

MV distribution

# LF circuit breakers up to 17.5 kV



Catalogue

# 2007

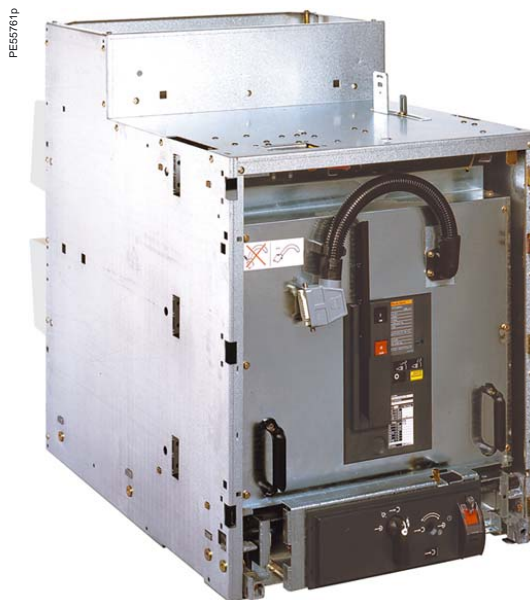
# LF circuit breakers

*One range of comprehensive and proven three-pole circuit breaker units for indoor installation using SF6 technology. Both compact and dependable, it is ideally suited to the most demanding applications and integrate perfectly in the Merlin Gerin Guiding System. This circuit breaker range meets IEC standard 62271-100.*

**LF circuit breakers fixed version from 7.2 kV to 17.5 kV**



**LF circuit breakers withdrawable version from 7.2 kV to 17.5 kV**



# *General contents*

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***General presentation*** **6**

---

***Panorama*** **9**

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***LF circuit breakers  
fixed version*** **11**

---

***LF circuit breakers  
withdrawable version*** **23**

---

***LFP circuit breakers*** **39**

## **The Guiding System, the new way to create your electrical installations**

### **A comprehensive offer of products with consistent design**

The Guiding System is first and foremost a Merlin Gerin product offer covering all electrical distribution needs. However, what makes all the difference is that these products have been designed to operate together: mechanical and electrical compatibility, interoperability, modularity, communication.

Thus the electrical installation is both optimised and more efficient: better continuity of supply, enhanced safety for people and equipment, guaranteed upgradeability, effective monitoring and control.

### **Tools to simplify design and implementation**

With the Guiding System, you have a comprehensive range of tools - the Guiding Tools - that will help you increase your product knowledge and product utilisation. Of course this is in compliance with current standards and procedures.

These tools include technical booklets and guides, design aid software, training courses, etc. and are regularly updated.

**The Guiding System, combined with the know-how and creativity, allows optimised, reliable, open-ended and standard compliant installations**

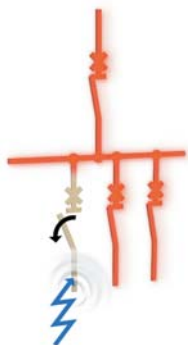
### **For a genuine partnership with you**

Because each electrical installation is unique, there is no standard solution. With the Guiding System, the variety of combinations allows for genuine customisation solutions. You can create and implement electrical installations to meet your creative requirements and design knowledge.

You and Merlin Gerin's Guiding System form a genuine partnership.

**For more details on the Guiding System, consult [www.merlin-gerin.com](http://www.merlin-gerin.com)**

## A consistent design of offers from Medium Voltage to Low Voltage



*Discrimination guarantees co-ordination between the operating characteristics of serial-connected circuit-breakers. Should a fault occurs downstream, only the circuit-breaker placed immediately upstream from the fault will trip.*



*Direct connection of the Canalis KT busbar trunking on the Masterpact 3200 A circuit breaker.*

**Transparent Ready**

*Thanks to the use of standard Web technologies, you can offer your customers intelligent Merlin Gerin switchboards allowing easy access to information: follow-up of currents, voltages, powers, consumption history, etc.*

**Guiding Tools  
for more efficient design  
and implementation  
of your installations.**

**All Merlin Gerin offers are designed according to electrical, mechanical and communication consistency rules. The products express this consistency by their overall design and shared ergonomics.**

### Electrical consistency:

Each product complies with or enhances system performance at co-ordination level: breaking capacity,  $I_{sc}$ , temperature rise, etc. for more safety, continuity of supply (discrimination) or economic optimisation (cascading).

The leading edge technologies employed in Merlin Gerin's Guiding System ensure high performance levels in discrimination and cascading of protection devices, electrodynamic withstand of switches and current distributors, heat loss of devices, distribution blocks and enclosures.

Likewise, inter-product ElectroMagnetic Compatibility (EMC) is guaranteed.

### Mechanical consistency:

Each product adopts dimensional standards simplifying and optimising its use within the system.

It shares the same accessories and auxiliaries and complies with global ergonomic choices (utilisation mode, operating mode, setting and configuration devices, tools, etc.) making its installation and operation within the system a simpler process.

### Communication consistency:

Each product complies with global choices in terms of communication protocols (Modbus, Ethernet, etc.) for simplified integration in the management, supervision and monitoring systems.

## SM6

Medium voltage switchboard system from 1 to 36 kV



## Sepam

Protection relays



## Masterpact

Protection switchgear from 100 to 6300 A



## Trihal

MV/LV dry cast resin transformer from 160 to 5000 kVA

## Evolis

MV vacuum switchgear and components from 1 to 24 kV.

## The Technical guide

These technical guides help you comply with installation standards and rules i.e.: The electrical installation guide, the protection guide, the switchboard implementation guide, the technical booklets and the co-ordination tables all form genuine reference tools for the design of high-performance electrical installations. For example, the LV protection co-ordination guide - discrimination and cascading - optimises choice of protection and connection devices while also increasing markedly continuity of supply in the installations.



## CAD software and tools

The CAD software and tools enhance productivity and safety. They help you create your installations by simplifying product choice through easy browsing in the Guiding System offers.

Last but not least, they optimise use of our products while also complying with standards and proper procedures.



## Compact

Protection switchgear system from 100 to 630 A



## Multi 9

Modular protection switchgear system up to 125 A



## Prisma Plus

Functional system for electrical distribution switchboards up to 3200 A



### Pragma

Enclosures for distribution switchboards up to 160 A

### Canalis

Prefabricated Busbar Trunking from 25 to 4000 A

### PowerLogic

Power management

## Training

Training allows you to acquire the Merlin Gerin expertise (installation design, work with power on, etc.) for increased efficiency and a guarantee of improved customer service.

The training catalogue includes beginner's courses in electrical distribution, knowledge of MV and LV switchgear, operation and maintenance of installations, design of LV installations to give but a few examples.



## merlin-gerin.com

This international site allows you to access all the Merlin Gerin products in just 2 clicks via comprehensive range data-sheets, with direct links to:

- complete library: technical documents, catalogs, FAQs, brochures...
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*With over 37 years' industrial experience in SF6 techniques and over 300,000 installed devices throughout the world, Merlin Gerin is today one of the foremost manufacturers of SF6 switchgear.*

*Merlin Gerin has developed a wide range of high performance and reliable devices operating faultlessly on all 5 continents. Continuously increasing its performance, the company maintains a very high level of innovation in its offer.*

61051N



### Safety

The breaking medium is sulfur hexafluoride (SF6) used at low pressure.

The insulating enclosure containing the circuit breaker pole(s) is equipped with a safety membrane.

In addition, the rated characteristics, breaking the rated current under the rated voltage, are generally maintained at zero relative bars of SF6.

### Reliability

The motor-charged spring stored energy operating mechanism is a key factor of device reliability: Merlin Gerin cumulates 37 years' experience with this type of mechanism, 300,000 of which are already in operation.

Merlin Gerin's mastery of design and the testing of sealed systems guarantees sustained device performance for at least 30 years.

### Increased endurance

The mechanical and electrical endurance of Merlin Gerin SF6 breaking devices are in conformity with the most demanding specifications recommended by the IEC. These devices therefore meet requirements for even the most exposed of networks.

### Less maintenance

Throughout the device's service life, which in normal operating conditions may be at least 30 years, the only maintenance required is on the mechanical operating mechanism, once every 10 years or every 10,000 operations.

Although no maintenance is performed on poles, a diagnosis is possible:

- contact wear can be checked by external pole measurement
- SF6 pressure can be continually monitored by a pressure switch.

### Environmentally-friendly

Merlin Gerin devices have been designed to ensure protection of the environment:

- the materials used, both insulating and conductive, are identified and easy to separate and recycle,
- the SF6 gas is under control from production through to the circuit breaker's end of life. In particular it can be recovered at the end of the circuit breaker's life and re-used after treatment in line with the new European directive,
- an end of life manual for the product details procedures for dismantling and recycling components.

### Quality Assurance

During production, each circuit breaker undergoes systematic routine tests in order to check quality and conformity:

- pole sealing check
- checking the correct mechanical operation of the device, plus its associated locking mechanisms
- checking simultaneous closing of contacts
- checking power frequency insulation level
- checking main circuit resistance
- checking auxiliary circuit insulation
- checking auxiliary circuit electrical resistance
- checking switching speeds
- checking the switching cycle
- measuring the switching times.

The results are recorded on the test certificate for each device which is initialed by the quality control department.

### Certification

The quality system for the design and production of LF range circuit breakers is certified in conformity with ISO 9001: 2000 quality assurance standard requirements. The environmental management system adopted by Merlin Gerin production sites for the production of LF range circuit breakers has been assessed and judged to be in conformity with requirements in standard ISO 14001.

DE55745



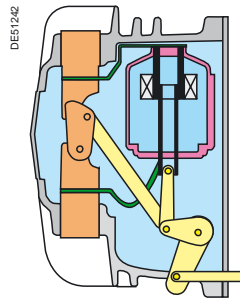
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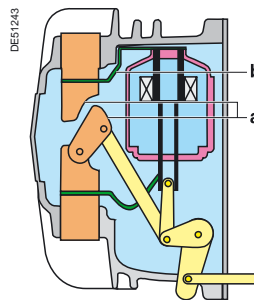


### Breaking principle: self expansion

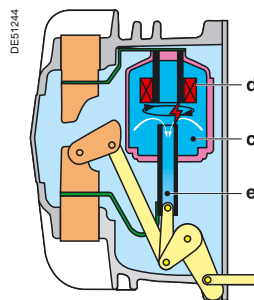
LF circuit breakers use the SF6 gas self expansion technique. This technique is the result of many years' experience in SF6 technology and major research work. It combines the effect of thermal expansion with a rotating arc to create arc blowing and quenching conditions. The result is reduced control energy requirements and arcing contact erosion; this increases mechanical and electrical endurance. The operating sequence of a self-expansion breaking chamber, whose moving part is driven by the mechanical operating mechanism, is as follows:



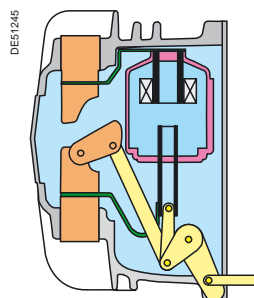
■ the circuit breaker is closed



■ on opening of the main contacts (a) the current is shunted into the breaking circuit (b)



■ on separation of the arcing contacts, an electrical arc appears in the expansion volume (c). The arc rotates under the effect of the magnetic field created by the coil (d) through which flows the current to be broken: the overpressure created by the temperature build-up of the gas in the expansion volume (c) causes a gaseous flow blowing the arc inside the tubular arcing contact (e), resulting in arc quenching when the current passes through the zero point



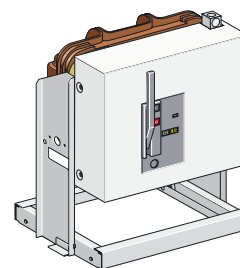
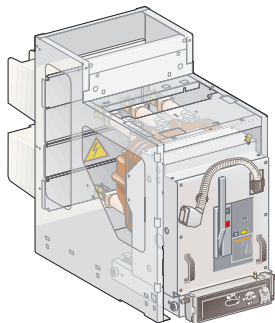
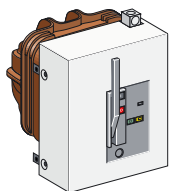
■ the circuit breaker is open.

