Medium voltage
distribution

LFP: High power circuit breaker Merlin Gerin

1 to 17.5 kV

Merlin Gerin
Modicon
Square D
Telemecanique

Schneider Electric
We do more with electricity

Presentation

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 56.

The advantages of tried and tested technology

Safety and security
The breaking medium is sulphur hexafluoride (SF6) used at low pressure. The insulating enclosure containing the pole-unit are equipped with safety membranes and an alarm unit in the event of overpressure.

With self-expansion, the breaking technique used in LFP circuit breakers, all current types, capacitive and inductive, can be made or broken without generating overvoltage which could damage your installation.
Moreover, the nominal features, normal current breaking under normal voltage, are maintained at 0 relative bar of SF6.

Reliability
The motor charged spring stored energy operating mechanism is a key factor of device reliability: Schneider draws on 30 years of experience on this type of mechanism, 180,000 of which are already in operation.
Schneider's mastery of design and checking of sealed systems guarantees sustained device performance well at least 30 years.

Endurance
The mechanical and electrical endurance of LFP circuit breaker is superior to those recommended by the IEC.
The LFP circuit breaker has successfully passed mechanical endurance tests for well over 10,000 switching operations, it is able of breaking its short-circuit current over 15 times and its nominal current 2,000 times.

Maintenance
Throughout device 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 5 years or every 5,000 operations.
The poles do not require maintenance but diagnosis is possible:
■ contact wear can be checked by external measurement on the poles or, if the installation includes a Sepam 2000 unit, by measuring the cumulated broken kA^2;
■ SF6 pressure can be permanently monitored through the dual-threshold pressure switch, with the device's performance levels being guaranteed up to the pressure switch threshold.

Environmentally-friendly

The LFP circuit breaker is manufactured and is designed to ensure protection of the environment:
- the materials used, both insulating and conductive, are identified, and easy to separate and recycle;
- the SF6 can be recovered at end of service life and re-used after treatment;
- the production site is ISO 14001 certified.



Quality assurance

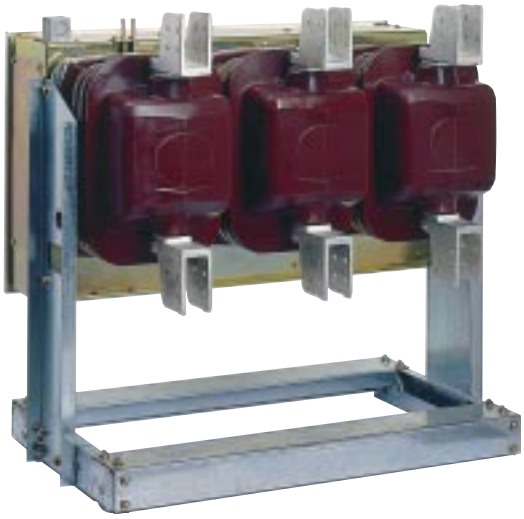
Each circuit breaker undergoes systematic routine tests in order to check quality and conformity:
- pole sealing check;
- checking proper mechanical operation of the device, plus its associated locking mechanisms;
- checking simultaneous closing of contacts;
- checking power frequency insulation level;
- checking main circuit resistance;
- checking auxiliary circuit insulation;
- checking switching speeds;
- checking switching cycle;
- measuring switching times.

The results are recorded on the test certificate for each device.
The entire circuit breaker creation and manufacturing process undergoes quality control in accordance with the requirements of the French Quality Assurance Association (AFAQ): ISO 9001 and ISO 9002 certification.

Description of the device

The basic fixed version consists of:
■ 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.



LFP on supporting frame, rear view

Technical features

IEC 60056								
rated voltage	kV, 50/60 Hz		12		15		17.5	
insulation level	kV, rms 50 Hz - 1 min		28*		38*		38*	
	kV, impulse 1.2/50 µs		75*		95*		95*	
rated current	A		5000		5000		5000	
breaking capacity Isc	kA, rms		40	50	40		31.5	25
	asymmetry (%)		50	30	30		30	100
making capacity	kA, peak		100	125	100		79	62.5
permissible short time withstand current	kA, rms 3 s		40	50	40		31.5	25
capacitor breaking capacity	A		1200		1200		1200	
rated switching sequence	O - 3 min - CO - 3 min - CO		■		■		■	
operating times	ms	opening	48		48		48	
		breaking	70		70		70	
		closing	65		65		65	

(*) For higher values: please consult us.

Principle of the self-expansion breaking technique

This technique is the result of many years' experience in SF6 technology and of major research work.
It combines the effect of thermal expansion to the rotating arc technique in order to create arc blowing and quenching conditions.
The result is reduced stored energy and arcing contact erosion, i.e. increased mechanical and electrical endurance.

