



ORTHOFLUOR FPX

SF₆ circuit breaker
from 7,2 to 24 kV



Indoor applications

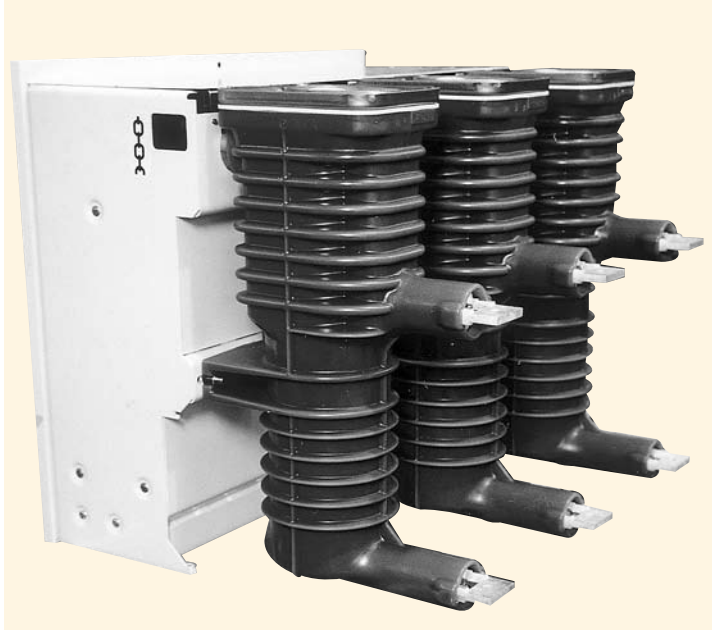
Modular design

IEC, VDE and BS standards

**Technical
Specifications**



ORTHOFLUOR FPX : innovation



Innovation

AREVA T&D is ready to innovate in all fields whenever it does any development work, in order to increase the reliability of its equipment.

A number of innovations have been made in the ORTHOFLUOR FPX circuit breaker, including:

- Lower operating forces and energies,
- Fewer parts used in breaking components,
- Standardization of components and subassemblies.

Summary

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ORTHOFLUOR FPX : simplicity of design

An answer to all your needs

The ORTHOFLUOR FPX circuit breaker is designed to satisfy a wide range of needs. Designed for indoor use, these circuit breakers are easily and inexpensively included in many installations such as open substations, compartmented or Metal-clad cubicles, or outdoor shelters.

Our research has been guided by two main principles:

- modular design,
- ease of installation.

Modular design

The ORTHOFLUOR FPX circuit breaker is of separate pole type. These poles are fixed to a rigid common frame that also supports the operating mechanism. This structure is used to make standard units with different phase spacings for the same rating, in order to better satisfy requirements.

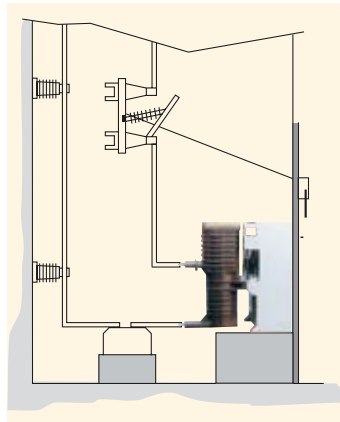
Ease of installation

The layout and configuration of HV connections has been specially designed to facilitate connection of the circuit breaker to your equipment primary circuit. HV cables, equipped with standard lugs, can be connected directly to the connections provided, without the addition of intermediate parts. Plug-in contacts can easily be fitted on these connections for installation in compartmented or Metal-clad cubicles. Special attention was also paid to making easy access to the terminal block for operating mechanism electric circuits.

ORTHOFLUOR FPX circuit breakers can also be supplied with a truck that inherently provides the necessary dielectric earthing distances.



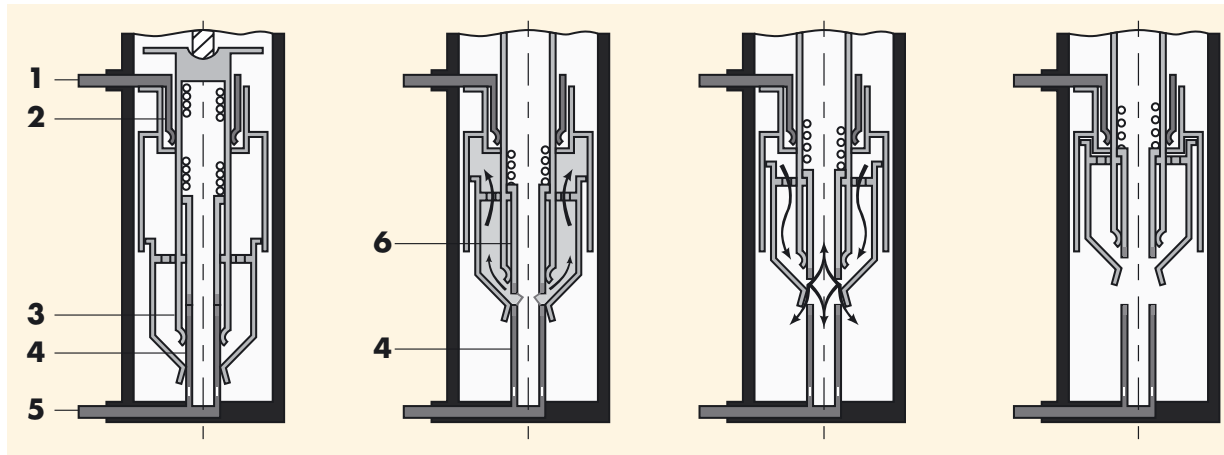
ORTHOFLUOR FPX circuit breaker in a compartmented cubicle.