Electrical arc in a self-expansion breaking chamber





## LF range circuit breakers

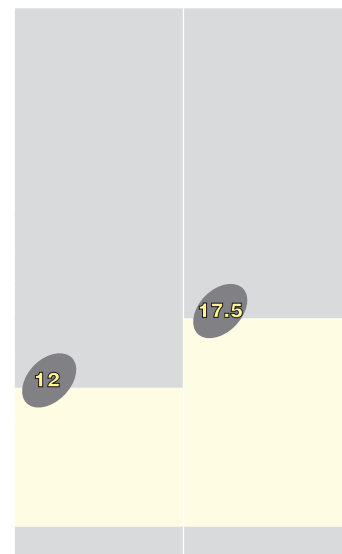
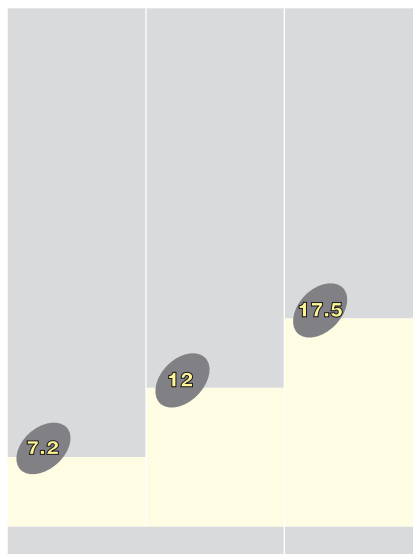
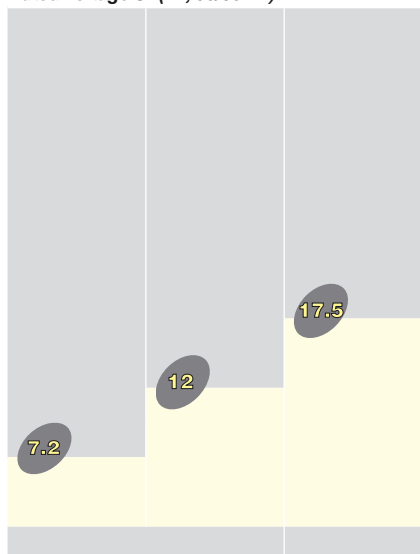


**Fixed LF1-LF2-LF3**  
Front operating mechanism

**Withdrawable LF1-LF2-LF3**  
Front operating mechanism

**LFP**  
Front operating mechanism  
(only fixed installation)

**Rated voltage  $U_r$  (kV, 50/60 Hz)**



**Rated short-circuit breaking current ( $I_{sc}$ )**

from 25 to 50 kA      from 25 to 40 kA

from 25 to 50 kA      from 25 to 40 kA

from 40 to 50 kA      from 25 to 31.5 kA

**Rated current ( $I_r$ )**

from 630 to 3150 A

from 630 to 3150 A

5000 A

# Guiding

TOOLS

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## The technical guide

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the electrical installation guide, the protection guide, the switchboard implementation guide, the technical booklets and the co-ordination tables all form genuine reference tools for the design of high performance electrical installations.

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<i>General presentation</i>	6
<i>Panorama</i>	9
<b>Presentation</b>	<b>13</b>
<b>General characteristics</b>	<b>14</b>
<b>Description of functions</b>	<b>16</b>
RI stored energy operating mechanism	16
Wiring diagram	16
Opening circuit	17
Remote control	18
Indication and locking/interlocking	19
<b>Dimensions</b>	<b>20</b>
<b>Order form</b>	<b>21</b>
<i>LF circuit breakers withdrawable version</i>	23
<i>LFP circuit breakers</i>	39

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PE55761



LF1 - LF2 - LF3 circuit breakers

PE55763



LF1 - LF2 - LF3 circuit breakers installed on a pole support

## Description of the device

### The LF circuit breaker comprises a basic fixed version:

- 3 poles integrated in a "sealed pressure system" type insulating enclosure. The sealed assembly is filled with SF6 gas at low relative pressure (0.15 Mpa/1.5 bars) and equipped with a pressure switch
- an RI stored energy electrical operating mechanism. This gives the device an opening and closing speed that is independent of the operator, for both electrical and manual orders. It enables reclosing cycles to be carried out
- a front panel housing the manual operating mechanism and status indicators
- upstream and downstream terminals for the power circuit connection
- a terminal block for connection of external auxiliary circuits.

### Each device can also be fitted with the following options:

- a supporting frame equipped with rollers and ground fixing brackets for fixed installation
- circuit breaker locking in the open position by a keylock installed on the front plate of the operating mechanism
- a 42-pin Harting type LV connector.

## Applications

LF circuit breakers are three-pole indoor MV circuit breakers. They are mainly used for operation and protection of public, industrial and tertiary distribution networks from 7.2 to 17.5 kV.

Through their anti-seismic qualification, they are particularly well suited to nuclear or thermal power production installations and applications in heavy industries such as the petrochemical industry.

Through their compact dimensions and harmonized range, LF circuit breakers are positioned very favorably on the retrofit market.

With self expansion, the breaking technique used in these circuit breakers, all current types, capacitive and inductive, can be made or broken without generating overvoltage which could damage your installation.

The LF circuit breaker is therefore ideally suited to operating capacitor banks.

PE55761



**Electrical characteristics according to IEC 62271-100**

			LF1				
Rated voltage	<b>Ur</b>	kV 50/60 Hz	7.2	12			
Insulation voltage							
- power frequency withstand	<b>Ud</b>	kV 50 Hz 1min (*)	20	28			
- lightning impulse withstand	<b>Up</b>	kV peak	60	75			
Rated current	<b>Ir</b>	A	630	■	■	■	■
			1250	■	■	■	■
			2000	–	–	–	–
			2500	–	–	–	–
			3150	–	–	–	–
Short circuit current	<b>Isc</b>	kA	25	31.5	25	31.5	
Short time withstand current	<b>Ik/tk</b>	kA/3 s	25	31.5	25	31.5	
Short-circuit making current	<b>Ip</b>	kA peak	50 Hz	63	79	63	79
			60 Hz	65	82	65	82
Rated switching sequence		O-3 min-CO-3 min-CO	■	■	■	■	
		O-0.3 s-CO-3 min-CO	■	■	■	■	
		O-0.3 s-CO-15 s-CO	■	■	■	■	
Operating times		Opening ms	48				
		Breaking ms	70				
		Closing ms	65				
Service temperature	<b>T</b>	°C	–25 to +40				
Mechanical endurance		Class	M2				
		Number of switching operations	10 000				
Electrical endurance		Class	E2				
Capacitive current breaking capacity		Class	C2				

(\*) Ud 42 kV 50 Hz, 1 min possible  
 ■ Available  
 – Non available.

**Specific applications**

**Protection of generators and power station auxiliaries**

All circuit breakers in the LF range break short circuit currents with an asymmetry of at least 30%.

In cases where the network constant X/R is greater than 45 ms, the asymmetry to be broken is higher; this is often the case of circuit breakers protecting nuclear or thermal power station auxiliaries or circuit breakers that are close to generator sets or large transformers.

Specific tests have been carried out:

Circuit breakers	kV	kA	Asymmetry
LF2	7.2	43.5	50%
LF3	7.2	43.5	50%
	12	40	50%
	17.5	25	100%

**Switching and protection of capacitor banks**

LF range circuit breakers are particularly well suited to switching and protection of capacitor banks; they are classed C2 according to standard IEC 62271-100. Tests carried out according to the standard for breaking at 400 A with making and breaking cycles in case of a capacitor bank with a making current of 20 kA. Additional tests have been carried out: please consult us.



LF2					LF3											
7.2		12	17.5		7.2				12				17.5			
20		28	38		20				28				38			
60		75	95		60				75				95			
■	■	■	■	■	-	-	-	-	-	-	-	-	-	-	-	-
■	■	■	■	■	-	-	-	-	-	-	-	■	-	-	-	■
■	■	■	■	■	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	■	■	■	■	■	■	■	■	■	■	■	■
-	-	-	-	-	-	■	■	■	-	■	■	■	■	■	■	■
40	50	40	25	31.5	25	31.5	40	50	25	31.5	40	50	25	31.5	40	50
40	50	40	25	31.5	25	31.5	40	50	25	31.5	40	50	25	31.5	40	50
100	125	100	63	79	63	79	100	125	63	79	100	125	63	79	100	125
104	130	104	65	82	65	82	104	130	65	82	104	130	65	82	104	130
■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	-
■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	-
48					48											
70					70											
65					65											
-25 to +40					-25 to +40											
M2					M2											
10000					10000											
E2					E2											
C2					C2											

PE55826



#### Operation of the RI stored energy operating mechanism

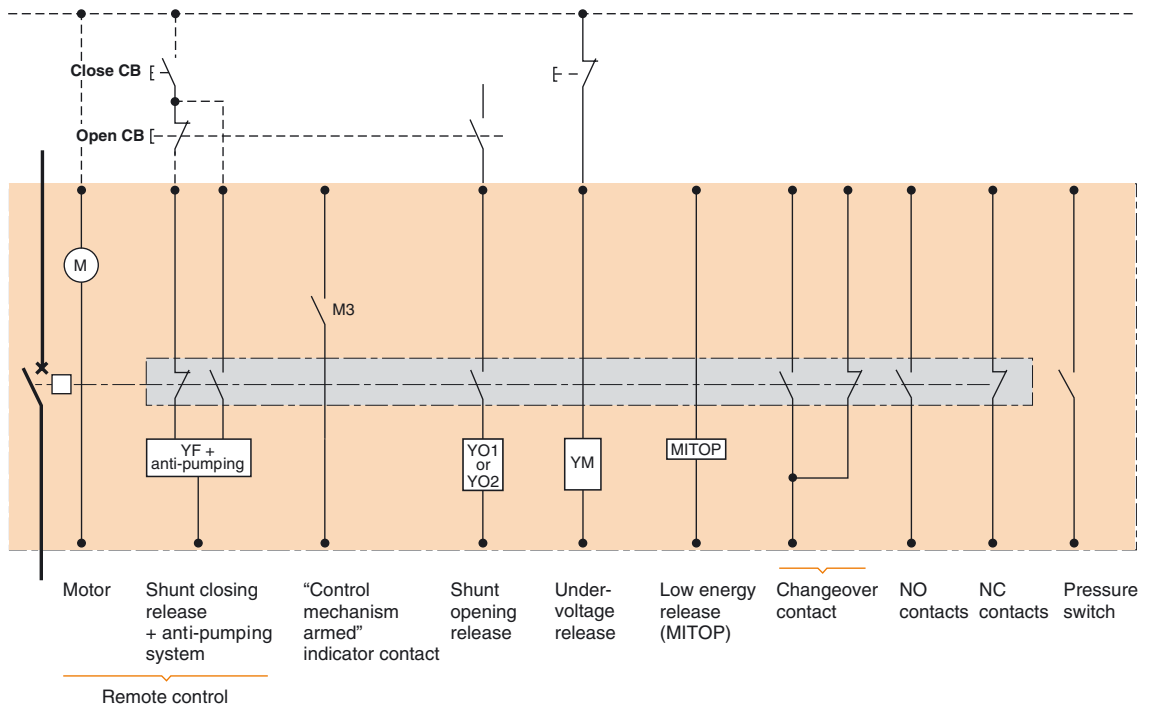
This mechanism guarantees the device an opening and closing speed unaffected by the operator, for both electric and manual orders.

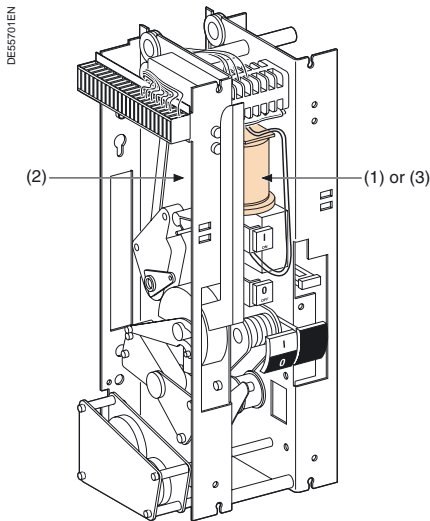
It carries out the O and CO cycles and is automatically recharged by a gear motor after closing. It consists of:

- the stored energy operating mechanism which stores in springs the energy required to open and close the device
- a gear motor electrical charging device with manual charging by lever (useful on loss of auxiliary supply)
- manual order devices by push buttons on the front panel of the device (red and black)
- an electrical remote closing device containing a release with an antipumping relay
- an electrical opening device containing one or more releases, for example:
  - shunt trip devices
  - Mitop, a low consumption release, used only with the Sepam 100 LA protection relay.
- an operation counter
- a position indication device by mechanical indicator (black and white) and a module of 14 auxiliary contacts whose availability varies according to the diagram used
- a device for indicating "charged" operating mechanism status by mechanical indicator and electrical contact
- a single contact pressure switch is activated when the gas pressure reduces below 0.1 MPa (relative pressure: 1 bar).

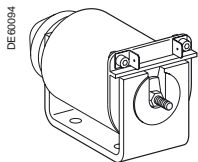
#### Wiring diagram

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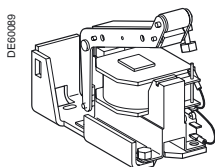




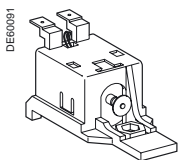
Operating device



Shunt opening release (1)



Undervoltage release (2)



Low energy release (3)

### Composition

The opening circuit can be produced using the following components:

- shunt opening release (on energizing) (YO1)
- second shunt opening release (on energizing) (YO2)
- undervoltage release (YM)
- low energy release (Mitop).