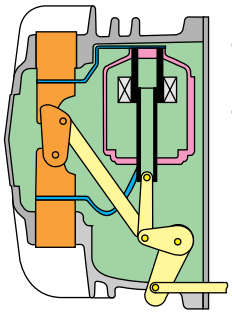


Fig. 1

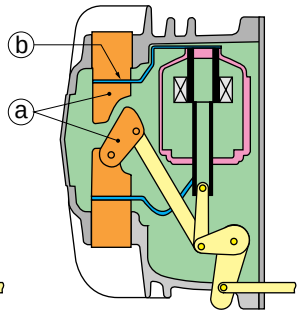


Fig. 2

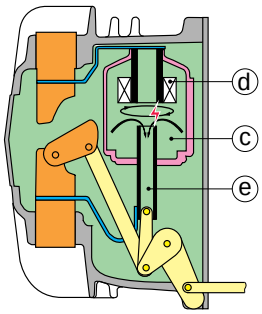


Fig. 3

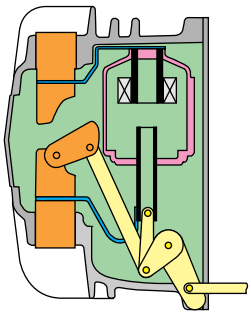


Fig. 4

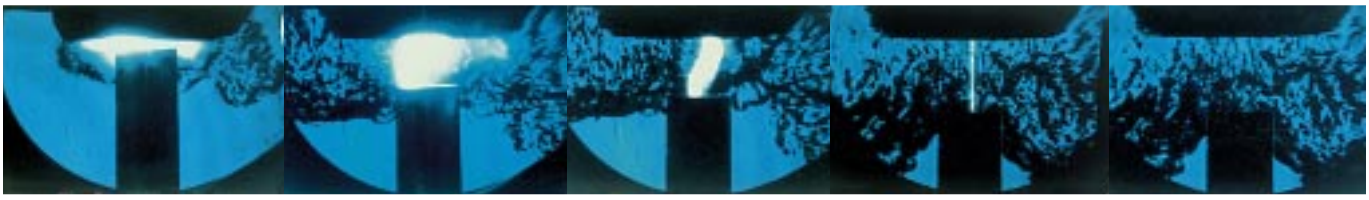
The operating sequence of a self-expansion breaking chamber whose moving part is driven by the mechanical operating mechanism is as follows:

Fig. 1: the circuit breaker is closed.

Fig. 2: on opening of the main contacts (a), the current is shunted into the breaking circuit (b).

Fig. 3: on separation of the arcing contacts, an electric arc appears in the expansion volume (c). This 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) and resulting in arc quenching when the current passes through the zero point.

Fig. 4: the circuit breaker is open.



Electric arc in a self-expansion breaking chamber.

RI stored energy operating mechanism

RI operating mechanism

Operation of the mechanical 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,
  - □ undervoltage releases with time delay adjustable from 1 to 3 sec,
  - □ 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.

Opening release combination choices (1)

1st release / 2nd release	single shunt release (Y01)	undervoltage release (YM)	MITOP
without	5NO - 4NC - 1I	5NO - 5NC - 1I	5NO - 5NC - 1I
single shunt release (Y02)	5NO - 3NC - 1I (2)	5NO - 4NC - 1I	5NO - 4NC - 1I
undervoltage release (YM)	5NO - 4NC - 1I		5NO - 5NC - 1I
MITOP	5NO - 4NC - 1I	5NO - 5NC - 1I	

Number of contacts available:
NO: normally open
NC: normally closed
I: changeover

(1) For other combinations: please consult us

(2) 2 single coil association

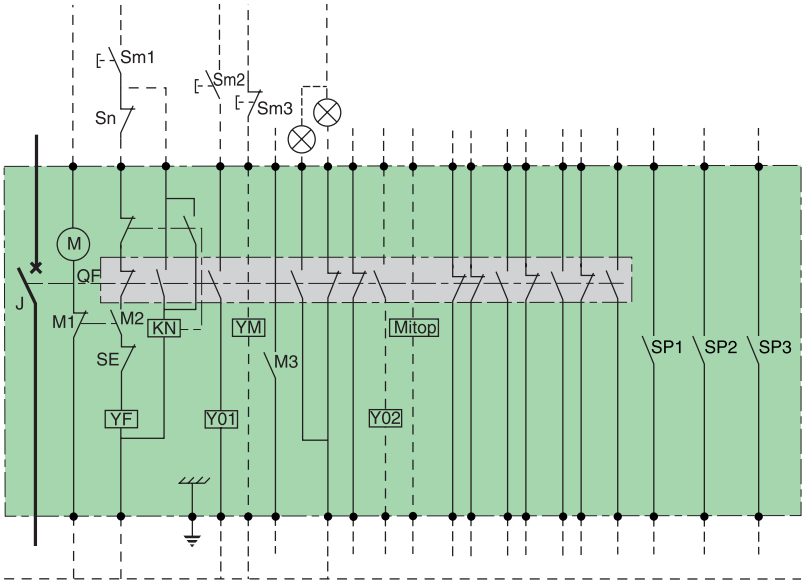
RI operating mechanism low voltage auxiliaries

	electrical spring charging M	closing release YF	opening releases YO1, YO2	YM	MITOP
supply voltages					
AC (V) 50 Hz	48-110-220	48-110-220	48-110-220		Sepam 100 LA supply
AC (V) 60 Hz	120-240	120-240	120-240		Sepam 100 LA supply
DC (V)	24-30-48-60-110-125-220	24-30-48-60-110-125-220	24-30-48-60-110-125-220		Sepam 100 LA supply
consumptions					
AC	340 VA	160 VA	160 VA	100 VA	
DC	340 W	50 W	50 W	10 W	

Diagrams

Without low voltage plug

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)



