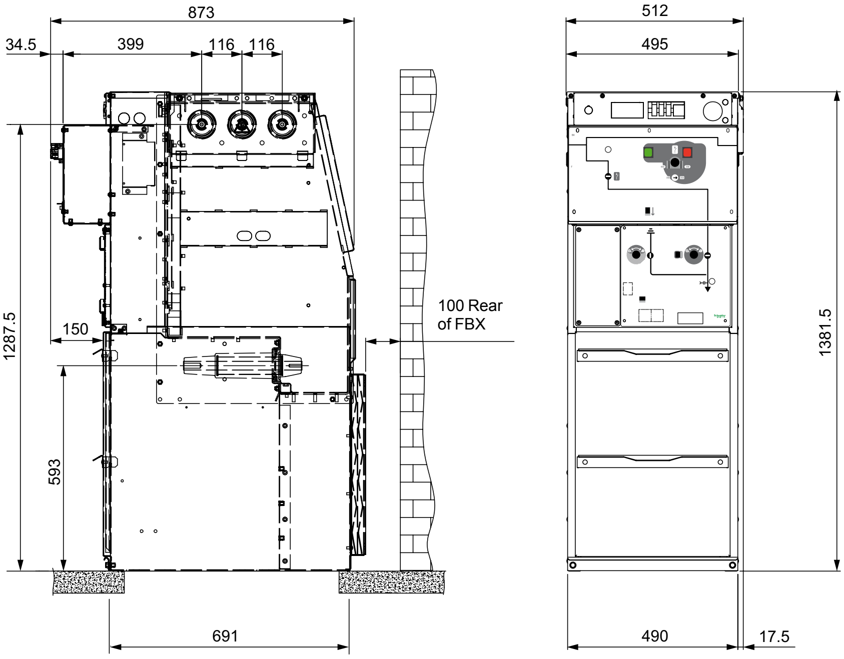
Overall dimension drawings

DM103199



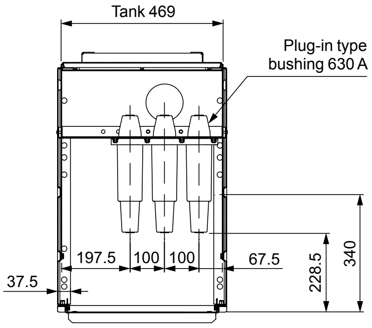
FBX-E, 1 function switchboard CB configuration