**Note:** see the table of the releases' combinations "Order form" page.

### Shunt opening release (YO1 and YO2)

Energizing this unit causes instant opening of the circuit breaker.

#### Characteristics

Power supply	See "Order form" page	
Threshold	V AC	0.85 to 1.1 Ur
	V DC	0.7 to 1.1 Ur
Consumption	V AC	160 VA
	V DC	50 W

### Undervoltage release (YM)

This release unit causes the systematic opening of the circuit breaker when its supply voltage drops below a value less than 35% of the rated voltage, even if this drop is slow and gradual. It can open the circuit breaker between 35% and 70% of its rated voltage. If the release unit is not supplied power, manual or electrical closing of the circuit breaker is impossible. Closing of the circuit breaker is compulsory when the supply voltage of the release unit reaches 85% of its rated voltage.

#### Characteristics

Power supply	See "Order form" page		
Threshold	Opening	0.35 to 0.7 Ur	
	Closing	0.85 Ur	
Consumption	Triggering	V AC	400 VA
		V DC	100 W
	Latched	V AC	100 VA
		V DC	10 W

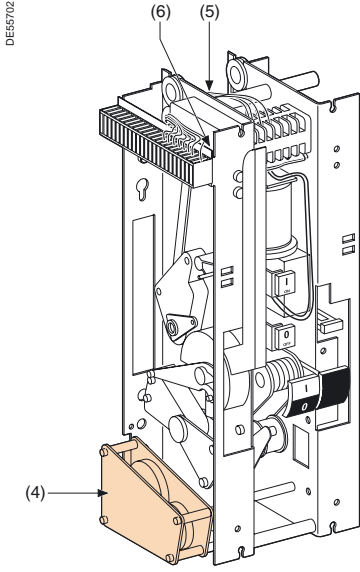
### Low energy release (Mitop)

This specific release unit comprises a low consumption unit and is specifically used for Sepam 100LA self-powered relays.

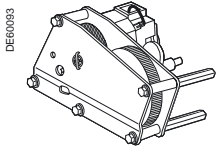
#### Characteristics

Power supply	Direct current
Threshold	0.6 A < I < 3 A

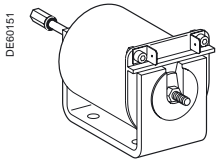
Any tripping due to the Mitop release unit is momentarily indicated by an SDE type changeover contact.



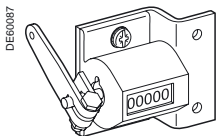
Operating mechanism



Electrical motor and gearing (4)



Shunt closing release (5)



Operation counter (6)

### Function

Remote control enables the remote opening and closing of the circuit breaker.

### Composition

The remote control mechanism comprises:

- an electrical motor with gearing
- a shunt closing release (YF) combined with an anti-pumping device
- an operation counter.

### Electrical motor with gearing (M)

The electrical motor arms and re-arms the stored energy unit as soon as the circuit breaker is closed. This allows the instant closing of the device after opening. The arming lever is only used as a back-up operating mechanism in the case of any auxiliary power supply.

The M3 contact indicates the end of arming operations.

#### Characteristics

Power supply	See "Order form" page	
Threshold	V AC/V DC	0.85 to 1.1 Ur
Consumption	V AC	380 VA
	V DC	380 W

### Shunt closing release (YF)

This allows the remote closing of the circuit breaker when the operating mechanism is armed.

#### Characteristics

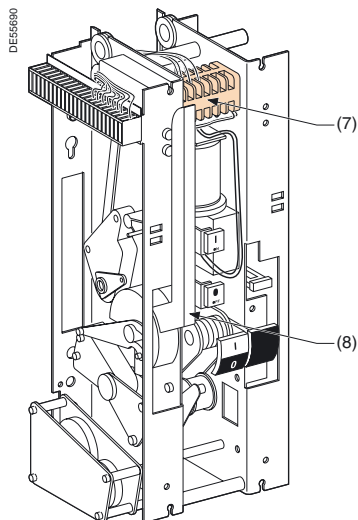
Power supply	See "Order form" page	
Threshold	V AC	0.85 to 1.1 Ur
	V DC	0.85 to 1.1 Ur
Consumption	V AC	160 VA
	V DC	50 W

The anti-pumping relay enables the guaranteeing of opening priority in the case of a permanent closing order. This therefore avoids the device being caught in a uncontrolled opening-closing loop.

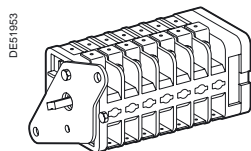
### Operation counter

The operation counter is visible on the front panel.

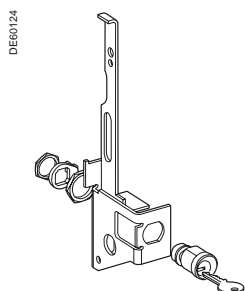
It displays the number of switching cycles (CO) that the device has carried out.



Operating mechanism



Auxiliary contacts (7)



Keylocking kit (8)

### “Open/closed” auxiliary contacts

The number of contacts available depends on the options chosen on the operating mechanism.

In the basic configuration, the circuit breaker’s operating mechanism comprises a total of:

- 5 normally closed contacts (NC)
- 5 normally open contacts (NO)
- 1 changeover contact (CHG).

The usage procedure for auxiliary contacts is given in the following table:

Options	NC contact	NO contact
Shunt opening release (each one)	0	1
Undervoltage release	0	0
Low energy release (Mitop)	0	0

In order to know the final number of available contacts, you must deduct the total number of contacts included in the circuit breaker (5 NC + 5 NO + 1 CHG), the number of contacts used given in the table above.

**E.g.:** a circuit breaker equipped with a remote control and a shunt trip unit has the following available contacts:

5 NC + 4 NO + 1 CHG.

With a undervoltage release instead of the shunt trip, this circuit breaker would have the following available contacts:

5 NC + 5 NO + 1 CHG.

Shunt opening release combination				
	1st release	Shunt opening release YO1	Undervoltage release YM	Mitop
<b>2nd release</b>				
<b>Without</b>		5NC + 4NO + 1CHG	5NC + 5NO + 1CHG	5NC + 5NO + 1CHG
<b>Shunt opening release YO2</b>		5NC + 3NO + 1CHG	5NC + 4NO + 1CHG	5NC + 4NO + 1CHG
<b>Undervoltage release YM</b>		5NC + 4NO + 1CHG		5NC + 5NO + 1CHG
<b>Mitop</b>		5NC + 4NO + 1CHG	5NC + 5NO + 1CHG	

### Locking the circuit breaker in the “open” position

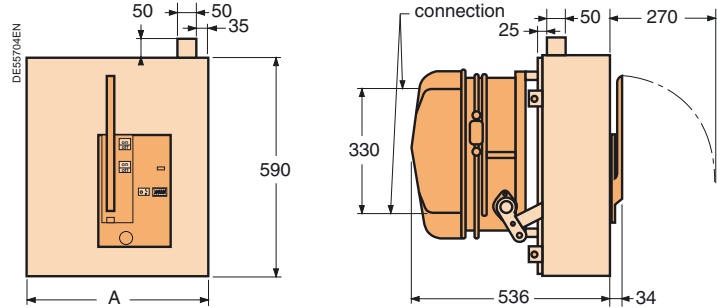
This key-operated device allows the circuit breaker to be locked in the “open” position. The circuit breaker is locked in the open position by blocking the opening push button in the “engaged” position.

Locking is achieved using a Profalux or Ronis captive key type keylock.

Device

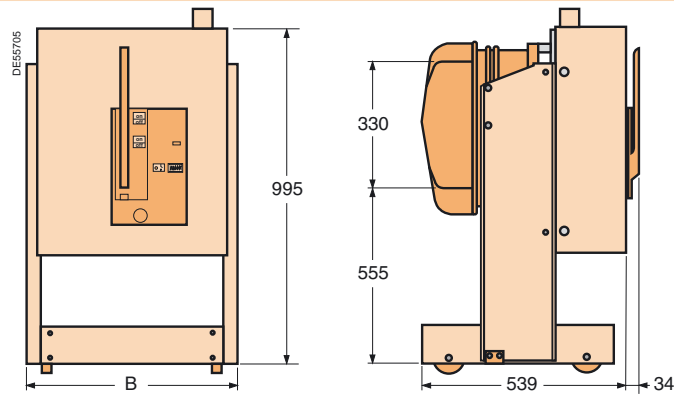
Basic fixed

	LF1	LF2	LF3
A	493	554	728
Weight (kg)	106	128	149.5



Fixed with a support frame

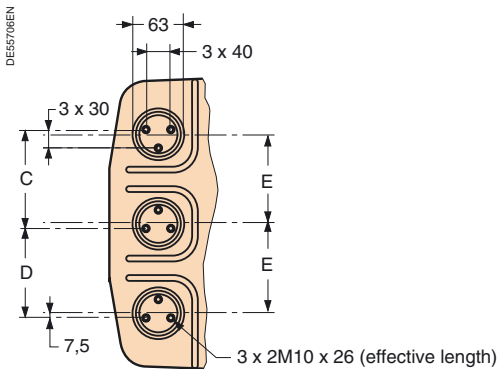
	LF1	LF2	LF3
B	542	602	776
Weight (kg)	124	148	168



Connections

Direct to the device

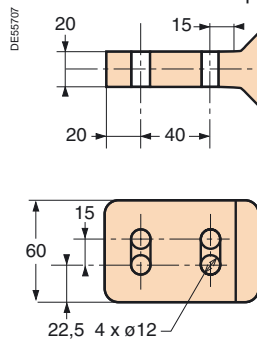
- LF1
- LF2 < 2000 A < 95 kV impulse
- LF3 < 2500 A and < 95 kV impulse



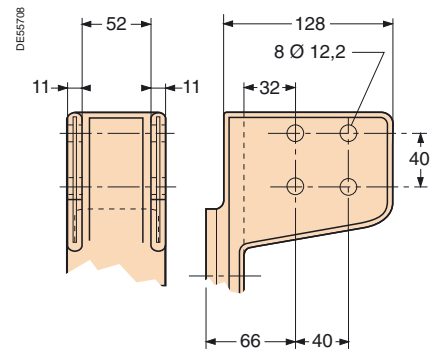
	LF1	LF2	LF3
C	160	180	240
D	145	165	225
E	145	165	225

Connection on pads

- LF2:
  - 2000 A
  - 1250 A/95 kV impulse
  - 630 A/95 kV impulse
- LF3: 1250 A/95 kV impulse



- LF3:
  - 2500 A/95 kV impulse
  - 3150 A/95 kV impulse



Note:

- recommended connection screw M10 class 8.8. Tightening torque: 50 Nm with contact washer.
- connectors delivered mounted on the device
- for more details refer to the dimensional drawings

Only one of the boxes (ticked  or filled  by the needed value) have to be considered between each horizontal line.

Orange box  corresponds to none priced functions.