With low voltage plug

J Circuit breaker
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M1-M2 End-of-charging contacts
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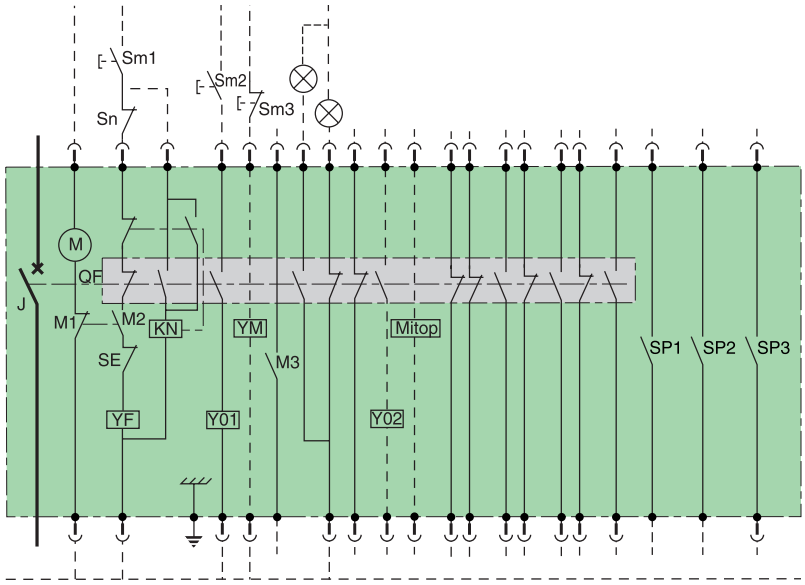
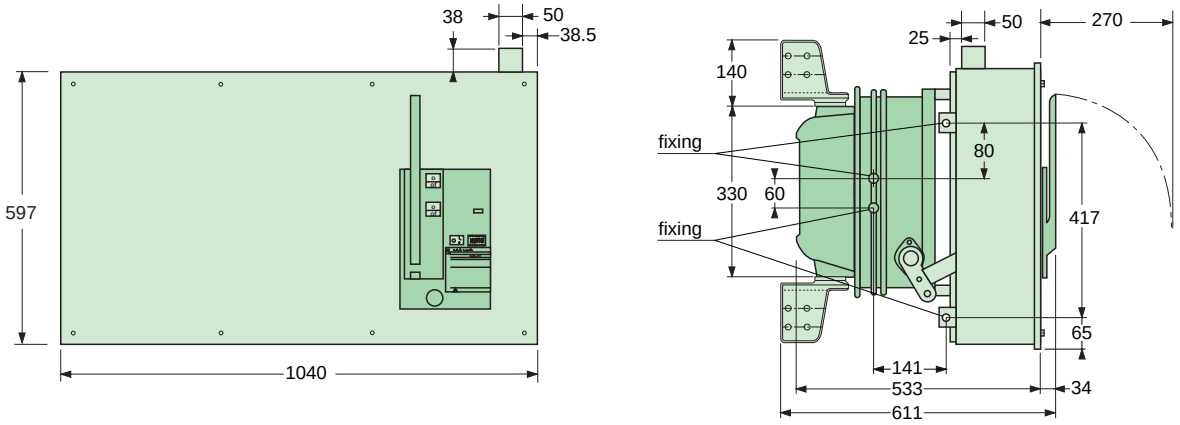


Dimensions and weights

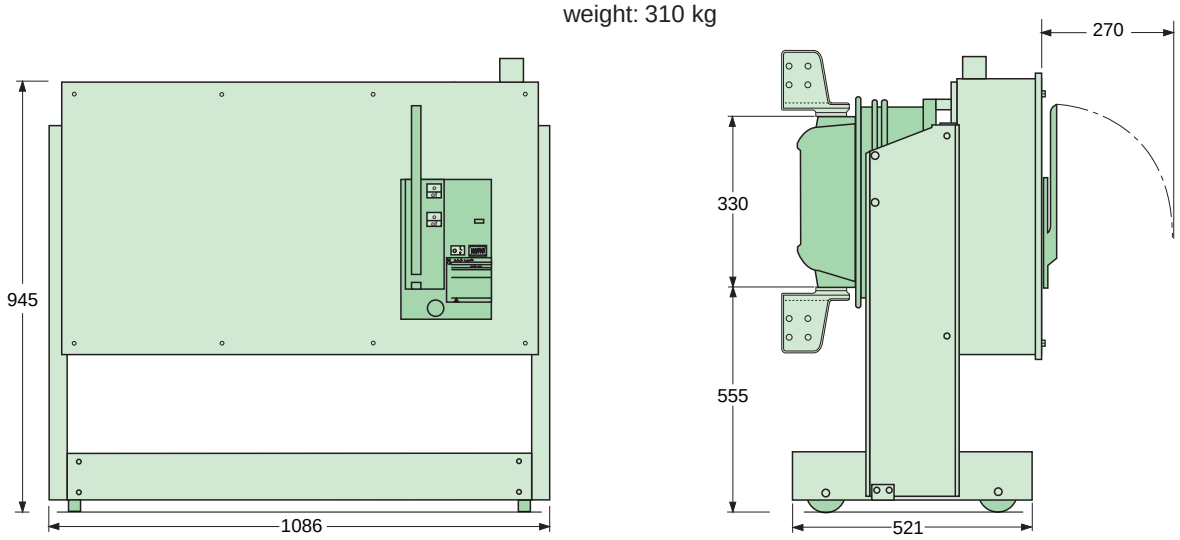
Basic fixed assembly

weight: 270 kg



Fixed assembly with supporting frame

weight: 310 kg



Specific points

Conditions for use

The circuit breaker operates in the following atmospheric and climatic conditions:

■ climatic conditions(1): - 5°C to + 40°C.

Standard packaging

Basic fixed assembly: packaging on untreated wooden pallet.

Fixed assembly with frame: packaging on 2 untreated wooden pallets.

(1) For other values, please consult us.

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A consistent design of offers from Medium Voltage to Ultra terminal

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.

Prefabricated and tested solutions, upstream and downstream from the device complying with the IEC 60439-1 switchboard standard.

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, Isc, 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 Compatibilty (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.

Contents

Presentation

PE55821

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.