ORTHOFLUOR FPX circuit breaker in an open substation.



Operating principle



“Closed” position

The current flows between terminals 1 and 5 of the equipment through fixed contacts 2 and 4, and mobile contact 3.

Start of opening

The arc is initiated between contacts 4 and 6. The energy dissipated by the arc increases the SF₆ pressure.

During opening

The SF₆ compressed in the breaking chamber blasts the arc in two opposite directions.

“Open” position

The breaking space is occupied by SF₆, ensuring high dielectric strength.

Efficient breaking: thermopuffing

The ORTHOFLUOR FPX circuit breaker combines two breaking techniques, thermal expansion and autopneumatic puffing, developed and used by AREVA T&D in its previous circuit breaker models.

This principle optimizes the reliability of switchgear by reducing the SF₆ filling pressure and reducing the operating energy necessary at the operating mechanism.

Operating safety

ORTHOFLUOR FPX circuit breakers operate at low pressure. The internal rise in pressure at the time of the break caused by compression and increased gas temperature, remains low. The break is clean as a result of the thermodynamic properties of SF₆ gas and the design of the puffing chamber.

High endurance

ORTHOFLUOR FPX circuit breakers have a very high endurance due to:

- The intrinsic qualities of the SF₆ gas that are maintained throughout the life of the unit.
- Breaking contacts that are not highly stressed by the low arc energy concerned due to:
 - the low arcing time
 - instability of the arc roots thanks to the use of hollow arcing contacts extinguishing the arc in different directions.
- Full separation of arcing contacts and current carrying contacts.

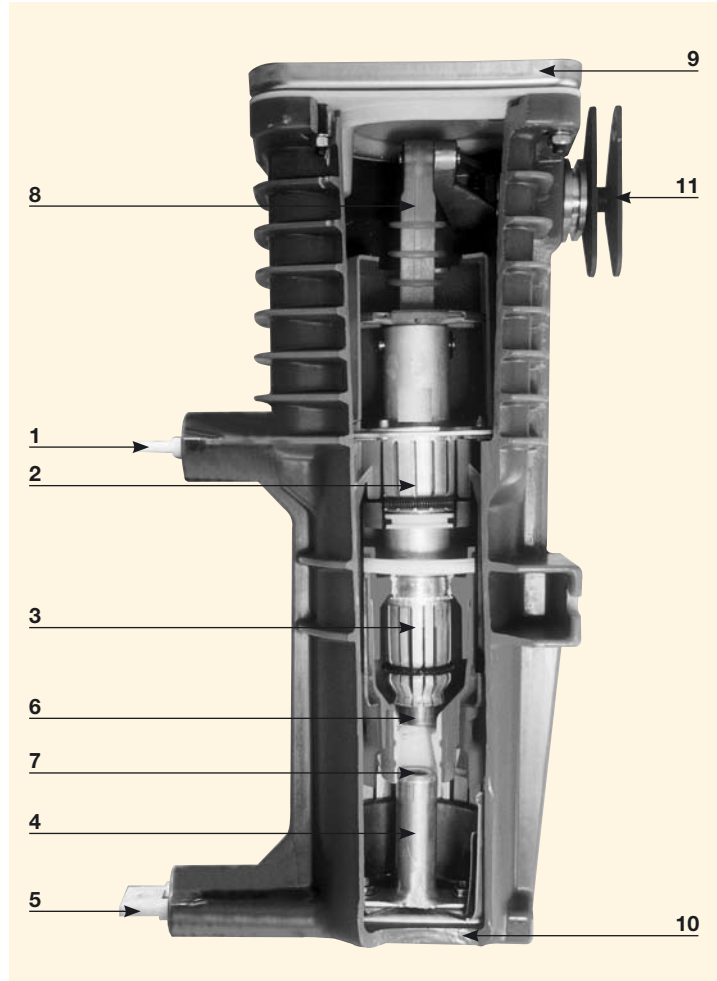
Furthermore, the displacement of mechanical parts is damped by a hydraulic absorber, such that the number of circuit breaker operations is much higher than that recommended by standards.



Description of a pole

Each pole is composed of:

- A main circuit that carries the permanent current. It includes fixed contacts (2) and (4) and mobile contact (3).
- A breaking circuit separate from the main circuit. This circuit includes a fixed arcing contact (7) and a mobile arcing contact (6). These two contacts are equipped with tungsten alloy end pieces for long life.
- An operating device transmits energy from the operating mechanism to the mobile contact. It contains shaft (11) that activates connecting rod (8). This rod with long creepage distance ensures that guaranteed circuit breaker insulation values are maintained throughout its life.
- An insulating envelope (10) encloses all active parts and is closed by cover (9). The fins form part of the enclosure and follow pole leakage lines, such that the dielectric strength of ORTHOFLUOR FPX circuit breakers is excellent even when used in a very polluted atmosphere.
- A pressure switch can also be installed for each pole as an option.