<b>Basic fixed circuit breaker</b>		Quantity <input type="text"/>
Rated voltage Ur	(kV)	<input type="text"/>
Impulse voltage Up	(kVbil)	<input type="text"/>
short-circuit current Isc	(kA)	<input type="text"/>
Rated current Ir	(A)	<input type="text"/>
Frequency	50 Hz <input checked="" type="checkbox"/>	60 Hz <input type="checkbox"/>
Colour for push buttons and indicators	IEC standard <input type="checkbox"/>	ANSI standard <input type="checkbox"/>
Push buttons open/close:	Red/black <input checked="" type="checkbox"/>	<input type="checkbox"/>
Indicator open/close:	Black/white <input type="checkbox"/>	Green/red <input type="checkbox"/>
Operating mechanism charged/discharged:	White/yellow <input checked="" type="checkbox"/>	Charge/discharge <input type="checkbox"/>

### Circuit breaker options

**1st opening release** (see possible choices in combination table below)

Shunt opening release YO1

24 Vdc <input checked="" type="checkbox"/>	60 Vdc <input checked="" type="checkbox"/>	220 Vdc <input checked="" type="checkbox"/>	220 Vac (50 Hz) <input checked="" type="checkbox"/>
30 Vdc <input checked="" type="checkbox"/>	110 Vdc <input checked="" type="checkbox"/>	48 Vac (50 Hz) <input checked="" type="checkbox"/>	120 Vac (60 Hz) <input checked="" type="checkbox"/>
48 Vdc <input checked="" type="checkbox"/>	125 Vdc <input checked="" type="checkbox"/>	110 Vac (50 Hz) <input checked="" type="checkbox"/>	240 Vac (60 Hz) <input checked="" type="checkbox"/>

**2nd opening release** (see possible choices in combination table below)

Shunt opening release YO2

24 Vdc <input type="checkbox"/>	60 Vdc <input type="checkbox"/>	220 Vdc <input type="checkbox"/>	220 Vac (50 Hz) <input type="checkbox"/>
30 Vdc <input type="checkbox"/>	110 Vdc <input type="checkbox"/>	48 Vac (50 Hz) <input type="checkbox"/>	120 Vac (60 Hz) <input type="checkbox"/>
48 Vdc <input type="checkbox"/>	125 Vdc <input type="checkbox"/>	110 Vac (50 Hz) <input type="checkbox"/>	240 Vac (60 Hz) <input type="checkbox"/>

Undervoltage release YM

24 Vdc <input type="checkbox"/>	60 Vdc <input type="checkbox"/>	220 Vdc <input type="checkbox"/>	220 Vac (50 Hz) <input type="checkbox"/>
30 Vdc <input type="checkbox"/>	110 Vdc <input type="checkbox"/>	48 Vac (50 Hz) <input type="checkbox"/>	120 Vac (60 Hz) <input type="checkbox"/>
48 Vdc <input type="checkbox"/>	125 Vdc <input type="checkbox"/>	110 Vac (50 Hz) <input type="checkbox"/>	240 Vac (60 Hz) <input type="checkbox"/>

Mitop (not available with seismic version)

Without contact  With contact

### Remote control

Electrical motor M	24...32 Vdc <input checked="" type="checkbox"/>	110...127 Vdc/ac <input type="checkbox"/>
	48...60 Vdc/ac <input checked="" type="checkbox"/>	220...250 Vdc/ac <input type="checkbox"/>

Shunt closing release YF

24 Vdc <input checked="" type="checkbox"/>	60 Vdc <input checked="" type="checkbox"/>	220 Vdc <input checked="" type="checkbox"/>	220 Vac (50 Hz) <input checked="" type="checkbox"/>
30 Vdc <input checked="" type="checkbox"/>	110 Vdc <input checked="" type="checkbox"/>	48 Vac (50 Hz) <input checked="" type="checkbox"/>	120 Vac (60 Hz) <input checked="" type="checkbox"/>
48 Vdc <input checked="" type="checkbox"/>	125 Vdc <input checked="" type="checkbox"/>	110 Vac (50 Hz) <input checked="" type="checkbox"/>	240 Vac (60 Hz) <input checked="" type="checkbox"/>

Low voltage wiring connection	Male plug (1.2 m) <input type="checkbox"/>	Female socket (2 m) <input type="checkbox"/>
Locking C.B. in open position	Ronix <input type="checkbox"/>	Profalux <input type="checkbox"/>
Sismic version (consult us)	<input type="checkbox"/>	<input type="checkbox"/>
Support frame	<input type="checkbox"/>	<input type="checkbox"/>
Leaflets language	French <input checked="" type="checkbox"/>	English <input type="checkbox"/>

Different releases combinations

Shunt opening releases YO1/YO2	1	2	1	1
Undervoltage release YM	1	1	1	1
Mitop	1	1	1	1

# Guiding

TOOLS

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The CAD software and tools enhance productivity and safety. They help you create your installations by simplifying product choice through easy browsing in the Guiding System offers.

Last but not least, they optimise use of our products while also complying with standards and proper procedures.

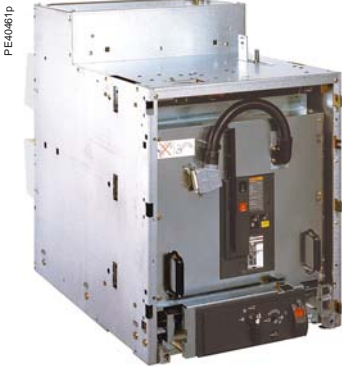




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<i>General presentation</i>	6
<i>Panorama</i>	9
<i>LF circuit breakers fixed version</i>	11
<b>Presentation</b>	<b>25</b>
<b>General characteristics</b>	<b>26</b>
<b>Description of functions</b>	<b>28</b>
Racking in	28
Connection	30
RI stored energy operating mechanism	31
Wiring diagram	31
Opening circuit	32
Remote control	33
Indication and locking/interlocking	34
Safety functions	35
<b>Dimensions</b>	<b>36</b>
<b>Order form</b>	<b>37</b>
<i>LFP circuit breakers</i>	39

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LF withdrawable circuit breaker and cassette

## Description of the device

### The basic withdrawable version of the LF circuit breaker comprises:

- the circuit breaker unit with its operating mechanism:
  - 3 poles integrated in a “sealed pressure system” type insulating enclosure. The sealed assembly is filled with SF6 gas at low relative pressure (0.15 Mpa/1.5 bars) and equipped with a pressure switch
  - an RI stored energy electrical operating mechanism. This gives the device an opening and closing speed that is independent of the operator, for both electrical and manual orders. It enables reclosing cycles to be carried out
  - a front panel housing the manual operating mechanism and status indicators.
- the components enabling it to be withdrawable:
  - the circuit breaker is equipped with racking arms and contact fingers and mounted on a racking in/out drive device with a threaded shaft activated by a handle, including all of the safety interlock systems.
  - a Harting type male LV connector allows connection of the external auxiliary circuits.

### Each device can optionally be fitted with:

- locking of the circuit breaker in the following positions:
  - open, by a key lock installed on the control panel
  - racked out, by a key lock installed on the drive device.
- the basic MC cassette, comprising:
  - a metal structure and two guide rails
  - fixed connection fingers insulated by bushings
  - metal shutters to insulate from the HV part
  - safety interlocking systems
  - a female Harting type LV connector.
- MC cassette options:
  - circuit breaker racked-in or out position indicator contacts
  - a circuit breaker operating mechanism spring discharge system
  - a circuit breaker racked-in blocking mechanism
  - an extraction tool
  - an equipped door
  - a foolproof device for the circuit breaker rating
  - an earthing switch operating mechanism (see chapter 5 in catalogue “MV switchboards components” ref. AMTED305019EN).

## Applications

LF circuit breakers are three-pole indoor MV circuit breakers. They are mainly used for operation and protection of public, industrial and tertiary distribution networks from 7.2 to 17.5 kV.

Through their anti-seismic qualification, they are particularly well suited to nuclear or thermal power production installations and applications in heavy industries such as the petrochemical industry.

Through their compact dimensions and harmonized range, LF circuit breakers are positioned very favorably on the retrofit market.

With self expansion, the breaking technique used in these circuit breakers, all current types, capacitive and inductive, can be made or broken without generating overvoltage which could damage your installation.

The LF circuit breaker is therefore ideally suited to operating capacitor banks.

PE60461p



**Electrical characteristics according to IEC 62271-100**

Circuit breaker/Cassette			LF1/MC1				
Rated voltage	<b>Ur</b>	kV 50/60 Hz	7.2	12			
Insulation voltage							
- power frequency withstand	<b>Ud</b>	kV 50 Hz 1min (*)	20	28			
- lightning impulse withstand	<b>Up</b>	kV peak	60	75			
Rated current	<b>Ir</b>	A	630	■	■	■	■
			1250	■	■	■	■
			2000	–	–	–	–
			2500	–	–	–	–
			3150	–	–	–	–
Short circuit current	<b>Isc</b>	kA	25	31.5	25	31.5	
Short time withstand current	<b>Ik/tk</b>	kA/3 s, kA/1 s	25	31.5	25	31.5	
Short-circuit making current	<b>Ip</b>	kA peak	50 Hz	63	79	63	79
			60 Hz	65	82	65	82
Rated switching sequence	O-3 min-CO-3 min-CO		■	■	■	■	
	O-0.3 s-CO-3 min-CO		■	■	■	■	
	O-0.3 s-CO-15 s-CO		■	■	■	■	
Operating times	Opening ms		48				
	Breaking ms		70				
	Closing ms		65				
Service temperature	<b>T</b>	°C	–25 to +40				
Mechanical endurance	Class		M2				
	Number of switching operations		10 000				
Electrical endurance	Class		E2				
Capacitive current breaking capacity	Class		C2				

(\*) Ud 42 kV 50 Hz, 1 min possible  
 (\*\*) Rated short-circuit breaking duration (tk): 1 s  
 ■ Available  
 – Non available.

**Specific applications**

**Protection of generators and power station auxiliaries**

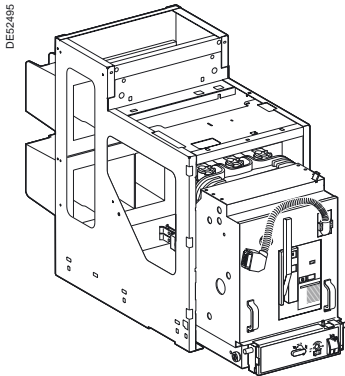
All circuit breakers in the LF range break short circuit currents with an asymmetry of at least 30%.  
 In cases where the network constant X/R is greater than 45 ms, the asymmetry to be broken is higher; this is often the case of circuit breakers protecting nuclear or thermal power station auxiliaries or circuit breakers that are close to generator sets or large transformers.  
 Specific tests have been carried out:

Circuit breakers	kV	kA	Asymmetry
LF2	7.2	43.5	50%
LF3	7.2	43.5	50%
	12	40	50%
	17.5	25	100%

**Switching and protection of capacitor banks**

LF range circuit breakers are particularly well suited to switching and protection of capacitor banks; they are classed C2 according to standard IEC 62271-100. Tests carried out according to the standard for breaking at 400 A with making and breaking cycles in case of a capacitor bank with a making current of 20 kA. Additional tests have been carried out: please consult us.

LF2/MC2					LF3/MC3											
7.2		12	17.5		7.2				12				17.5			
20		28	38		20				28				38			
60		75	95		60				75				95			
■	■	■	■	■	-	-	-	-	-	-	-	-	-	-	-	-
■	■	■	■	■	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	■	-	-	■	
-	-	-	-	-	■	■	■	■	■	■	■	■	■	■	■	
-	-	-	-	-	-	■	■	■	-	■	■	■	■	■	■	
40	50	40	25	31.5	25	31.5	40	50	25	31.5	40	50	25	31.5	40	
40	50 (**)	40	25	31.5	25	31.5	40	50 (**)	25	31.5	40	50 (**)	25	31.5	40	
100	125	100	63	79	63	79	100	125	63	79	100	125	63	79	100	
104	130	104	65	82	65	82	104	130	65	82	104	130	65	82	104	
■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	-	
■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	-	
48					48											
70					70											
65					65											
-25 to +40					-25 to +40											
M2					M2											
10000					10000											
E2					E2											
C2					C2											



### Assembly components

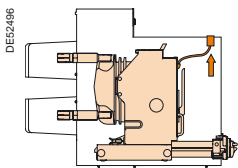
The "racking-in/out" function is achieved by:

- the withdrawable circuit breaker with its LV connector (mobile part)
- the cassette with its bushings (fixed part).

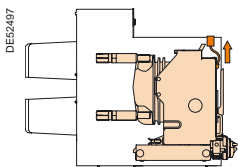
### Circuit breaker operation

The withdrawable circuit breaker can be placed in 3 stable positions:

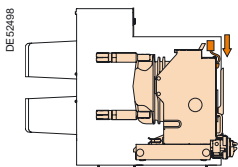
- **service position:** circuit breaker racked in and locked in position; LV plugs connected
- **test position:** circuit breaker racked out and locked in position; LV plug connected
- **disconnected position:** circuit breaker extracted and locked in this position, LV plug disconnected.



Operation position



Test position



Disconnected position

### Circuit breaker safety functions

A drive system using a threaded shaft gives easier racking and unracking.

#### Test position contact

This is activated when the circuit breaker is in the "test" or "service" position.

**Earthing** is achieved throughout the operation via the racking carriage casters. An addition earthing system can be supplied as an option.

#### Interlocking mechanisms

In conformity with IEC standards 62271-100 and 62271-200, the following interlocks are available:

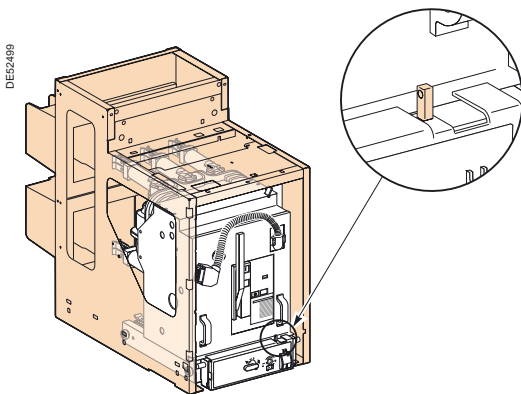
- impossibility of racking in or out if the circuit breaker is not in the "open" position
- impossible to rack in the circuit breaker when the LV plug is not connected
- impossible to disconnect the LV plug if the circuit breaker is not racked-out.