The advantages of tried and tested technology

Safety and security

The breaking medium is sulphur hexafluoride (SF6) used at low pressure.
The insulating enclosure containing the pole-unit are equipped with safety membranes and an alarm unit in the event of overpressure.
With self-expansion, the breaking technique used in LFP circuit breakers, all current types, capacitive and inductive, can be made or broken without generating overvoltage which could damage your installation.
Moreover, the nominal features, normal current breaking under normal voltage, are maintained at 0 relative bar of SF6.

Reliability

The motor charged spring stored energy operating mechanism is a key factor of device reliability: Schneider Electric draws on 30 years of experience on this type of mechanism, 180,000 of which are already in operation.
Schneider Electric's mastery of design and checking of sealed systems guarantees sustained device performance well at least 30 years.

Endurance

The mechanical and electrical endurance of LFP circuit breaker is superior to those recommended by the IEC.
The LFP circuit breaker has successfully passed mechanical endurance tests for well over 10,000 switching operations, it is able of breaking its short-circuit current over 15 times and its nominal current 2,000 times.

Maintenance

Throughout device 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 5 years or every 5,000 operations.
The poles do not require maintenance but diagnosis is possible:
■ contact wear can be checked by external measurement on the poles or, if the installation includes a Sepam unit, by measuring the cumulated broken kA^2;
■ SF6 pressure can be permanently monitored through the dual-threshold pressure switch, with the device's performance levels being guaranteed up to the pressure switch threshold.

Presentation (cont.)

DE55746

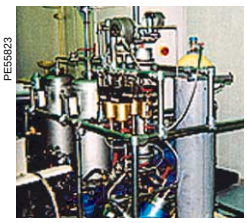
Environmentally-friendly

The LFP circuit breaker is manufactured and is designed to ensure protection of the environment:

- the materials used, both insulating and conductive, are identified, and easy to separate and recycle
- the SF6 can be recovered at end of service life and re-used after treatment
- the production site is ISO 14001 certified.

PE55822

PE55823



PE55824

DE55745

Quality assurance

Each circuit breaker undergoes systematic routine tests in order to check quality and conformity:

- pole sealing check
- checking proper 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 switching speeds
- checking switching cycle
- measuring switching times.

The results are recorded on the test certificate for each device.
The quality system for the design and production of LFP range circuit breakers is certified in conformity with ISO 9001: 2000 quality assurance standard requirements.
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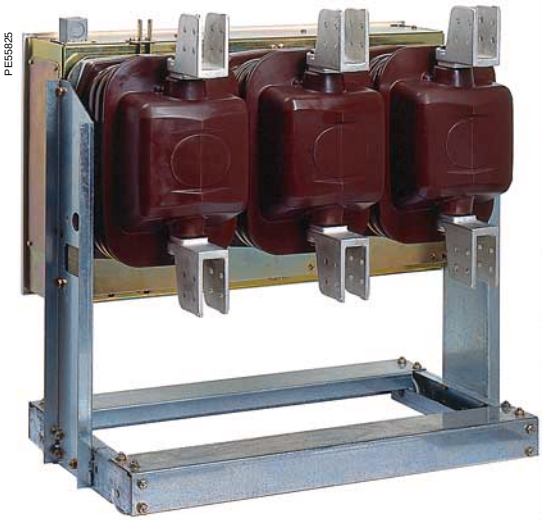
Description of the device

The basic fixed version consists of:

■ 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.



LFP on supporting frame, rear view

Electrical features according to IEC 62271-100

Rated voltage	kV, 50/60 Hz		**12**		**15**	**17.5**		
Insulation level	kV, rms 50 Hz - 1 min		28*		38*	38*		
	kV, impulse 1.2/50 µs		75*		95*	95*		
Rated current	A		5000		5000	5000		
Breaking capacity Isc	kA, rms		40	50	40	31.5	25	
	asymmetry (%)		50	30	30	30	100	
Making capacity	kA, peak		100	125	100	79	62.5	
Permissible short time withstand current	kA, rms 3 s		40	50	40	31.5	25	
Capacitor breaking capacity	A		1200		1200	1200		
Rating switching sequence	O - 3 min - CO - 3 min - CO		■		■	■		
Operating times	ms	Opening	48		48	48		
		Breaking	70		70	70		
		Closing	65		65	65		

(*) For higher values: please consult us.

Description of the device (cont.)

Principle of the self-expansion breaking technique

LFP 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:

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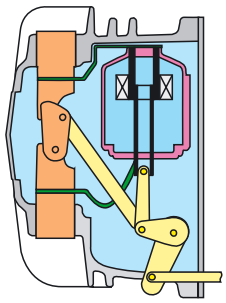

■ the circuit breaker is closed

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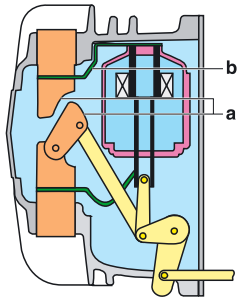

■ on opening of the main contacts (a) the current is shunted into the breaking circuit (b)

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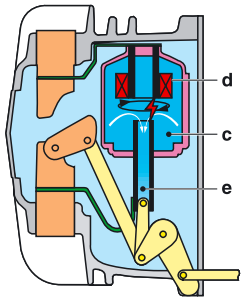
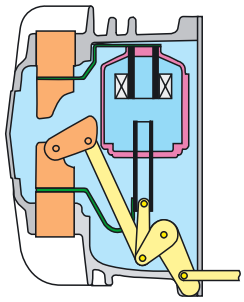


■ on separation of the arcing contacts, an electrical arc appears in the expansion volume (c). The arc rotates under the effect of the magnetic field created by the coil (d) through which flows the current to be broken: the overpressure created by the temperature build-up of the gas in the expansion 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

DE51245



■ the circuit breaker is open.