FPX 12 25 12 circuit breaker pole

Legend:

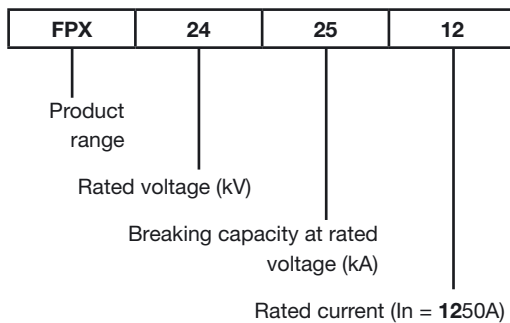
- 1 Upper connection
- 2 Upper fixed contact
- 3 Main mobile contact
- 4 Lower fixed contact
- 5 Lower connection
- 6 Mobile arcing contact
- 7 Fixed arcing contact
- 8 Insulating operating rod
- 9 Cover
- 10 Pole envelope
- 11 Operating shaft



Selection guide to IEC standard

Rated voltage	Withstand voltages		Breaking capacity	Rated normal current								
	Impulse	1 mn		400A	630A	800A	1250A	1600A	2000A	2500A	3150A	4000A
	kVp	kV rms.										
7.2	60	20	16	FPX071604	FPX071606	FPX071608	FPX071612	FPX071616	FPX071620	FPX071625	FPX071631	FPX071640
			20	FPX072004	FPX072006	FPX072008	FPX072012	FPX072016	FPX072020	FPX072025	FPX072031	FPX072040
			25	FPX072504	FPX072506	FPX072508	FPX072512	FPX072516	FPX072520	FPX072525	FPX072531	FPX072540
			31.5	FPX073104	FPX073106	FPX073108	FPX073112	FPX073116	FPX073120	FPX073125	FPX073131	FPX073140
			40	FPX074004	FPX074006	FPX074008	FPX074012	FPX074016	FPX074020	FPX074025	FPX074031	FPX074040
12	75	28	16	FPX121604	FPX121606	FPX121608	FPX121612	FPX121616	FPX121620	FPX121625	FPX121631	FPX121640
			20	FPX122004	FPX122006	FPX122008	FPX122012	FPX122016	FPX122020	FPX122025	FPX122031	FPX122040
			25	FPX122504	FPX122506	FPX122508	FPX122512	FPX122516	FPX122520	FPX122525	FPX122531	FPX122540
			31.5	FPX123104	FPX123106	FPX123108	FPX123112	FPX123116	FPX123120	FPX123125	FPX123131	FPX123140
			40	FPX124004	FPX124006	FPX124008	FPX124012	FPX124016	FPX124020	FPX124025	FPX124031	FPX124040
17.5	95	38	12.5	FPX171204	FPX171206	FPX171208	FPX171212	FPX171216	FPX171220	FPX171225	FPX171231	FPX171240
			16	FPX171604	FPX171606	FPX171608	FPX171612	FPX171616	FPX171620	FPX171625	FPX171631	FPX171640
			20	FPX172004	FPX172006	FPX172008	FPX172012	FPX172016	FPX172020	FPX172025	FPX172031	FPX172040
			25	FPX172504	FPX172506	FPX172508	FPX172512	FPX172516	FPX172520	FPX172525	FPX172531	FPX172540
			31.5	FPX173104	FPX173106	FPX173108	FPX173112	FPX173116	FPX173120	FPX173125	FPX173131	FPX173140
24	125	50	12.5	FPX241204	FPX241206	FPX241208	FPX241212	FPX241216	FPX241220	FPX241225	FPX241231	
			16	FPX241604	FPX241606	FPX241608	FPX241612	FPX241616	FPX241620	FPX241625	FPX241631	
			20	FPX242004	FPX242006	FPX242008	FPX242012	FPX242016	FPX242020	FPX242025	FPX242031	
			25	FPX242504	FPX242506	FPX242508	FPX242512	FPX242516	FPX242520	FPX242525	FPX242531	
			31.5	FPX243104	FPX243106	FPX243108	FPX243112	FPX243116	FPX243120	FPX243125	FPX243131	