#### Cubicle door interlocking mechanism

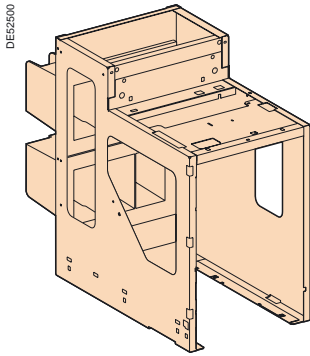
The carriage is equipped with a device that enables interlocking between the racking out of the circuit breaker and the cubicle door:

- possible to rack in the circuit breaker only if the door is closed
- possible to open the door only if the circuit breaker is racked out.

This device must be disabled if the interlocking function is not present.



Interlocking door-cubicle



**MC cassette safety functions**

The MC cassette is designed to receive the LF circuit breaker and comprises the following components ensuring safety when racking-in (see details in the *Installation Guide ref. 07897536EN*).

**Metal structure with two guide rails**

The rails guide the LF circuit breaker during racking-in/out operations.

**Fixed connection fingers insulated by bushings**

The three ends of the circuit breaker, fitted with racking clusters, provide the contact with these three fingers.

**Metal shutters to insulate from the MV part**

Three shutters mounted on the structure stop access to the racking fingers when the circuit breaker is extracted (protection index: IP2X).

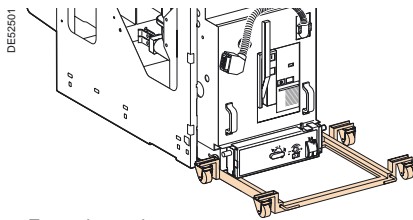
**Safety interlocking systems**

When carrying out maintenance operations, it is possible to:

- padlock the shutters in the closed position
- unlock the access mechanism to the fixed contacts.

**Anti-drop function**

This function ensures operator safety during circuit breaker extraction.



Extraction tool

**Compulsory MC cassette accessories**

**Female Harting low voltage connector**

A connector with a cable can either be delivered with the circuit breaker, with the circuit breaker plus the cassette, or separately.

**Panel with circuit breaker operation pictograms**

A self-adhesive panel shows racking-in and out operations for the circuit breaker. This is systematically delivered when the circuit breaker is ordered either with the cassette or as a separate order.

**Racking handle**

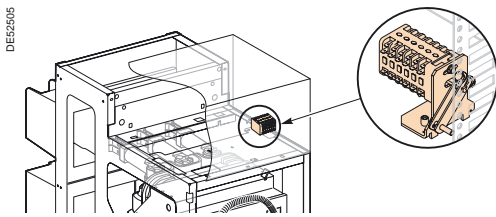
The handle is used for circuit breaker racking-in/out operations and for earthing switch opening and closing operations.

**Extraction tool**

- A standard tool allows the breaking device to be extracted from each cassette version, whatever the installation height, up to 800 mm from the ground.
- A simplified extraction tool can be manufactured locally according to the installation height.

**50 kA fixing lock**

This upper lock enabling the circuit breaker to be held in the cassette in the case of a fault, is compulsory for LF2/LF3 circuit breakers with a 50 kA withstand.



Indication contacts

**MC cassette options**

**Circuit breaker racked-in or racked-out position indicator contacts**

6 contacts (3 NO + 3 NC) or 12 contacts (6 NO + 6 NC)

**Operating mechanism spring discharge system**

Circuit breaker operating mechanism springs are automatically discharged when it is extracted from the cubicle. This function avoids any risk of unwanted circuit breaker closing.

**Mechanical circuit breaker racked-in lock**

This option is included when the earthing switch is installed. However, it can be delivered separately if the earthing circuit breaker is not required: it takes the space and volume of the earthing switch operating mechanism.

**Equipped MV access door**

Possibility of delivering a fully equipped, painted door (RAL 9001) available with or without the manual circuit breaker closing mechanism.

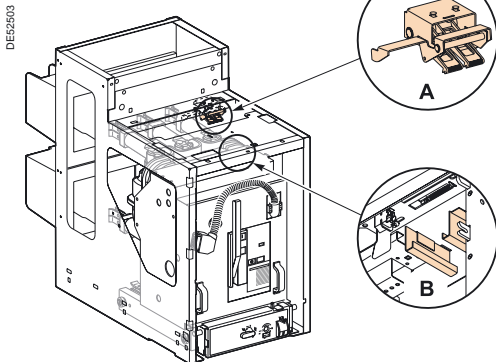
Possibility of producing the door locally (drawings and accessories available).

**Foolproofing device**

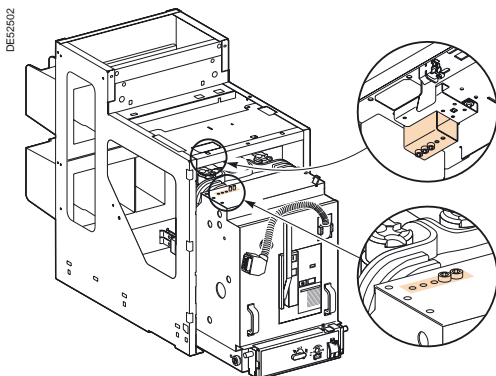
This enables foolproofing of the circuit breaker rating relative to the cassette rating. This system is mounted on the cassette side. The corresponding combining of the right circuit breaker rating must be carried out by the panel builder.

**Earthing switch operating mechanism**

This can be mounted under the cassette, for suitable interlocking between the circuit breaker and the earthing switch (see detailed description in chapter 5 catalogue "MV switchboards components" ref. AMTED305019EN).



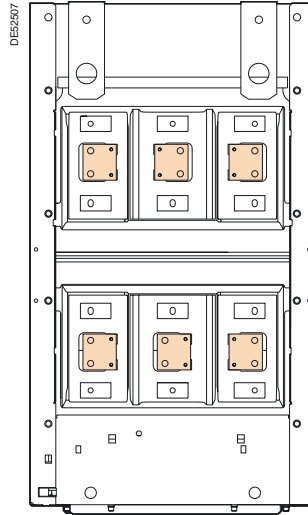
(A) 50 kA interlock  
(B) Discharge of the circuit breaker operating mechanism on extraction



Cassette/circuit breaker foolproofing device

### MV connection

The customer connection is easily made at the rear of the cassette on the connection terminals integrated in the bushings (see drilling details in the "Installation Guide" ref. 07897536EN).



MV connection

### LV connection

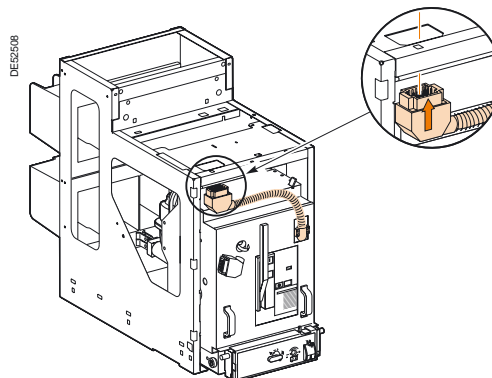
With the withdrawable circuit breaker, the LV cabling has an LV connector with:

- a mobile part (male Harting connector) at the end of a flexible cable, fully connected to the operating mechanism terminal by a sleeve
- a fixed part (female Harting connector) compatible with the male part mounted at the top, inside the cassette.

### Interlocking function

In conformity with IEC standard 62271-200, an interlocking function prohibits:

- racking in when the LV plug is not connected
- disconnection of the LV plug if the circuit breaker is in the racked-in position.



LV plug connection



PE56626



**Operation of the RI stored energy operating mechanism**

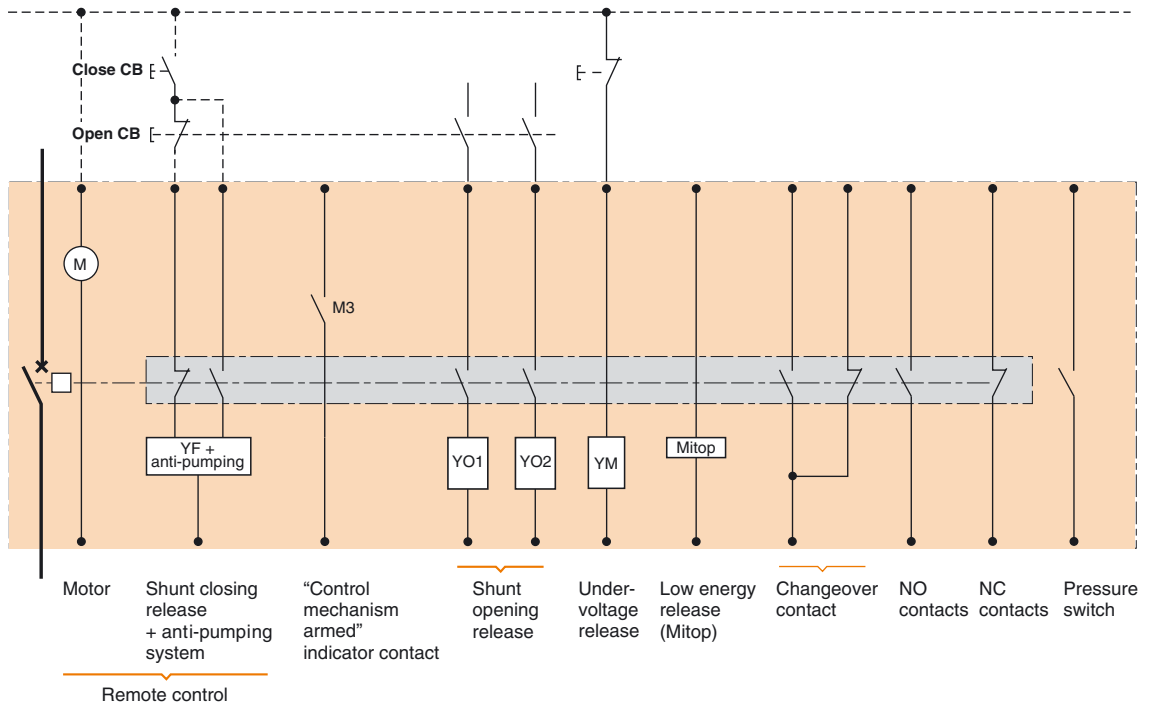
This mechanism guarantees the device an opening and closing speed unaffected by the operator, for both electric and manual orders.

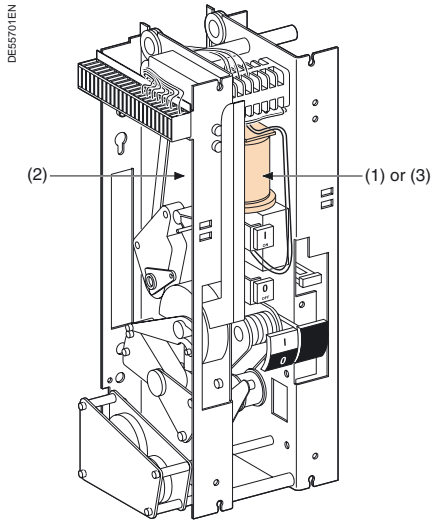
It carries out the O and CO cycles and is automatically recharged by a gear motor after closing. It consists of:

- the stored energy operating mechanism which stores in springs the energy required to open and close the device
- a gear motor electrical charging device with manual charging by lever (useful on loss of auxiliary supply)
- manual order devices by push buttons on the front panel of the device (red and black)
- an electrical remote closing device containing a release with an antipumping relay
- an electrical opening device containing one or more releases, for example:
  - shunt trip devices
  - Mitop, a low consumption release, used only with the Sepam 100 LA protection relay.
- an operation counter
- a position indication device by mechanical indicator (black and white) and a module of 14 auxiliary contacts whose availability varies according to the diagram used
- a device for indicating “charged” operating mechanism status by mechanical indicator and electrical contact
- a single contact pressure switch is activated when the gas pressure reduces below 0.1 MPa (relative pressure: 1 bar).

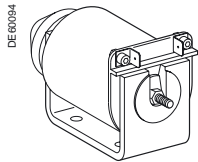
**Wiring diagram**

DE56626EN

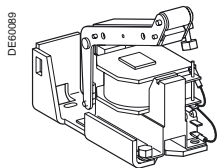




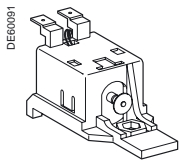
Operating mechanism



Shunt opening release (1)



Undervoltage release (2)



Low energy release (3)

### Composition

The opening circuit can be produced using the following components:

- shunt opening release (on energizing) (YO1)
- second shunt opening release (on energizing) (YO2)
- undervoltage release (YM)
- low energy release (Mitop).

**Note:** see the table of the releases' combinations, "Order form" page.

### Shunt opening release (YO1 and YO2)

Energizing this unit causes instant opening of the circuit breaker.