Electrical arc in a self-expansion breaking chamber

PE55764

RI stored energy operating mechanism


PE55826

Operation of the mechanical 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:
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  - 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.

Opening release combination choices(1)

1st release / 2nd release	Single shunt release (Y01)	Undervoltage release (YM)	Mitop
Without	5NO - 4NC - 1I	5NO - 5NC - 1I	5NO - 5NC - 1I
Single shunt release (Y02)	5NO - 3NC - 1I (2)	5NO - 4NC - 1I	5NO - 4NC - 1I
Undervoltage release (YM)	5NO - 4NC - 1I		5NO - 5NC - 1I
Mitop	5NO - 4NC - 1I	5NO - 5NC - 1I	

Number of contacts available:
NO: normally open
NC: normally closed
I: changeover

(1) For other combinations: please consult us

(2) 2 single coil association

RI operating mechanism low voltage auxiliaries

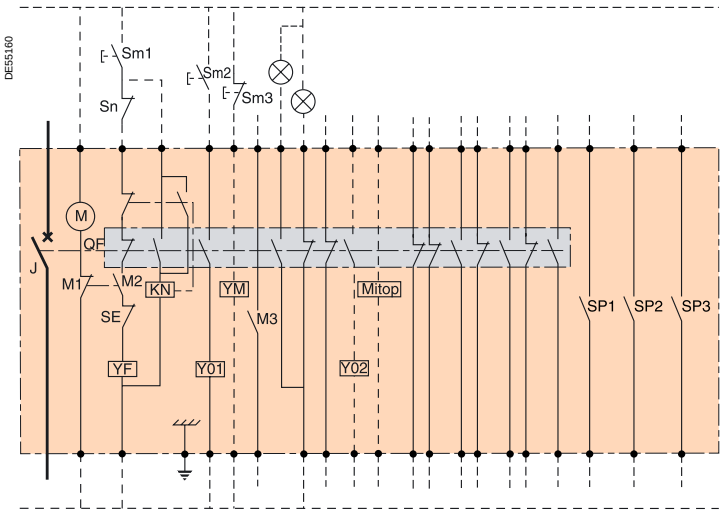
	Electrical spring charging	Closing release	Opening releases		
	M	YF	YO1, YO2	YM	Mitop
Supply voltages					
AC (V) 50 Hz	48-110-220	48-110-220	48-110-220		Sepam 100 LA supply
AC (V) 60 Hz	120-240	120-240	120-240		Sepam 100 LA supply
DC (V)	24-30-48-60-110-125-220	24-30-48-60-110-125-220	24-30-48-60-110-125-220		Sepam 100 LA supply
Consumptions					
AC	340 VA	160 VA	160 VA	100 VA	
DC	340 W	50 W	50 W	10 W	

RI stored energy operating mechanism (cont.)

Diagrams

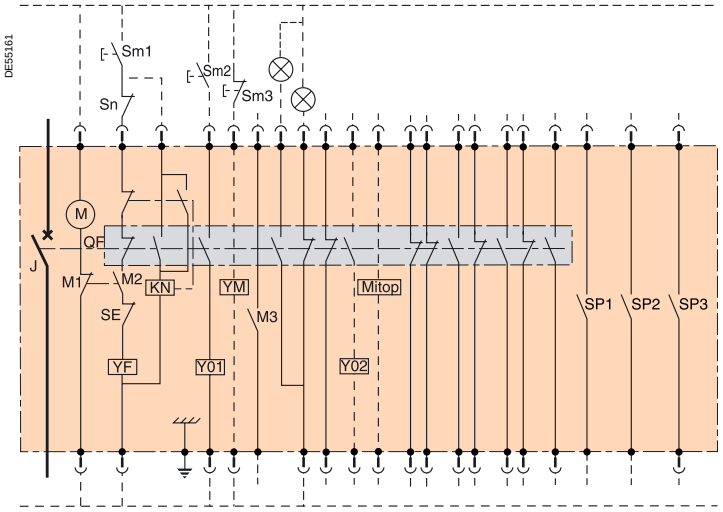
Without low voltage plug

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)



With low voltage plug

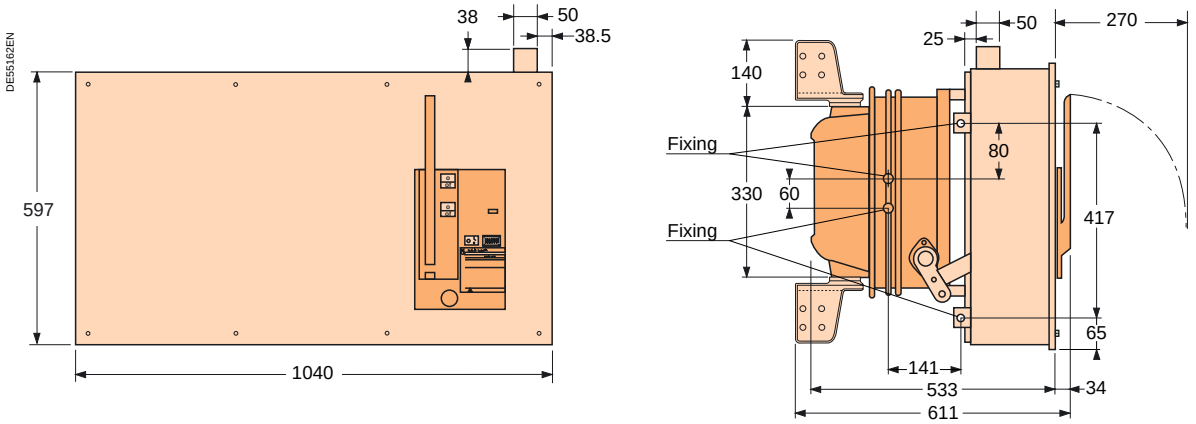
J	Circuit breaker
KN	Anti-pumping relay
M	Spring charging motor
M1-M2	End-of-charging contacts
M3	“Operating mechanism charged” indication contact
QF	Circuit breaker auxiliary contacts
SE	Trip indication maintained contact
Sm1	Closing pushbutton (external)
Sm2	Opening pushbutton for shunt release (external)
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)