DM103198



Cable compartment dimensions

DM100123

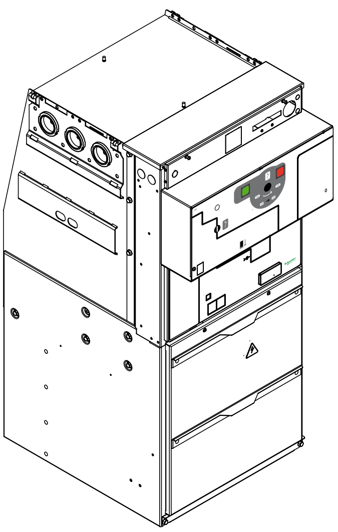


FBX-E, 1 function switchboard CBb configuration

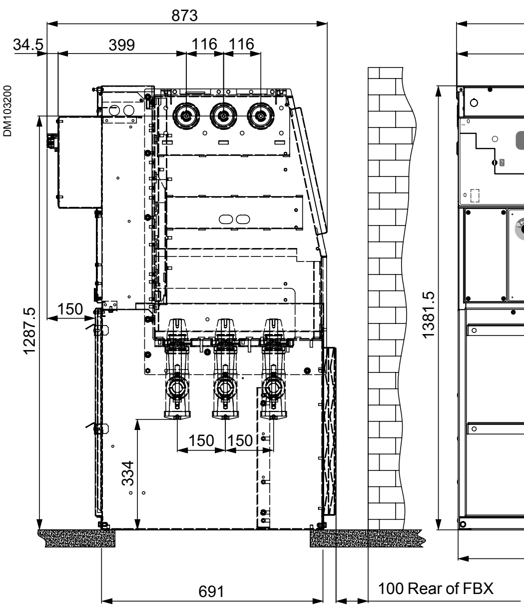
CBb - left busbar coupling

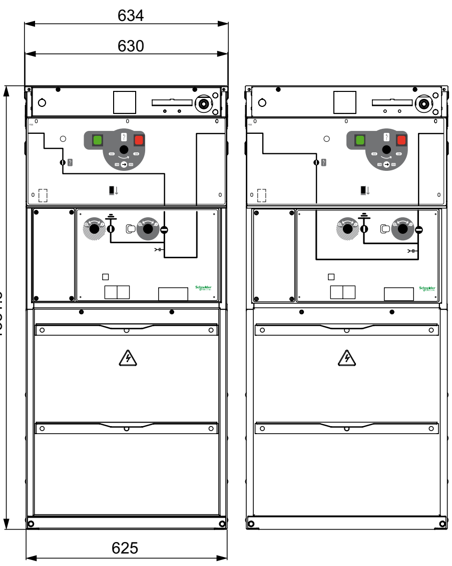
CBb - right busbar coupling

DM103201



DM103200

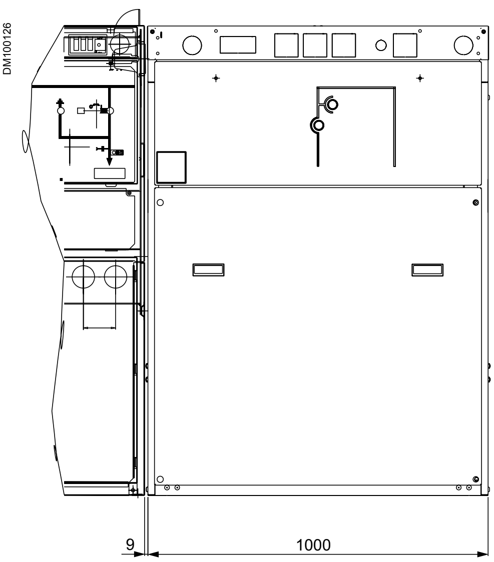




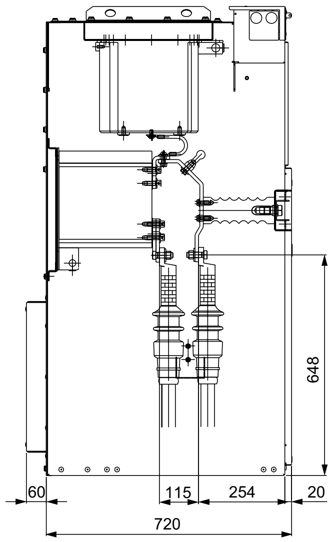
Overall dimension drawings

Metering cubicles

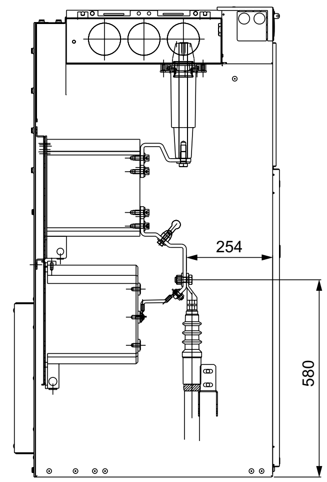