#### Characteristics

Power supply	See "Order form" page	
Threshold	V AC	0.85 to 1.1 Ur
	V DC	0.7 to 1.1 Ur
Consumption	V AC	160 VA
	V DC	50 W

### Undervoltage release (YM)

This release unit causes the systematic opening of the circuit breaker when its supply voltage drops below a value less than 35% of the rated voltage, even if this drop is slow and gradual. It can open the circuit breaker between 35% and 70% of its rated voltage. If the release unit is not supplied power, manual or electrical closing of the circuit breaker is impossible. Closing of the circuit breaker is possible when the supply voltage of the release unit reaches 85% of its rated voltage.

#### Characteristics

Power supply	See "Order form" page		
Threshold	Opening	0.35 to 0.7 Ur	
	Closing	0.85 Ur	
Consumption	Triggering	V AC	400 VA
		V DC	100 W
	Latched	V AC	100 VA
		V DC	10 W

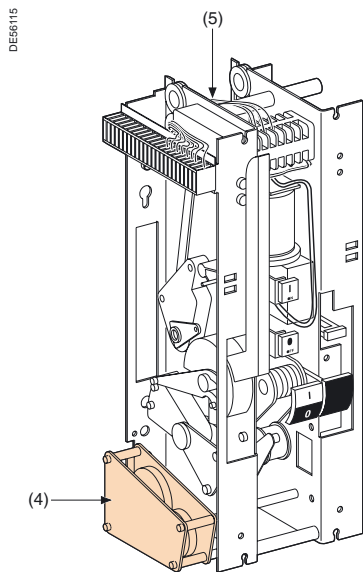
### Low energy release (Mitop)

This specific release unit comprises a low consumption unit and is specifically used for Sepam 100LA self-powered relays.

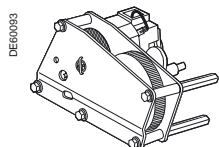
#### Characteristics

Power supply	Direct current
Threshold	0.6 A < I < 3 A

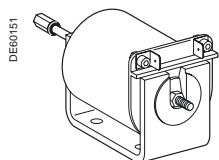
Any tripping due to the Mitop release unit is momentarily indicated by an SDE type changeover contact (option).



Operating mechanism



Electrical motor and gearing (4)



Shunt closing release (5)

### Function

In its basic version, the circuit breaker comprises a remote control mechanism for remote circuit breaker opening and closing.

### Composition

The remote control mechanism comprises:

- an electrical motor with gearing
- a shunt closing release (YF) combined with an anti-pumping device
- an operation counter.

### Electrical motor with gearing (M)

The electrical motor carries out the automatic rearming of the stored energy unit as soon as the circuit breaker is closed. This allows the instant reclosing of the device after opening. The arming lever is only used as a backup operating mechanism in the case of the absence of the auxiliary power supply. The M3 contact indicates the end of arming operations.

#### Characteristics

Power supply	See "Order form" page	
Threshold	V AC/V DC	0.85 to 1.1 Ur
Consumption	V AC	380 VA
	V DC	380 W

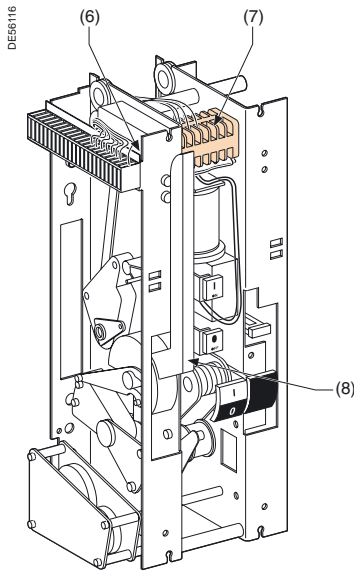
### Shunt closing release (YF)

This release allows the remote closing of the circuit breaker when the operating mechanism is armed.

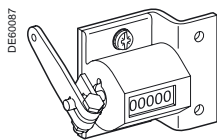
#### Characteristics

Power supply	See "Order form" page	
Threshold	V AC	0.85 to 1.1 Ur
	V DC	0.85 to 1.1 Ur
Consumption	V AC	160 VA
	V DC	50 W

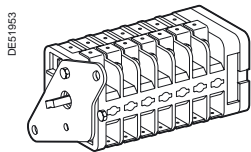
The shunt closing release is combined with an anti-pumping relay that enables priority to be given to opening in the case of a permanent closing order. This thus avoids the device being caught in an uncontrolled opening-closing cycle.



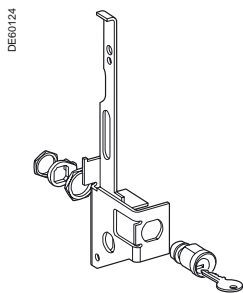
Operating mechanism



Operation counter (6)



Auxiliary contacts (7)



Kit to lock the circuit breaker in the "open" position (8)

### Operation counter

The operation counter is visible on the front panel. It displays the number of switching cycles (CO) that the device has carried out.

### "Open/closed" auxiliary contacts

These auxiliary contacts indicate the "open" or "closed" position of the circuit breaker. The number of contacts available depends on the options chosen on the operating mechanism.

In the basic configuration, the circuit breaker operating mechanism comprises a total of:

- 5 normally closed contacts (NC)
- 5 normally open contacts (NO)
- 1 changeover contact (CHG).

The usage mode for auxiliary contacts is given in the following table:

Options	NC contact	NO contact
Shunt opening release (each one)	0	1
Undervoltage release	0	0
Low energy release (Mitop)	0	0

To know the final number of available contacts, you must deduct the total number of contacts included in the circuit breaker (5 NC + 5 NO + 1 CHG), from the number of contacts used indicated in the table above.

**E.g.:** a circuit breaker equipped with a remote control and a shunt release has the following contacts available:

5 NC + 4 NO + 1 CHG.

With an undervoltage release instead of a shunt release, this circuit breaker would have the following available contacts:

5 NC + 5 NO + 1 CHG.

### Shunt opening release combination

	1st release	Shunt opening release YO1	Undervoltage release YM	Mitop
2nd release				
Without		5NC + 4NO + 1CHG	5NC + 5NO + 1CHG	5NC + 5NO + 1CHG
Shunt opening release YO2		5NC + 3NO + 1CHG	5NC + 4NO + 1CHG	5NC + 4NO + 1CHG
Undervoltage release YM		5NC + 4NO + 1CHG		5NC + 5NO + 1CHG
Mitop		5NC + 4NO + 1CHG	5NC + 5NO + 1CHG	

### Contacts characteristics

Rated current			10 A
Breaking capacity	AC	220 V (cos φ ≥ 0.3)	1 A
	DC	110/220 V (L/R ≤ 0.02 s)	0.3 A

### Locking the circuit breaker in the "open" position

This key-operated device allows the circuit breaker to be locked in the "open" position. The circuit breaker is locked in the open position by blocking the opening push button in the "engaged" position.


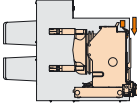
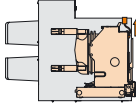
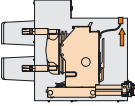
Locking is achieved using a Profalux or Ronis captive key type keylock.

This table describes the safety functions available on the withdrawable version of the LF circuit breaker.

**How to use the table**

Each of the boxes describes the functional status of each circuit breaker position and the associated parts:

- Possible status
- Possible status, impossible operation
- Impossible status

Parts		Circuit breaker positions					
		 Removed	Insertion ←-----→ Extraction	 Disconnected	 Test position	Racking-in ←-----→ Racking-out	 Service
1 - Cradle			Fool-proof protection <sup>(1)</sup> Anti-drop <sup>(2)</sup>				
		No opening shutters					
		Shutters padlocking possible					
2 - LV plug	Disconnected			Door closing impossible	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Connected	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		No unplugging <sup>(5)</sup>		
3 - Circuit breaker	Closed		Auto-discharge function <sup>(3)</sup>		No racking-in	<input checked="" type="checkbox"/>	No racking-out
	Open					No closing	
		Open position circuit breaker locking available <sup>(3)</sup>					
4 - Switchboard door	Open				No racking-in	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Closed				No door opening <sup>(4)</sup>		
5 - Earthing switch	Open					No earthing switch closing	
	Closed				No racking-in	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

(1) This protection mechanism ensures that the performance levels of the circuit breaker correspond with those of the cassette.

(2) Device that prevents the circuit breaker from dropping when extracted from the cassette.

The device can be either unlocked manually or when the extraction rig is put in position.

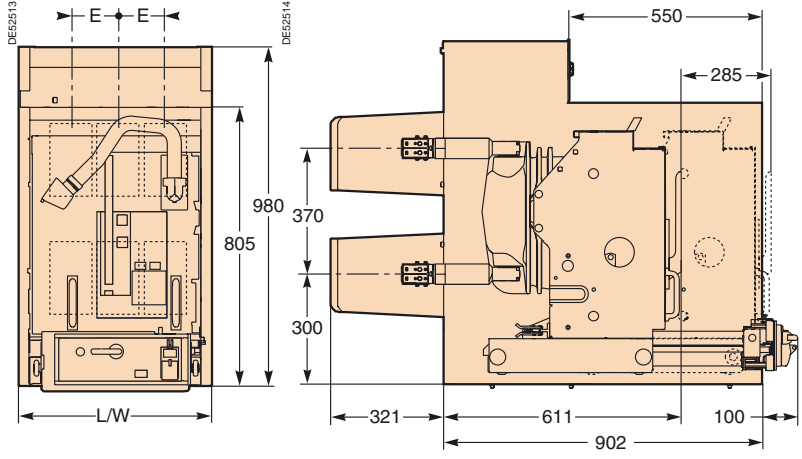
(3) Option.

(4) Interlocking device to be fitted to the cubicle door.

(5) Because the door is closed.

**Device**  
Basic withdrawable

C.B./Cassette	LF1/MC1	LF2/MC2	LF3/MC3
L/W	556	686	886
E (phase to phase)	145	185	240
Weight (kg)	245	285	325 (1250 A) 365 (2500 A) 435 (3150 A)



Only one of the boxes (ticked  or filled ) by the needed value) have to be considered between each horizontal line.

Orange box  corresponds to none priced functions.

<b>Basic withdrawable circuit breaker</b>		Quantity <input type="text"/>
Rated voltage $U_r$	(kV)	<input type="text"/>
Impulse voltage $U_p$	(kVbil)	<input type="text"/>
short-circuit current $I_{sc}$	(kA)	<input type="text"/>
Rated current $I_r$	(A)	<input type="text"/>
Frequency	50 Hz <input checked="" type="checkbox"/>	60 Hz <input type="checkbox"/>
Colour for push buttons and indicators	IEC standard	ANSI standard
Push buttons open/close:	Red/black <input checked="" type="checkbox"/>	
Indicator open/close:	Black/white <input type="checkbox"/>	Green/red <input type="checkbox"/>
Operating mechanism charged/discharged:	White/yellow <input checked="" type="checkbox"/>	Charge/discharge <input type="checkbox"/>

### Circuit breaker options

**1st opening release** (see possible choices in combination table below)

Shunt opening release **YO1**

24 Vdc <input checked="" type="checkbox"/>	60 Vdc <input checked="" type="checkbox"/>	220 Vdc <input checked="" type="checkbox"/>	220 Vac (50 Hz) <input checked="" type="checkbox"/>
30 Vdc <input checked="" type="checkbox"/>	110 Vdc <input checked="" type="checkbox"/>	48 Vac (50 Hz) <input checked="" type="checkbox"/>	120 Vac (60 Hz) <input checked="" type="checkbox"/>
48 Vdc <input checked="" type="checkbox"/>	125 Vdc <input checked="" type="checkbox"/>	110 Vac (50 Hz) <input checked="" type="checkbox"/>	240 Vac (60 Hz) <input checked="" type="checkbox"/>

**2nd opening release** (see possible choices in combination table below)

Shunt opening release **YO2**

24 Vdc <input type="checkbox"/>	60 Vdc <input type="checkbox"/>	220 Vdc <input type="checkbox"/>	220 Vac (50 Hz) <input type="checkbox"/>
30 Vdc <input type="checkbox"/>	110 Vdc <input type="checkbox"/>	48 Vac (50 Hz) <input type="checkbox"/>	120 Vac (60 Hz) <input type="checkbox"/>
48 Vdc <input type="checkbox"/>	125 Vdc <input type="checkbox"/>	110 Vac (50 Hz) <input type="checkbox"/>	240 Vac (60 Hz) <input type="checkbox"/>

Undervoltage release **YM**

24 Vdc <input type="checkbox"/>	60 Vdc <input type="checkbox"/>	220 Vdc <input type="checkbox"/>	220 Vac (50 Hz) <input type="checkbox"/>
30 Vdc <input type="checkbox"/>	110 Vdc <input type="checkbox"/>	48 Vac (50 Hz) <input type="checkbox"/>	120 Vac (60 Hz) <input type="checkbox"/>
48 Vdc <input type="checkbox"/>	125 Vdc <input type="checkbox"/>	110 Vac (50 Hz) <input type="checkbox"/>	240 Vac (60 Hz) <input type="checkbox"/>

Mitop (not available with seismic version)