Circuit breaker reference





Characteristics

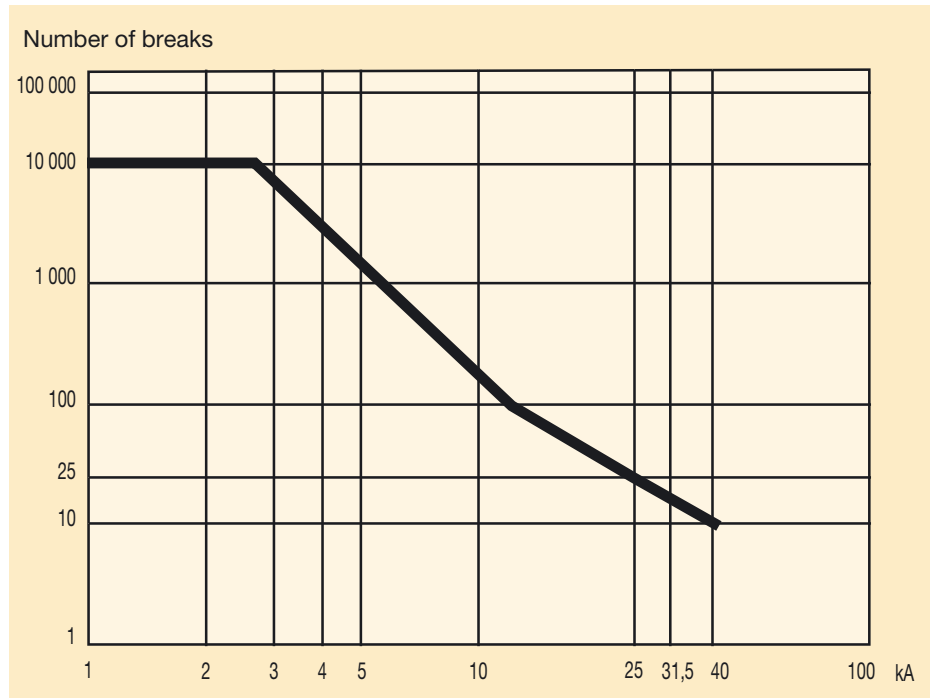
Rated voltage	7.2 kV and 12 kV		17.5 kV and 24 kV			
Breaking capacity	≤ 25 kA	> 25 kA	≤ 16 kA	> 16 kA	< 31.5 kA	≥ 31.5 kA
Rated SF ₆ pressure (bar relative at 20°C) ⁽¹⁾	1.2	2.7	1.2	2.7		3.5
Operating times						
- opening (ms)	50					
- arcing (ms)	70					
- closing (ms)	50					
Rated operating sequences						
	O - 3mn. - CO - 3mn. - CO					
	O - 0.3sec. - CO - 3mn. - CO					
	O - 0.3sec. - CO - 15sec. - CO					
Mechanical endurance	10 000 C/O					

(1) Circuit breaker without pressure switch.

Electrical endurance

The electrical endurance of ORTHOFLUOR FPX circuit breakers is inversely proportional to the square of the interrupted current.

The adjacent curve shows the electrical endurance of the ORTHOFLUOR FPX circuit breakers.





BRH: an efficient operating mechanism

ORTHOFLUOR FPX circuit breakers are equipped with a BRH type operating mechanism. This mechanism uses energy stored in springs. It may be delivered with a manual or electrical reset. This control mechanism is particularly suitable for circuit breakers intended to ensure a cycle of fast reclosing operation generally followed by a cycle of slow closing operation.

Simple and reliable operation

The closing spring is kept armed by a latch-in. Manual or electrical release of this latch-in causes:

- The closing spring to fully expand,
- the circuit breaker to close
- the tripping spring to be charged.

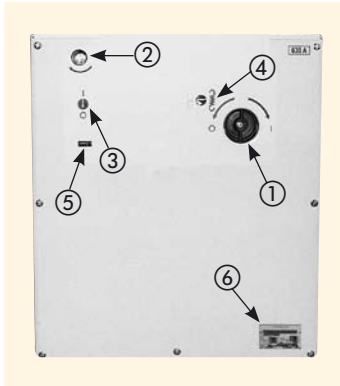
The closing spring can thus be charged again, with the circuit breaker closed, which authorizes a fast reclosing cycle (0 - 0.3 sec - CO -15 sec - CO).

BRH mechanism electrical equipment

Manual tripping and closing	●
Optical position indicator (circuit breaker and closing spring position)	●
Terminal block of LV auxiliaries	X0
Re-arming motor	②
Fuses for motor	①
Closing coil	④
Shunt trip coil	⑧
Second shunt trip coil	⑨
Undervoltage tripping coil	⑩
K1-3 stricker coil	⑪
Auxiliary contacts of spring position (1 NO/1 NC free)	③
16 auxiliary contacts (5NO/6NC free)	⑬
24 auxiliary contacts (9NO/10NC free)	⑭
Anti-pumping relay	⑤
Operating counter	●
Heating resistor	⑦
Interlock of the closing by lock	○

● Standard / ○ Option

Table refers to wiring diagram pages 10 and 11.



Easy operation

Closing and opening operations take place:

- manually, using a mechanically operating button located on the front of the mechanism (1);
- electrically, by closing and tripping coils;

A operating mechanism with an electrical reset can be reset manually (2). An indicator on the

front of the operating mechanism shows:

- the position of the circuit breaker “open” or “closed” (3);
- the state of the closing spring (4) armed or not.

An operation counter (5) and the circuit breaker name plate (6) are also located on the front of the operating mechanism.