Dimensions and weights

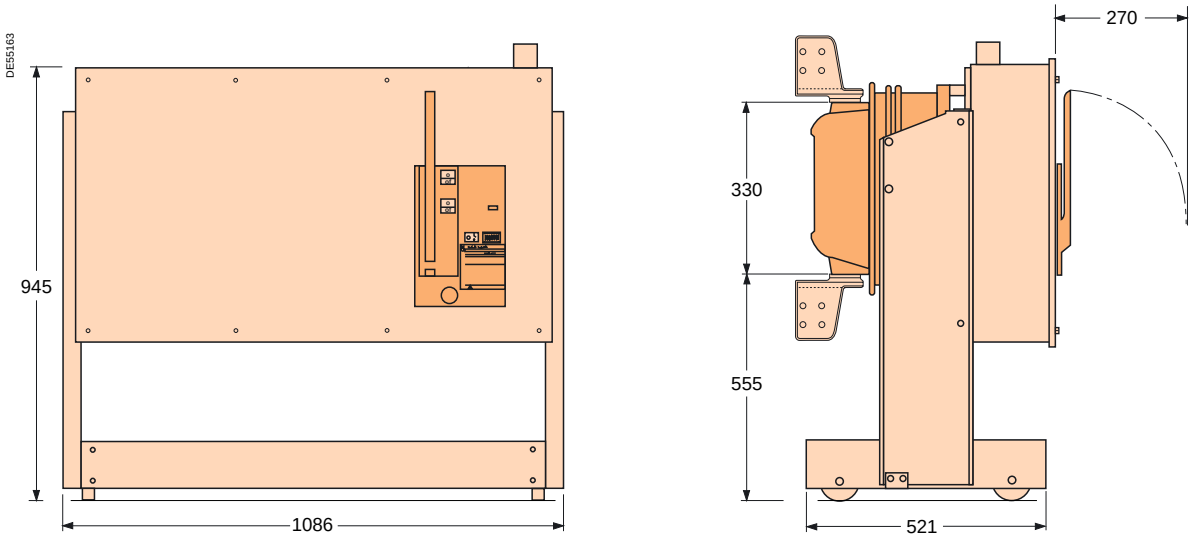
Basic fixed assembly

Weight: 270 kg



Fixed assembly with supporting frame

Weight: 310 kg



Specific points

Conditions for use

The circuit breaker operates in the following atmospheric and climatic conditions:
Climatic conditions: – 5°C to +40°C *(For other values, please consult us)*.

Standard packaging

Basic fixed assembly: packaging on untreated wooden pallet.
Fixed assembly with frame: packaging on 2 untreated wooden pallets.

MV Distribution
Circuit-breakers
LF1 - LF2 - LF3
1 to 17.5 kV

GROUPE SCHNEIDER

■ Merlin Gerin ■ Square D ■ Telemecanique

Contents

Presentation

Application

The Merlin Gerin LF circuit-breakers are three-pole indoor circuit-breakers using SF6 technology. Designed to operate and protect public and industrial distribution networks from 1 to 17.5 kV, they comply with the IEC 56 standard.

Bare fixed LF1.

The withdrawable version of the LF circuit-breakers is designed to equip the MV functional units of the MCset range.

The advantages of tried and tested technology

Safety
The breaking medium is sulphur hexafluoride (SF6) used at low pressure (0.15 MPa, i.e. 1.5 relative bar).

The insulating enclosure containing the 3 poles is equipped with safety membranes.

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

Moreover, the nominal features, nominal current breaking under nominal voltage, are maintained at 0 relative bar of SF6.

Reliability
The motor charged spring stored energy operating mechanism is a key factor of device reliability: Schneider draws on 25 years of experience on this type of mechanism, 150,000 of which are already in operation.

Schneider's mastery of design and checking of sealed systems guarantees sustained device performance well at least 30 years.

Increased endurance
The mechanical and electrical endurance of LF circuit-breakers are superior to those recommended by the IEC.

The LF circuit-breakers have successfully passed mechanical endurance tests for well over 10,000 switching operations, as well as electrical endurance tests several dozen times short-circuit current: these circuit breakers are able to break their nominal current 10,000 times.

Less maintenance
Throughout device 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
The LF circuit-breakers are designed to ensure protection of the environment:
- the materials used, both insulating and conductive, are identified, and easy to separate and recycle,
- the SF6 can be recovered at end of service life and re-used after treatment.

Quality
Each circuit-breaker undergoes systematic routine tests in order to check quality and conformity:
- pole sealing check,
- checking proper 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 switching speeds,
- checking switching cycle,
- measuring switching times.

The results are recorded on the test certificate for each device.

The entire circuit-breaker creation and manufacturing process undergoes quality control in accordance with the requirements of the French Quality Assurance Association (AFAQ): ISO 9001 and ISO 9002 certification.

The LF circuit-breakers have successfully passed the type tests required by the IEC 56.

LF3 on supporting frame.