Without contact  With contact

### Remote control

Electrical motor <b>M</b>	24...32 Vdc <input checked="" type="checkbox"/>	110...127 Vdc/ac <input type="checkbox"/>
	48...60 Vdc/ac <input checked="" type="checkbox"/>	220...250 Vdc/ac <input type="checkbox"/>

Shunt closing release **YF**

24 Vdc <input checked="" type="checkbox"/>	60 Vdc <input checked="" type="checkbox"/>	220 Vdc <input checked="" type="checkbox"/>	220 Vac (50 Hz) <input checked="" type="checkbox"/>
30 Vdc <input checked="" type="checkbox"/>	110 Vdc <input checked="" type="checkbox"/>	48 Vac (50 Hz) <input checked="" type="checkbox"/>	120 Vac (60 Hz) <input checked="" type="checkbox"/>
48 Vdc <input checked="" type="checkbox"/>	125 Vdc <input checked="" type="checkbox"/>	110 Vac (50 Hz) <input checked="" type="checkbox"/>	240 Vac (60 Hz) <input checked="" type="checkbox"/>

Locking C.B. in open position Ronis  Profalux

Sismic version (consult us)

Leaflets language French  English

### MC cassette

MC cassette type	MC1 <input type="checkbox"/>	MC2 <input type="checkbox"/>	MC3 <input type="checkbox"/>
Rated short circuit current $I_{sc}$		≤ 40 kA <input type="checkbox"/>	50 kA <input type="checkbox"/>
Rated current $I_r$	1250 A <input type="checkbox"/>	2500 A <input type="checkbox"/>	3150 A <input type="checkbox"/>

### MC cassette accessories

Racked in/out position contact 3 NO, 3 NC  6 NO, 6 NC

Pictogram of the circuit breaker  of the earthing switch

Circuit breaker spring mechanism discharge

Extraction table Quantity

Extra handle Quantity

Door with hinge, windows and pictogram

MC1  MC2  MC3

Accessories for door (local manufacturing): hinge, windows and pictogram

with front cover for MC1  MC2  MC3

Different releases combinations

Shunt opening releases <b>YO1/YO2</b>	1	2	1	1	2
Undervoltage release <b>YM</b>	1	1	1	1	1
Mitop			1	1	

# Guiding

TOOLS

## merlin-gerin.com

This international site allows you to access all the Merlin Gerin products in just 2 clicks via comprehensive range data-sheets, with direct links to:

- complete library: technical documents, catalogs, FAQs, brochures...
- selection guides from the e-catalog.
- product discovery sites and their Flash animations.

You will also find illustrated overviews, news to which you can subscribe, the list of country contacts...



## Training

Training allows you to acquire the Merlin Gerin expertise (installation design, work with power on, etc.) for increased efficiency and a guarantee of improved customer service. The training catalogue includes beginner's courses in electrical distribution, knowledge of MV and LV switchgear, operation and maintenance of installations, design of LV installations to give but a few examples.





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<i>General presentation</i>	6
<i>Panorama</i>	9
<i>LF circuit breakers fixed version</i>	11
<i>LF circuit breakers withdrawable version</i>	23
<b>Presentation</b>	<b>41</b>
<b>General characteristics</b>	<b>42</b>
<b>Description of functions</b>	<b>43</b>
RI stored energy operating mechanism	43
Wiring diagram	43
Opening circuit	44
Remote control	45
Indication and locking/interlocking	46
<b>Dimensions</b>	<b>47</b>
<b>Order form</b>	<b>48</b>



PE63621



### Description of the device

#### The basic version of the LFP circuit breaker comprises:

- 3 pole-units incorporated each in an insulating enclosure of the "sealed pressure system" type. The sealed assembly is filled with SF6 at low pressure
- a RI type operating mechanism
- a front panel housing the manual operating mechanism and the status indicators
- upstream and downstream terminals for power circuit connection
- a terminal block for connection of the external auxiliary circuits
- two pressure switches for permanent monitoring of the circuit breaker on each of the 3 pole-units:
  - a pressure switch with a high threshold contact for pressure rise indication
  - a pressure switch with two low threshold contacts for indication of an eventual drop in pressure.

#### Options:

- a supporting frame equipped with rollers and ground fixing brackets for simplified handling and installation
- circuit breaker locking in open position by keylock installed on the front plate of the operating mechanism
- a Harting brand multipin socket for the connected of low voltage auxiliary circuits.

### Application

The Merlin Gerin LFP circuit breaker is a three-pole indoor circuit breaker using SF6 technology.

It ensures the operation and protection of networks at the a.c. generator outlet side of hydraulic power plants or gas turbines and of networks supplying thermal or nuclear power plant auxiliaries.

It complies with IEC 62271-100.


**Electrical characteristics according to IEC 62271-100**

Rated voltage	<b>Ur</b>	kV 50/60 Hz	12	15	17.5		
Insulation voltage							
- power frequency withstand	<b>Ud</b>	kV 50 Hz 1min	28 (*)		38 (*)	38 (*)	
- lightning impulse withstand	<b>Up</b>	kV peak	75		95 (*)	95 (*)	
Rated current	<b>Ir</b>	A 5000	■	■	■	■	■
Short circuit current	<b>Isc</b>	kA	40	50	40	25	31.5
		Asymmetry (%)	50	30	30	100	30
Short time withstand current	<b>I<sub>k</sub>/t<sub>k</sub></b>	kA/3 s	40	50	40	25	31.5
Short-circuit making current	<b>I<sub>p</sub></b>	kA peak 50 Hz	100	125	100	63	79
Rated switching sequence		O-3 min-CO-3 min-CO	■	■	■	■	■
Operating times		Opening ms	48				
		Breaking ms	70				
		Closing ms	65				
Service temperature	<b>T</b>	°C	-25 to +40				

(\*) For higher values: consult us  
 ■ Available.

# Description of functions

## RI stored energy operating mechanism

### Wiring diagram

PE65626



#### Operation of the RI stored energy operating mechanism

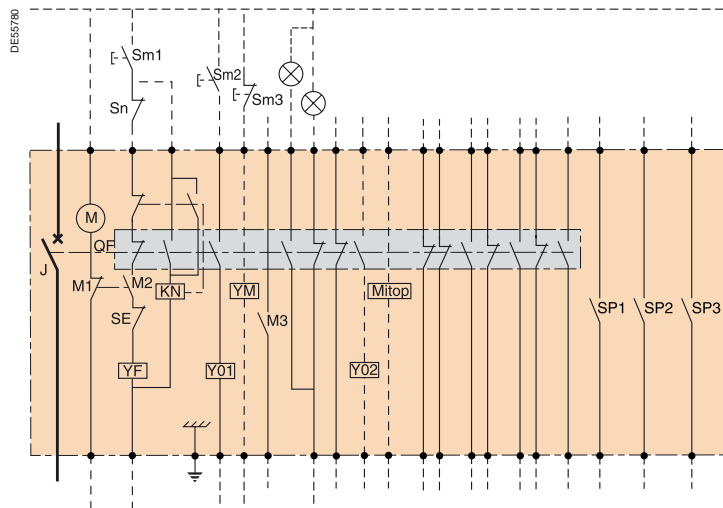
This mechanism guarantees the device an opening and closing speed unaffected by the operator, for both electric and manual orders.

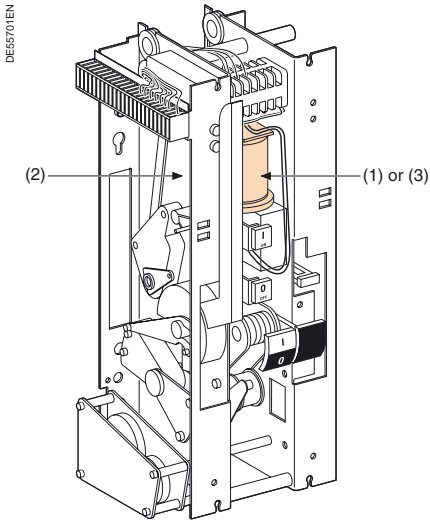
It carries out the O and CO cycles and is automatically recharged by a gear motor after closing. It consists of:

- the stored energy operating mechanism which stores in springs the energy required to open and close the device
- a gear motor electrical charging device with manual charging by lever (useful on loss of auxiliary supply)
- manual order devices by push buttons on the front panel of the device (red and black)
- an electrical remote closing device containing a release with an antipumping relay
- an electrical opening device containing one or more releases, for example:
  - shunt trip devices
  - Mitop, a low consumption release, used only with the Sepam 100 LA protection relay.
- an operation counter
- a position indication device by mechanical indicator (black and white) and a module of 14 auxiliary contacts whose availability varies according to the diagram used
- a device for indicating “charged” operating mechanism status by mechanical indicator and electrical contact
- a double contact pressure switch is activated when the gas pressure reduces below:
  - 1st stage: 0.18 MPa (relative pressure: 1.8 bar)
  - 2nd stage: 0.1 MPa (relative pressure: 1 bar)
- a single contact pressure switch is activated when the gas pressure exceeds 0.4 MPa (relative pressure: 4 bar).

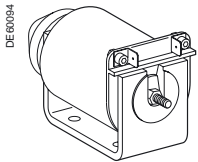
#### Wiring diagram

- J** Circuit breaker
- KN** Anti-pumping relay
- M** Spring charging motor
- M1-M2** End-of-charging contacts
- M3** Operating mechanism charged” indication contact
- QF** Circuit breaker auxiliary contacts
- SE** Trip indication maintained contact
- Sm1** Closing pushbutton (external)
- Sm2** Opening pushbutton for shunt release (external)
- Sm3** Opening pushbutton for undervoltage release (external)
- Sn** Closing disable contact (external)
- SP1** Pressure-switch contact
- SP2** Pressure-switch contact
- SP3** Pressure-switch contact
- YF** Closing release
- Y01-Y02** Shunt opening releases
- YM** Undervoltage opening release
- Mitop** Mitop opening release (autonomous)

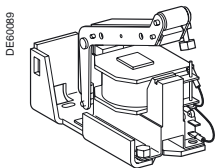




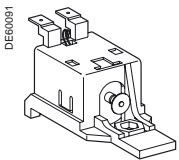
Operating mechanism



Shunt opening release (1)



Undervoltage release (2)



Low energy release (3)

### Composition

The opening circuit can be produced using the following components:

- shunt opening release (on energizing) (YO1)
- second shunt opening release (on energizing) (YO2)
- undervoltage release (YM)
- low energy release (Mitop).

**Note:** see the table of the releases' combinations "Order form" page.

### Shunt opening release (YO1 and YO2)

Energizing this unit causes instant opening of the circuit breaker.

#### Characteristics

Power supply	See "Order form" page	
Threshold	V AC	0.85 to 1.1 Ur
	V DC	0.7 to 1.1 Ur
Consumption	V AC	160 VA
	V DC	50 W

### Undervoltage release (YM)

This release unit causes the systematic opening of the circuit breaker when its supply voltage drops below a value less than 35% of the rated voltage, even if this drop is slow and gradual. It can open the circuit breaker between 35% and 70% of its rated voltage. If the release unit is not supplied power, manual or electrical closing of the circuit breaker is impossible. Closing of the circuit breaker is compulsory when the supply voltage of the release unit reaches 85% of its rated voltage.

#### Characteristics

Power supply	See "Order form" page		
Threshold	Opening	0.35 to 0.7 Ur	
	Closing	0.85 Ur	
Consumption	Triggering	V AC	400 VA
		V DC	100 W
	Latched	V AC	100 VA
		V DC	10 W

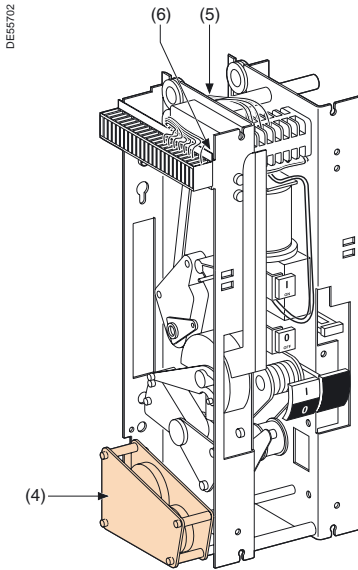
### Low energy release (Mitop)

This specific release unit comprises a low consumption unit and is specifically used for Sepam 100LA self-powered relays.

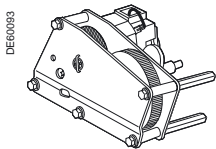
#### Characteristics

Power supply	Direct current
Threshold	0.6 A < I < 3 A

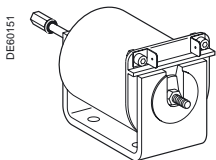
Any tripping due to the Mitop release unit is momentarily indicated by an SDE type changeover contact.



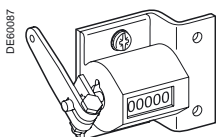
Operating mechanism



Electrical motor and gearing (4)



Shunt closing release (5)



Operation counter (6)

### Function

Remote control enables the remote opening and closing of the circuit breaker.