Operating mechanism electrical specifications

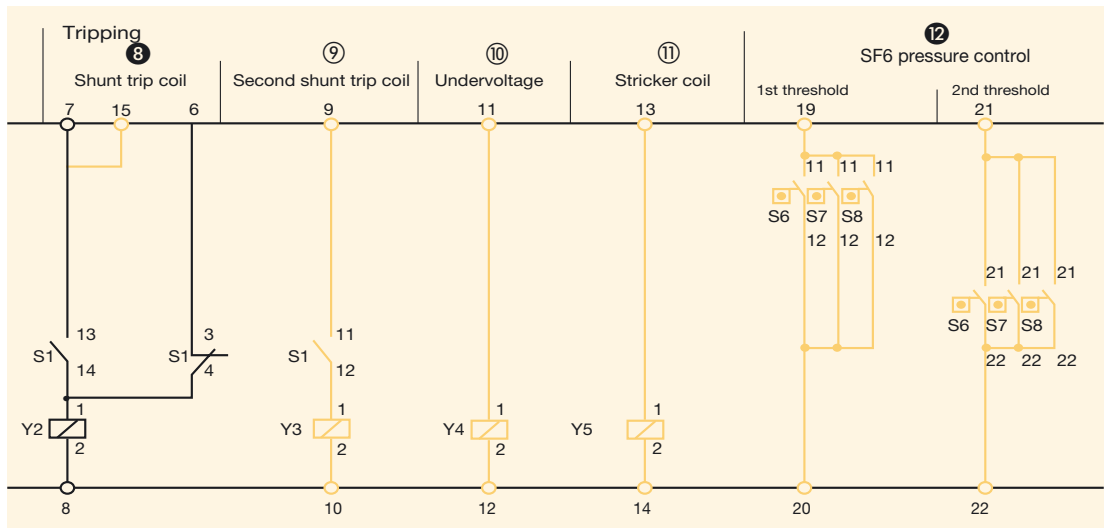
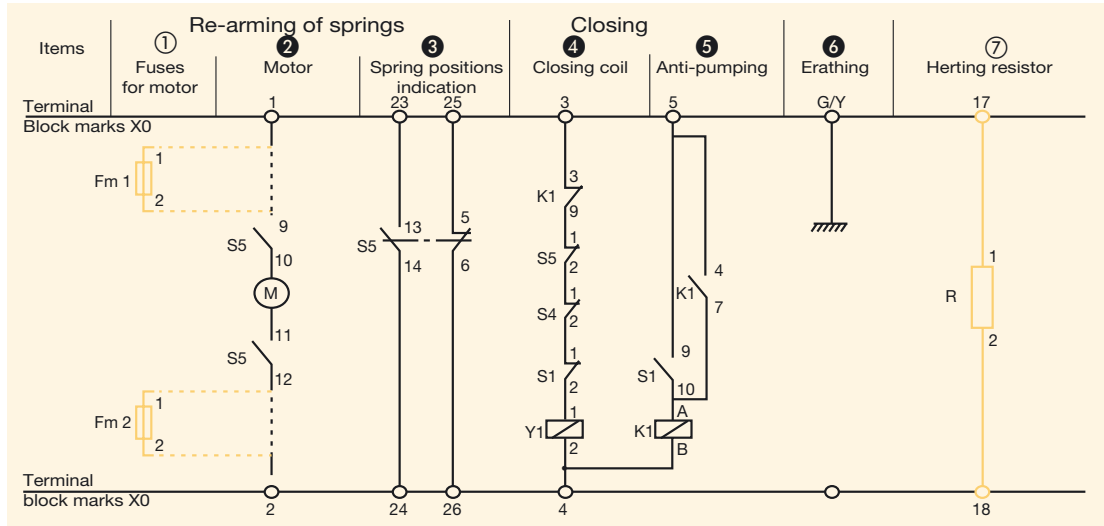
	Vdc	Vac
Rated power supply voltages (V)	48 - 60 110 - 125 - 220	120 - 230
Re-arming motor		
Voltage variation range	85 to 110%	85 to 110%
Input power	300 W	300 VA
Start up peak (A)	4 x In	4 x In
Reset time	< 10 s	< 10 s
Closing coil		
Voltage variation range	85 to 110%	85 to 110%
Input power	300 W	300 VA
Durée minimale d'impulsion	100 ms	100 ms
Tripping coil		
Shunt trip		
Voltage variation range	70 to 110%	85 to 110 %
Input power	80 W	80 VA
Minimum impulse duration	100 ms	100 ms
Undervoltage		
Voltage range for closing	35 to 85 %	35 to 85 %
Voltage range for tripping	70 to 35 %	70 to 35 %
Input power	24 W	24 VA
Auxiliary contacts		
Rated current (A)	10	10
Breaking capacity (A)	220V : 2A (L/R 20 ms)	10
	48V : 10A (L/R 10 ms)	
Heating resistor		
Rated voltage	-	220 Vac
Input power	-	30 VA