Description of the device

The basic fixed version consists of:
■ 3 poles incorporated in an insulating enclosure of the “sealed pressure system” type. The sealed assembly is filled with SF6 at low pressure (0.15 MPa, i.e. 1.5 bar).
■ 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.

Optional:
■ 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,
■ wiring of the pressure switch mounted on the cover of the insulating enclosure.

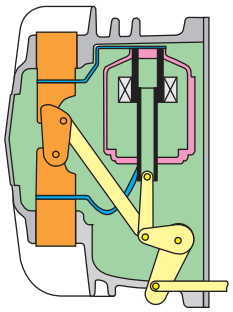


Fig.1

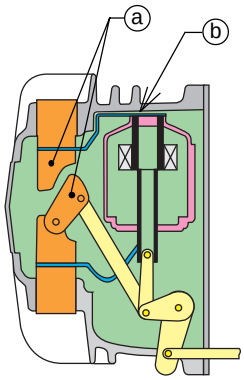


Fig.2

Principle of the self-expansion breaking technique

This technique is the result of many years’ experience in SF6 technology and of major research work.

It combines the effect of thermal expansion to the rotating arc technique in order to create arc blowing and quenching conditions.

The result is reduced stored energy and arcing contact erosion, i.e. increased 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:

Fig.1: the circuit-breaker is closed.

Fig.2: on opening of the main contacts (a), the current is shunted into the breaking circuit (b) ;

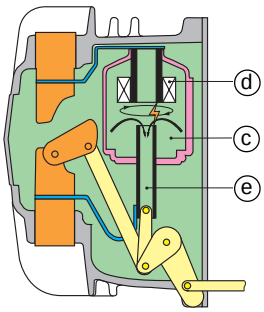


Fig.3

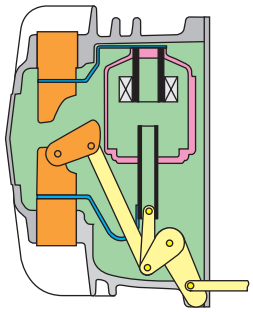


Fig.4

Fig.3: on separation of the arcing contacts, an electric arc appears in the expansion volume (c). This 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) and resulting in arc quenching when the current passes through the zero point.

Fig.4: the circuit-breaker is open.

Electric arc in a self-expansion breaking chamber.

RI stored energy operating mechanism

RI operating mechanism.

Operation of the mechanical operating mechanism

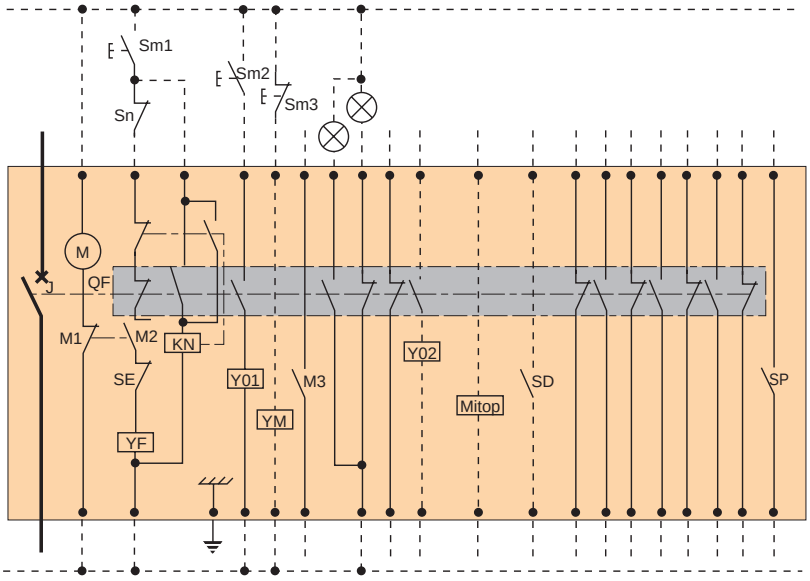
This mechanism guarantees the device an opening and closing speed unaffected by the operator, for both electric and manual orders.

It carries out the O and CO cycles and is automatically recharged by a gear motor within less than 15 s 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 optional manual charging by lever (useful on loss of auxiliary supply).
- manual order devices by push buttons on the front panel of the device.
- 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,
  - undervoltage releases with time delay adjustable from 1 to 3 sec,
  - 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.

Standard 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.
SD	Fault (Mitop) trip indication momentary contact.
SE	Trip indication maintained contact.
Sm1	Closing pushbutton (outside).
Sm2	Opening pushbutton for shunt release (outside).
Sm3	Opening pushbutton for undervoltage release (outside).
Sn	Closing disable contact (outside).
SP	Pressure-switch contact.
YF	Closing release.
Y01-Y02	Shunt opening releases.
YM	Undervoltage opening release.
Mitop	Mitop opening release (autonomous).

RI operating mechanism low voltage auxiliaries

	Electrical spring charging	closing release	opening releases		
	M	YF	YO1, YO2	YM	MITOP
supply voltages					
AC (V) 50 HZ	48 - 110 - 220	48 - 110 - 220	48 - 110 - 220		Sepam 100 LA supply
AC (V) 60 HZ	120 - 240	120 - 240	120- 240		Sepam 100 LA supply
DC (V)	24-30-48-60-110-125-220	24-30-48-60-110-125-220	24-30-48-60-110-125-220		Sepam 100 LA supply
consumptions					
AC	380 VA	160 VA	160 VA	100 VA	
DC	380 W	50 W	50 W	10 W	

Opening release combination choices

1st release	single shunt release (Y01)	double shunt release (Y02)	undervoltage release (YM)	MITOP
2nd release				
without	5O - 4C - 1I	5O - 3C - 1I	5O - 5C - 1I	5O - 5C - 1I
single shunt release (Y01)			5O - 4C - 1I	5O - 4C - 1I
double shunt release (Y02)			5O - 3C - 1I	5O - 3C - 1I
undervoltage release (YM)	5O - 4C - 1I	5O - 3C - 1I		5O - 5C - 1I
MITOP	5O - 4C - 1I	5O - 3C - 1I	5O - 5C - 1I	

number of contacts available:
O: open
C: closed
I: changeover

Specific points

Conditions for use
This circuit-breaker operates in the following atmospheric and climatic conditions:
■ climatic condition(1): - 5 °C to + 40 °C.