### Composition

The remote control mechanism comprises:

- an electrical motor with gearing
- a shunt closing release (YF) combined with an anti-pumping device
- an operation counter.

### Electrical motor with gearing (M)

The electrical motor arms and re-arms the stored energy unit as soon as the circuit breaker is closed. This allows the instant closing of the device after opening. The arming lever is only used as a back-up operating mechanism in the case of any auxiliary power supply. The M3 contact indicates the end of arming operations.

#### Characteristics

Power supply	See "Order form" page	
Threshold	V AC/V DC	0.85 to 1.1 Ur
Consumption	V AC	380 VA
	V DC	380 W

### Shunt closing release (YF)

This allows the remote closing of the circuit breaker when the operating mechanism is armed.

#### Characteristics

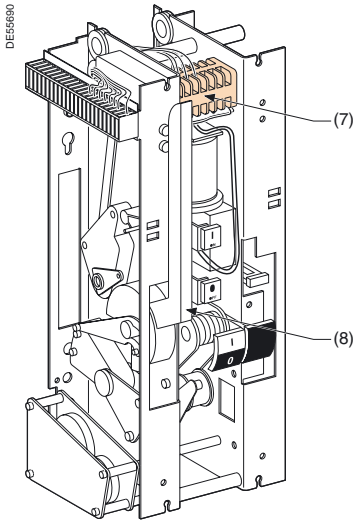
Power supply	See "Order form" page	
Threshold	V AC	0.85 to 1.1 Ur
	V DC	0.85 to 1.1 Ur
Consumption	V AC	160 VA
	V DC	50 W

The anti-pumping relay enables the guaranteeing of opening priority in the case of a permanent closing order. This therefore avoids the device being caught in a uncontrolled opening-closing loop.

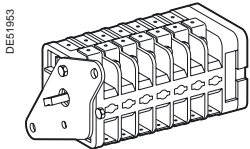
### Operation counter

The operation counter is visible on the front panel.

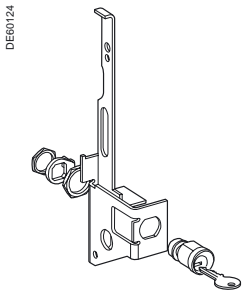
It displays the number of switching cycles (CO) that the device has carried out.



Operating mechanism



Auxiliary contacts (7)



Keylocking kit (8)

### “Open/closed” auxiliary contacts

The number of contacts available depends on the options chosen on the operating mechanism.

In the basic configuration, the circuit breaker’s operating mechanism comprises a total of:

- 5 normally closed contacts (NC)
- 5 normally open contacts (NO)
- 1 changeover contact (CHG).

The usage procedure for auxiliary contacts is given in the following table:

Options	NC contact	NO contact
Shunt opening release (each one)	0	1
Undervoltage release	0	0
Low energy release (Mitop)	0	0

In order to know the final number of available contacts, you must deduct the total number of contacts included in the circuit breaker (5 NC + 5 NO + 1 CHG), the number of contacts used given in the table above.

**E.g.:** a circuit breaker equipped with a remote control and a shunt trip unit has the following available contacts:

5 NC + 4 NO + 1 CHG.

With an undervoltage release instead of the shunt trip, this circuit breaker would have the following available contacts:

5 NC + 5 NO + 1 CHG.

Shunt opening release combination			
1st release	Shunt opening release YO1	Undervoltage release YM	Mitop
2nd release			
Without	5NC + 4NO + 1CHG	5NC + 5NO + 1CHG	5NC + 5NO + 1CHG
Shunt opening release YO2	5NC + 3NO + 1CHG	5NC + 4NO + 1CHG	5NC + 4NO + 1CHG
Undervoltage release YM	5NC + 4NO + 1CHG		5NC + 5NO + 1CHG
Mitop	5NC + 4NO + 1CHG	5NC + 5NO + 1CHG	

### Locking the circuit breaker in the “open” position

This key-operated device allows the circuit breaker to be locked in the “open” position. The circuit breaker is locked in the open position by blocking the opening push button in the “engaged” position.

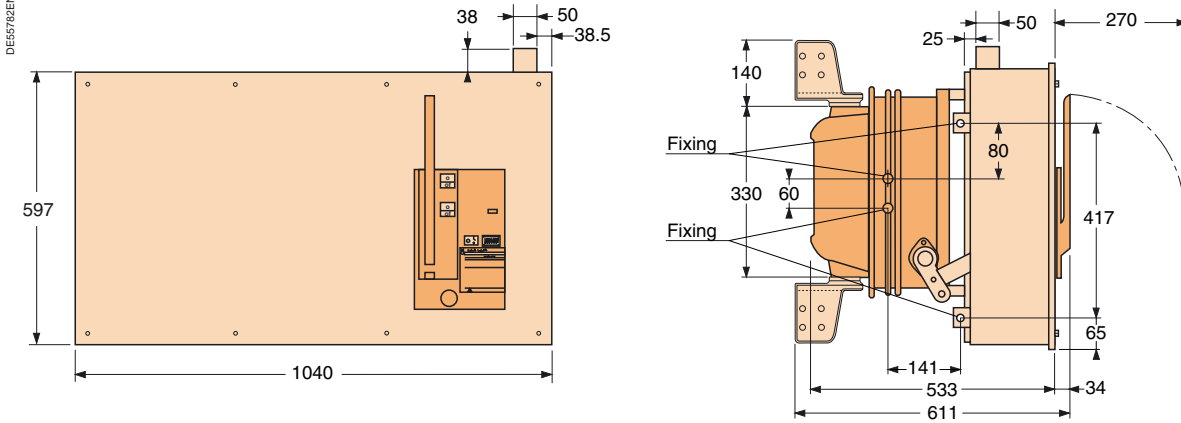
Locking is achieved using a Profalux or Ronis captive key type keylock.



**Device**

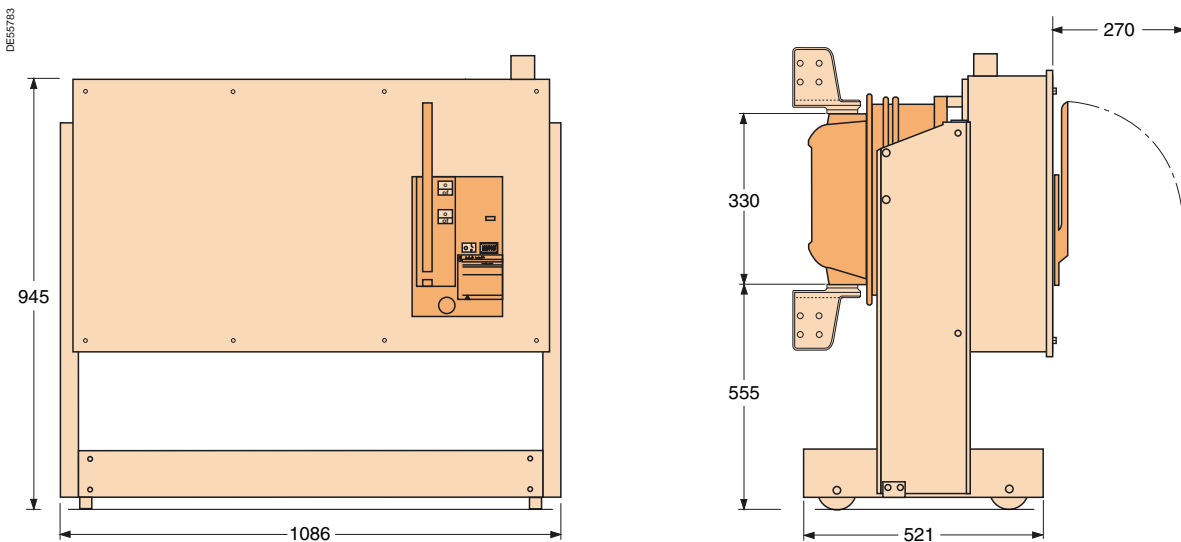
**Basic fixed**

Weight: 270 kg



**Fixed with a support frame**

Weight: 310 kg



**Specific points**

**Climatic conditions**

-25°C to +40°C.

**Standard packaging**

Basic fixed: packaging on untreated wooden pallet.

Fixed with frame: packaging on 2 untreated wooden pallets.

Only one of the boxes (ticked  or filled ) by the needed value) have to be considered between each horizontal line.  
 Orange box  corresponds to none priced functions.

<b>Basic fixed circuit breaker</b>		Quantity <input type="text"/>
Rated voltage $U_r$	(kV)	<input type="text"/>
Impulse voltage $U_p$	(kVbil)	<input type="text"/>
short-circuit current $I_{sc}$	(kA)	<input type="text"/>
Rated current $I_r$	(A)	<input type="text"/>
Frequency	50 Hz <input checked="" type="checkbox"/>	60 Hz <input type="checkbox"/>
Colour for push buttons and indicators	IEC standard	ANSI standard
Push buttons open/close:	Red/black <input checked="" type="checkbox"/>	
Indicator open/close:	Black/white <input type="checkbox"/>	Green/red <input type="checkbox"/>
Operating mechanism charged/discharged:	White/yellow <input checked="" type="checkbox"/>	Charge/discharge <input type="checkbox"/>

### Circuit breaker options

**1st opening release** (see possible choices in combination table below)

Shunt opening release **YO1**

24 Vdc <input checked="" type="checkbox"/>	60 Vdc <input checked="" type="checkbox"/>	220 Vdc <input checked="" type="checkbox"/>	220 Vac (50 Hz) <input type="checkbox"/>
30 Vdc <input type="checkbox"/>	110 Vdc <input type="checkbox"/>	48 Vac (50 Hz) <input type="checkbox"/>	120 Vac (60 Hz) <input type="checkbox"/>
48 Vdc <input type="checkbox"/>	125 Vdc <input type="checkbox"/>	110 Vac (50 Hz) <input type="checkbox"/>	240 Vac (60 Hz) <input type="checkbox"/>

**2nd opening release** (see possible choices in combination table below)

Shunt opening release **YO2**

24 Vdc <input type="checkbox"/>	60 Vdc <input type="checkbox"/>	220 Vdc <input type="checkbox"/>	220 Vac (50 Hz) <input type="checkbox"/>
30 Vdc <input type="checkbox"/>	110 Vdc <input type="checkbox"/>	48 Vac (50 Hz) <input type="checkbox"/>	120 Vac (60 Hz) <input type="checkbox"/>
48 Vdc <input type="checkbox"/>	125 Vdc <input type="checkbox"/>	110 Vac (50 Hz) <input type="checkbox"/>	240 Vac (60 Hz) <input type="checkbox"/>

Undervoltage release **YM**

24 Vdc <input type="checkbox"/>	60 Vdc <input type="checkbox"/>	220 Vdc <input type="checkbox"/>	220 Vac (50 Hz) <input type="checkbox"/>
30 Vdc <input type="checkbox"/>	110 Vdc <input type="checkbox"/>	48 Vac (50 Hz) <input type="checkbox"/>	120 Vac (60 Hz) <input type="checkbox"/>
48 Vdc <input type="checkbox"/>	125 Vdc <input type="checkbox"/>	110 Vac (50 Hz) <input type="checkbox"/>	240 Vac (60 Hz) <input type="checkbox"/>

Mitop

Without contact  With contact

**Remote control**

Electrical motor **M**

24...32 Vdc <input checked="" type="checkbox"/>	110...127 Vdc/ac <input type="checkbox"/>
48...60 Vdc/ac <input checked="" type="checkbox"/>	220...250 Vdc/ac <input type="checkbox"/>

Shunt closing release **YF**

24 Vdc <input checked="" type="checkbox"/>	60 Vdc <input checked="" type="checkbox"/>	220 Vdc <input checked="" type="checkbox"/>	220 Vac (50 Hz) <input type="checkbox"/>
30 Vdc <input type="checkbox"/>	110 Vdc <input type="checkbox"/>	48 Vac (50 Hz) <input type="checkbox"/>	120 Vac (60 Hz) <input type="checkbox"/>
48 Vdc <input type="checkbox"/>	125 Vdc <input type="checkbox"/>	110 Vac (50 Hz) <input type="checkbox"/>	240 Vac (60 Hz) <input type="checkbox"/>

Low voltage wiring connection	Male plug (1.2 m) <input type="checkbox"/>	Female socket (2 m) <input type="checkbox"/>
Locking C.B. in open position	Ronis <input type="checkbox"/>	Profalux <input type="checkbox"/>
Support frame	<input type="text"/>	
Leaflets language	French <input checked="" type="checkbox"/>	English <input type="checkbox"/>

*Different releases combinations*

Shunt opening releases <b>YO1/YO2</b>	1		2	1	1	
Undervoltage release <b>YM</b>		1		1		1
Mitop			1		1	1



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