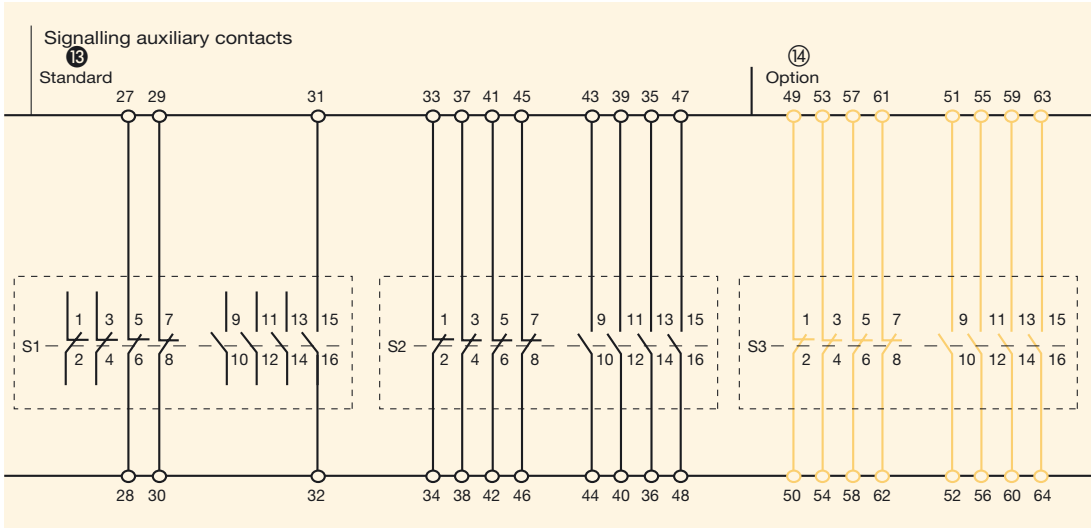


BRH mechanism schematic diagram

The schematic diagram shows the circuit breaker in the open position, with closing spring armed.

● Standard / ○ Option





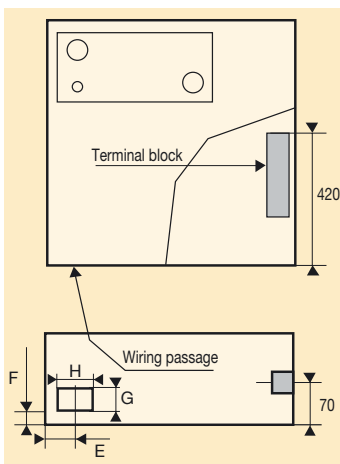
Fm : Fuses for motor
K1 : Anti-pumping relay
M1 : Re-arming motor
R : Heating resistor
S1 - S2 - S3 : Auxiliary contacts
S4 : Closing interlock contact
S5 : Spring position contact

S6 - S7 - S8 : SF6 pressure contact
X0 : Terminal block
Y1 : Closing coil
Y2 : Tripping coil
Y3 : Second tripping coil
Y4 : Undervoltage tripping coil
Y5 : K 1-3 stricker coil

Nota : The optional equipments are represented in orange. The items ⑩ and ⑪ can not be chosen simultaneously.

Connection to the terminal

The terminal block is made of screw-on connection terminals. The terminals can accept a wire with a section of maximum 4 mm².



Connection to the terminal

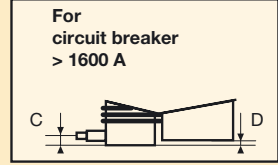
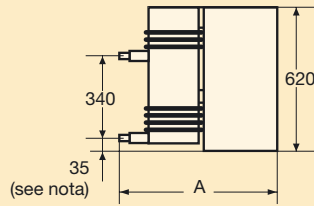
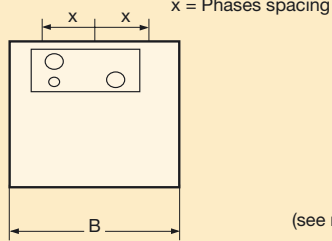
Phases spacing X (mm)	E	F	G	H
180	120	51.5	35	70
210	135	51.5	35	70
250	135	51.5	35	70
254	204	64.5	35	170
300	135	51.5	35	70
350	135	51.5	35	70



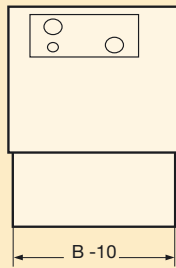
Size, connection, lay-out and accessories

Size

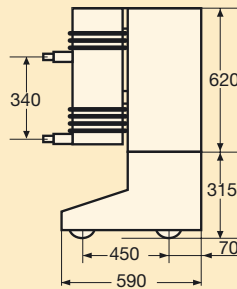
Circuit breaker frame



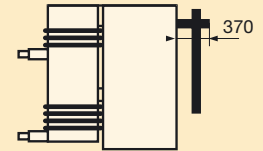
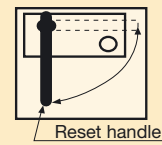
Circuit breaker on truck



