

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:

- b Transformer protection by fuse (T1 function)
- b Transformer protection by vacuum circuit-breaker (T2 function)
- b 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:

- b Humidity
- b Dust
- b Pollution
- b Dirt
- b 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).

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.

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

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:

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

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:

- b Safety valves at the rear yield and thus avoid gas overpressure
- b 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
- b Front protection for the operator (lateral also as an option).

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

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:

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

A quality and safety approach

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

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

Tests on the devices

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

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



SF6 leak test

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
Disconnecter (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.

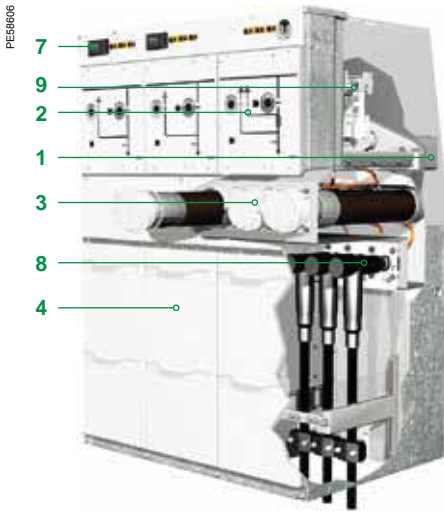


Illustration of an FBX-C
C-C-T1 function, protection by fuses

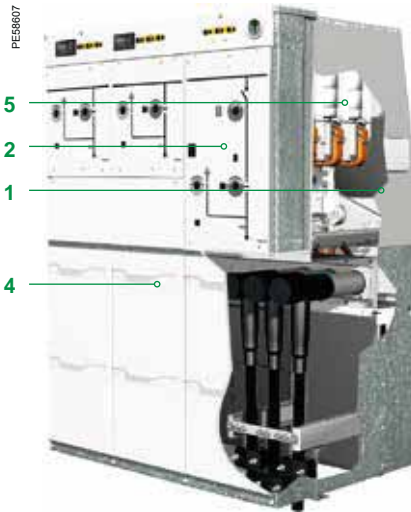


Illustration of an FBX-C
C-C-T2 function, protection by vacuum circuit-breaker

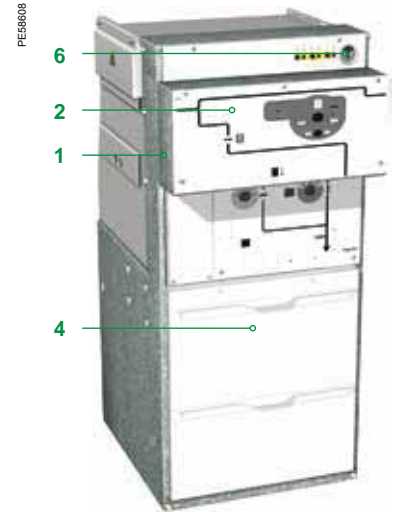
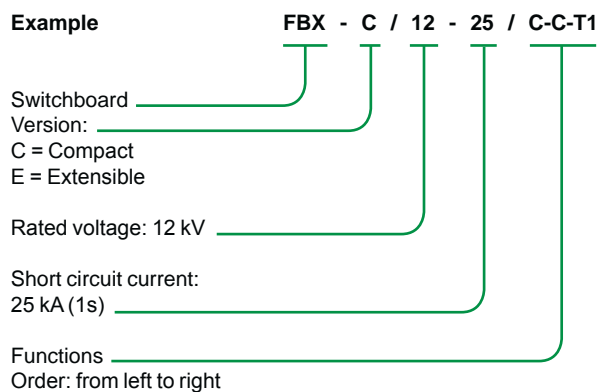


Illustration of an FBX-E
Vacuum circuit-breaker function

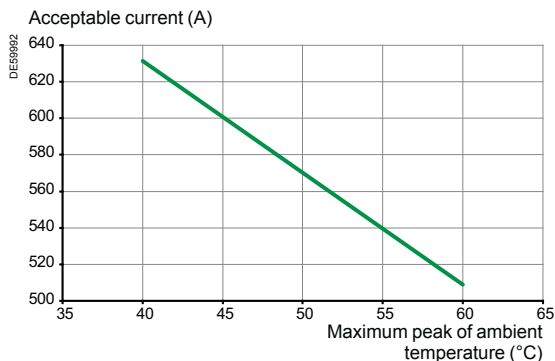
- 1 Hermetically-sealed stainless steel tank filled with gas to insulate the main circuit
- 2 Operating mechanism compartment and mimic diagram
- 3 Fuse compartment
- 4 Cables compartment door
- 5 Vacuum circuit-breaker
- 6 Tank pressure manometer
- 7 Voltage presence detection system and low voltage 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.



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



Operating conditions

- b Temperature classification: -5°C indoors (option: -25°C).
- b Ambient temperature: from -5°C to $+40^{\circ}\text{C}$ (option: -25°C) (option: up to $+55^{\circ}\text{C}$ for reduced service currents)
- b Average value over 24 hours (max.): $+35^{\circ}\text{C}$
- b 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.
- b Type of insulating gas: sulphur hexafluoride (SF6)
- b Rated pressure at $+20^{\circ}\text{C}$: 0.03 MPa
- b Flood proof (option): successfully tested under water for 24 hours at 24 kV 50 Hz.

Protection index (IP)

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