M1



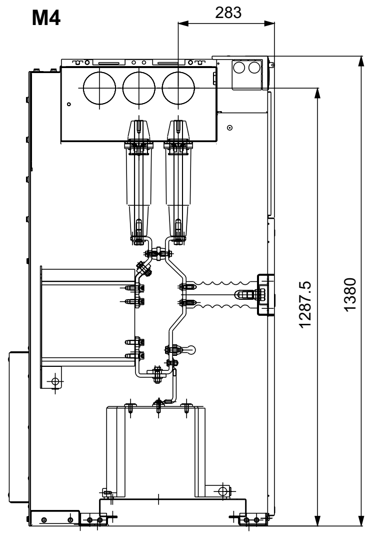
M1

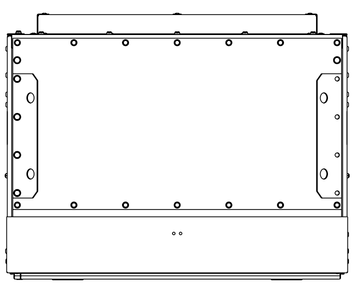


M2/M3

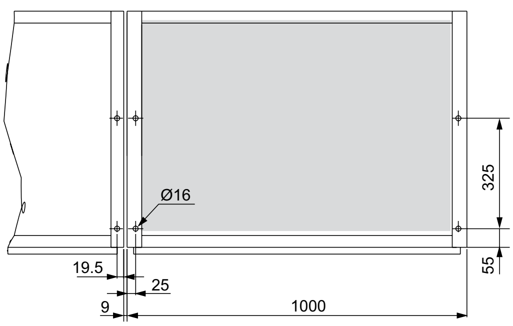


M4





Fixing points



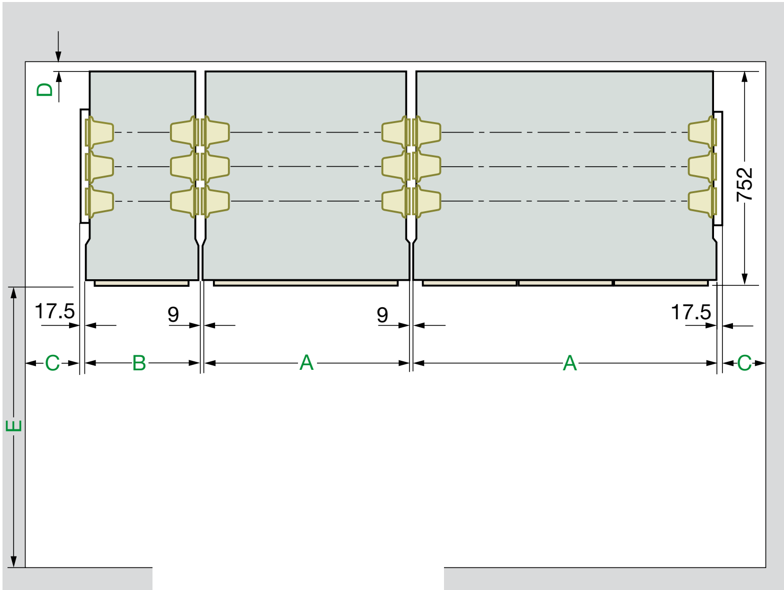
Indoor installation

	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	100
		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		

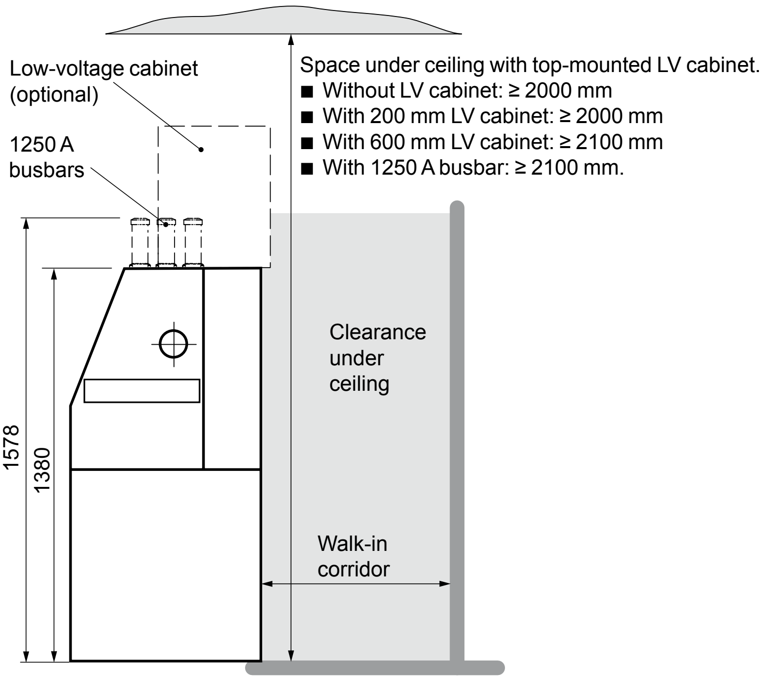
Minimum distances between the FBX-E and the building's walls