Dimensions in mm



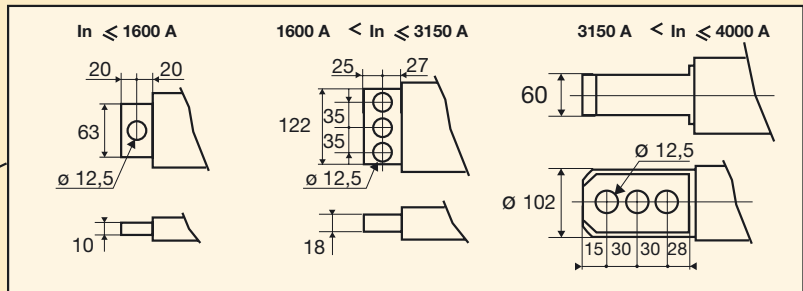
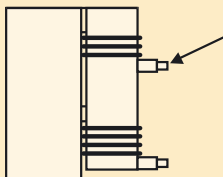
Size of the reset handle



HV connection

Dimensions in mm

Connections
 $\leq 1600 \text{ A}$: Silver-plated copper
 $> 1600 \text{ A}$: Silver-plated aluminium
 $= 4000 \text{ A}$: Silver-plated copper

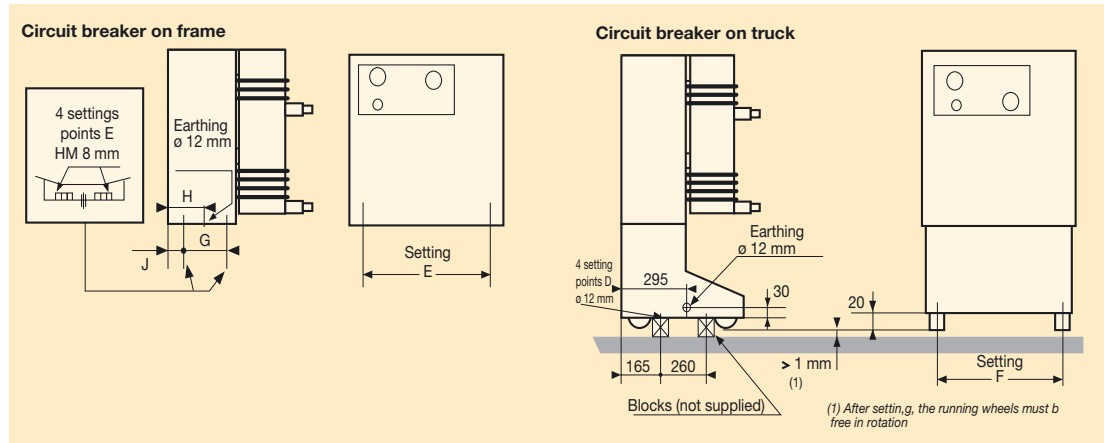


Possible phase spacings X

Rated voltage kV	In A	Phase spacings X					
		180 mm	210 mm	250 mm	254 mm	300 mm	350 mm
7,2	≤ 1600	●	●	●		●	●
	1600 < In ≤ 3150		●	●		●	●
	3150 < In ≤ 4000				●		
12	≤ 1600	●	●	●		●	●
	1600 < In ≤ 3150		●	●		●	●
	3150 < In ≤ 4000				●		
17,5	≤ 1600		●	●		●	●
	1600 < In ≤ 3150			●		●	●
	3150 < In ≤ 4000				●		
24	≤ 1600			●		●	●
	1600 < In ≤ 3150					●	●

Phases spacings X (mm)	In (A)		In > 1600			
	A	B	A	B	C	D
180	644	540	-	-	-	-
210	644	630	665	630	38	3
250	644	710	665	710	38	3
254	-	-	720	756	77	42
300	644	810	667	810	38	3
350	644	910	667	910	38	3

Lay-out



Dimensions in mm

Space phasings X (mm)	In (A)	≤ 1600					In > 1600				
		E	F	G	H	J	E	F	G	H	J
180		500	478	170	136.5	51.5	500	478	170	136.5	51.5
210		590	568	170	136.5	51.5	590	568	170	136.5	51.5
250		670	648	170	136.5	51.5	670	648	170	136.5	51.5
254		-	-	-	-	-	716	694	150	103.5	71.5
300		770	748	170	136.5	51.5	770	748	170	136.5	51.5
350		870	848	170	136.5	51.5	870	848	170	136.5	51.5

Force on floor

< 750 daN on each setting point

Approximate weights (kg)

	≤ 1600	1600 < In ≤ 3150	3150 < In ≤ 4000
Frame	150	210	330
Truck	170	230	350

Accessories



Reset handle

This handle is used to manually reset the operating mechanism.



SF₆ filling kit

In some cases in which ORTHOFLUOR FPX circuit breakers are delivered by air, the nominal pressure in poles must be reduced to below 0.5 bars. This kit is used to adjust the circuit breaker pole pressure.



Technical specification for FPX operating

Offer N° :		Customer :		Good's quantity :	
GENERAL CHARACTERISTICS OF THE BREAKER					
Temperature	Sservice voltage	Fréquency	Breaking capacity	Rated current	Phase spacing
-5°C à +40°C <input type="checkbox"/>	<input type="text"/>	<input type="text"/>	12.5 kA <input type="checkbox"/>	400 A <input type="checkbox"/>	180 mm <input type="checkbox"/>
Other <input type="text"/>	Niveau d'isolation		16 kA <input type="checkbox"/>	630 A <input type="checkbox"/>	210 mm <input type="checkbox"/>
Altitude	7.2 kV - 60 kVp - 20 kV 1 mn <input type="checkbox"/>	25 kA <input type="checkbox"/>	800 A <input type="checkbox"/>	250 mm <input type="checkbox"/>	
if higher than 1000	12 kV - 75 kVp - 28 Kv 1 mn <input type="checkbox"/>	31.5 kA <input type="checkbox"/>	1250 A <input type="checkbox"/>	254 mm <input type="checkbox"/>	
<input type="text"/>	17.5 kV - 95 kVp - 38 kV 1 mn <input type="checkbox"/>	40 kA <input type="checkbox"/>	1600 A <input type="checkbox"/>	300 mm <input type="checkbox"/>	
Standard	24 kV - 125 kVp - 50 kV 1 mn <input type="checkbox"/>	Autre <input type="text"/>	2000 A <input type="checkbox"/>	350 mm <input type="checkbox"/>	
IEC <input type="checkbox"/>			Short circuit duration	2500 A <input type="checkbox"/>	Reclosing cycle
VDE 0670 <input type="checkbox"/>	Autre <input type="text"/> kV - <input type="text"/> kVp - <input type="text"/> kV 1 mn		1 s <input type="checkbox"/> 3 s <input type="checkbox"/>	3150 A <input type="checkbox"/>	O-3 mn-CO-3mn-CO <input type="checkbox"/>
Other <input type="text"/>			Other <input type="text"/>	4000 A <input type="checkbox"/>	O-0.3s-CO-3 mn-CO <input type="checkbox"/>
Paint				Other <input type="text"/>	O-0.3s-CO-15s-CO <input type="checkbox"/>
RAL 9001 <input type="checkbox"/>				Other <input type="checkbox"/>	
CO-15s-CO <input type="checkbox"/>					
OPTIONS GUIDE (diagram n° 314 029/000)					
Circuit breaker on		Pressure switch		Resetting lever	
Truck <input type="checkbox"/>	Frame <input type="checkbox"/>	1 Step <input type="checkbox"/>	2 Steps <input type="checkbox"/>	Quantity <input type="checkbox"/>	
Resetting function (motor voltage) without fuse <input type="checkbox"/> or with fuse <input type="checkbox"/>					
48 Vdc <input type="checkbox"/>	60 Vdc <input type="checkbox"/>	110 Vdc <input type="checkbox"/>	125 Vdc <input type="checkbox"/>	220 Vdc <input type="checkbox"/>	Other <input type="checkbox"/>
110 Vac <input type="checkbox"/>	230 Vac <input type="checkbox"/>	Other <input type="checkbox"/>			
Closing function (coil voltage)					
24 Vdc <input type="checkbox"/>	48 Vdc <input type="checkbox"/>	60 Vdc <input type="checkbox"/>	110 Vdc <input type="checkbox"/>	125 Vdc <input type="checkbox"/>	220 Vdc <input type="checkbox"/>
110 Vac <input type="checkbox"/>	230 Vac <input type="checkbox"/>	Other <input type="checkbox"/>			
Tripping function (coil voltage)					
24 Vdc <input type="checkbox"/>	48 Vdc <input type="checkbox"/>	60 Vdc <input type="checkbox"/>	110 Vdc <input type="checkbox"/>	125 Vdc <input type="checkbox"/>	220 Vdc <input type="checkbox"/>
110 Vac <input type="checkbox"/>	230 Vac <input type="checkbox"/>	Other <input type="checkbox"/>			
Additional tripping function (coil voltage)					
24 Vdc <input type="checkbox"/>	48 Vdc <input type="checkbox"/>	60 Vdc <input type="checkbox"/>	110 Vdc <input type="checkbox"/>	125 Vdc <input type="checkbox"/>	220 Vdc <input type="checkbox"/>
110 Vac <input type="checkbox"/>	230 Vac <input type="checkbox"/>	Other <input type="checkbox"/>			
Under voltage tripping function (MIA coil voltage) except if K1-3					
24 Vdc <input type="checkbox"/>	48 Vdc <input type="checkbox"/>	60 Vdc <input type="checkbox"/>	110 Vdc <input type="checkbox"/>	125 Vdc <input type="checkbox"/>	220 Vdc <input type="checkbox"/>
110 Vac <input type="checkbox"/>	230 Vac <input type="checkbox"/>	Other <input type="checkbox"/>			
Striker pin K1-3 (except if MIA) <input type="checkbox"/>			Heating resistance <input type="checkbox"/>		
Padlock interlocking at closing <input type="checkbox"/>			Mechanical condemnation at closing <input type="checkbox"/>		
Auxiliary contacts block		5 NO + 6 NC <input type="checkbox"/> (free contacts basic)		Additional contacts 4 NO + 4 NC <input type="checkbox"/>	
Shipment		Air <input type="checkbox"/>		Sea <input type="checkbox"/>	
				Truck <input type="checkbox"/>	
Comments :				Date :	
				Visa	

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