Top view

DE59993



DE59994



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.

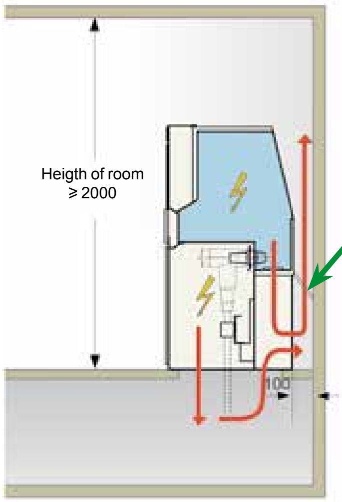
With rear deflector

PE58634

■ **IAC class AF 16/20 kA 1s**

With rear deflector

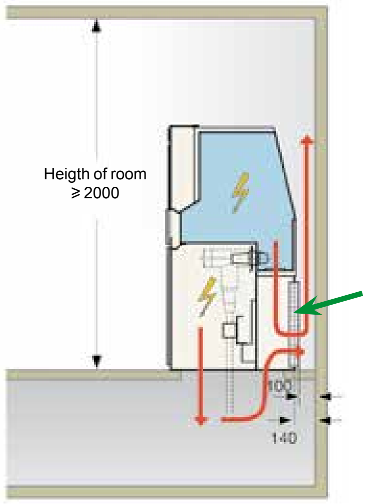
PE58637



: *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*

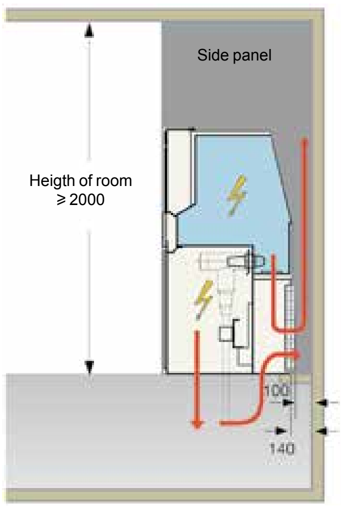
With double side panel

PE58635

■ **IAC class AFL 16/20 kA 1s**

With side panel

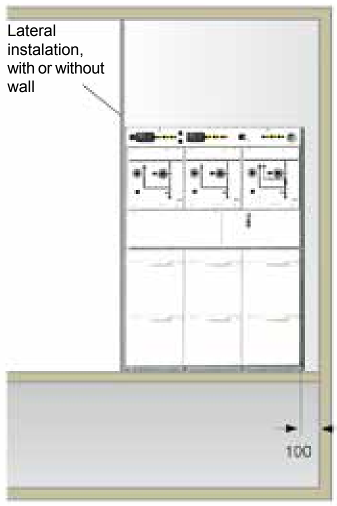
PE58638



: *Evacuation of gas in the event of overpressure*

■ **IAC class AFL 16/20 kA 1s**

With side panel



Indoor installation

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

Example of FBX installation where the exhaust of gas goes into cable duct and through a gas cooler made of 5 layers of metal.

■ **IAC class AFL 16/20 kA 1s**

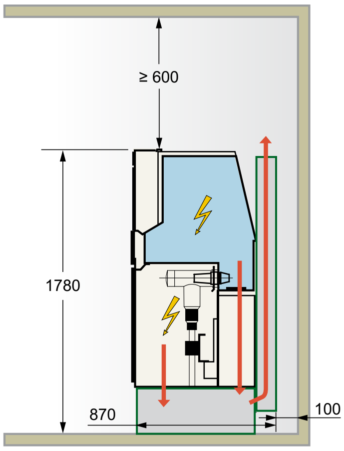
■ **IAC class AFL 16/20 kA 1 s**

With mounting base and gas exhaust duct

PE58636

With chimney and base

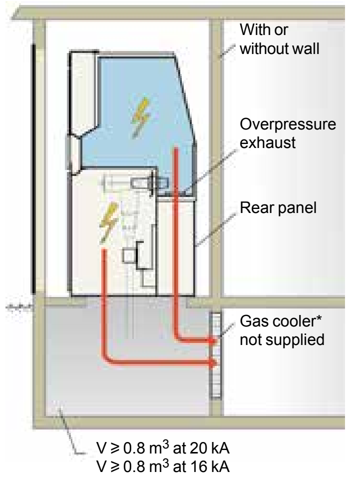
DE59995



: *Evacuation of gas in the event of overpressure*

Without side panel

PE58639



* Duct cross section > 0.3 m^3 at 16 and 20 kA

: *Evacuation of gas in the event of overpressure*

Packaging and transport

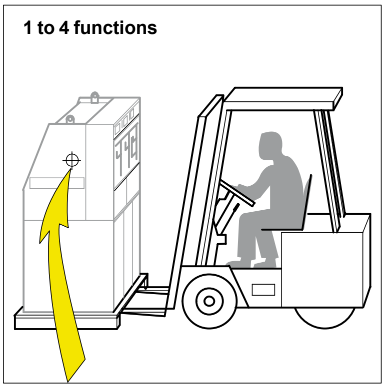
Packaging

■ 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).

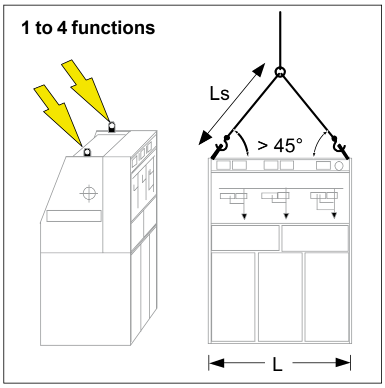
Handling

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.

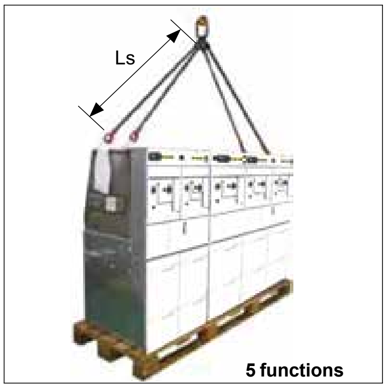
DE59996



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

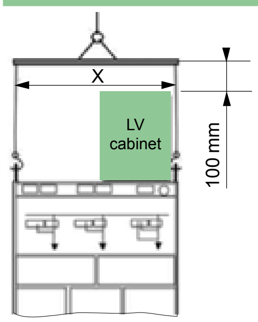


When transporting with slings, use the two lifting rings.



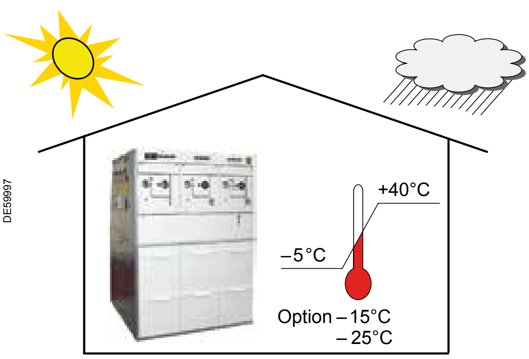
This switchboard can be transported:
■ either using slings, attached to the 4 lifting rings
■ or, by two hand trolleys, one at either end.

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

DE59997



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

PE58547

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.

PE58548

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
SF_6 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

Notes

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