Standard packaging
Basic fixed assembly: packaging on untreated wooden pallet.

Fixed assembly with frame: packaging on 2 untreated wooden pallets.

(1) For other values, please consult us.

LF1, LF2 circuit-breakers

IEC 56			LF1				LF2		
rated voltage	kV, 50/60 Hz		7.2		12		7.2	12	17.5
insulation level	kV rms 50 Hz - 1 mn		20		28		20	28	38
	kV, impact 1.2/50 µs		60		75		60	75	95
rated current	A	630	■	■	■	■	■	■	■
		1250	■	■	■	■	■	■	■
		2000 (1)					■	■	■
breaking capacity Isc	kA, rms		25	31.5	25	31.5	50	40	31.5
making capacity	kA, peak		63	79	63	79	125	100	79
permissible short time withstand current	kA, rms, 3 s		25	31.5	25	31.5	50	40	31.5
capacitor breaking capacity	A		440		440		440	440	440
rated switching sequence	O-3 mn - CO-3 mn - CO		■		■		■	■	■
	O-0.3 s - CO-15 s - CO		■		■		■	■	■
	O-0.3 s - CO-3 mn - CO		■		■		■	■	■
operating times	ms	opening	48		48		48	48	48
		breaking	70		70		70	70	70
		closing	65		65		65	65	65

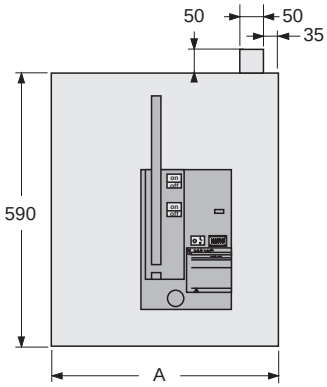
LF3 circuit-breaker

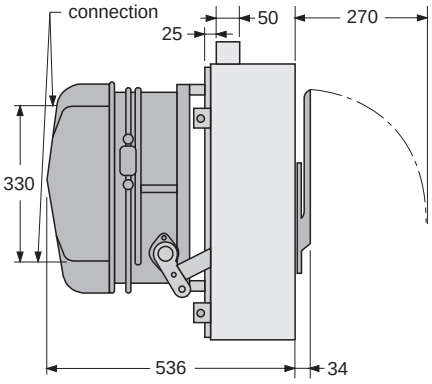
IEC 56			LF3									
rated voltage	kV, 50/60 Hz		7.2				12				17.5	
insulation level	kV, rms 50 Hz - 1 mn		20				28				38	
	kV, impact 1.2/50 µs		60				75				95	
rated current (Ia)	A	1250								■		
		2500	■	■	■	■	■	■	■	■	■	■
		3150	■	■	■	■	■	■	■	■	■	■
breaking capacity Isc	kA, rms		25	31.5	40	50	25	31.5	40	50	25	31.5
making capacity	kA, peak		63	79	100	125	63	79	100	125	63	79
permissible short time withstand current	kA, rms, 3 s		25	31.5	40	50	25	31.5	40	50	25	31.5
capacitor breaking capacity	A		440				440				440	
rated switching sequence	O-3 mn - CO-3 mn - CO		■				■				■	
	O-0.3 s - CO-15 s - CO		■				■				■	
	O-0.3 s - CO-3 mn - CO		■				■				■	
operating times	ms	opening	48				48				48	
		breaking	70				70				70	
		closing	65				65				65	
ANSI C37.04-C37.06-C37.09			**LF3**									
rated maximum voltage	kV, 60 Hz		4.76				8.25				15	
rated voltage range	K factor		1.24				1.25				1.3	
rated insulation level	kV, rms 60 Hz - 1 mn		19				36				36	
	kV, impact 1.2/50 µs		60				95				95	
rated continuous current	A	1200	■				■				■	
		2000	■				■				■	
		3000	■				■				■	
rated short-circuit current (at rated max kV)	kA, rms		29				33				28	
maximum symmetrical interrupting capability and rated short-circuit current	kA, rms		36				41				36	
closing and latching capability (2.7 K times rated short-circuit current)	kA, peak		97				111				97	
rated interrupting time	60 Hz cycles		5				5				5	

(1) Used only in fixed installations: consult us.

Basic fixed assembly
LF1 - LF2 - LF3

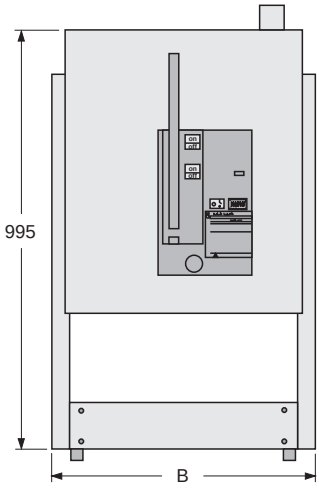
	LF1	LF2	LF3
A	493	554	728
weight (kg)	106	128	149.5

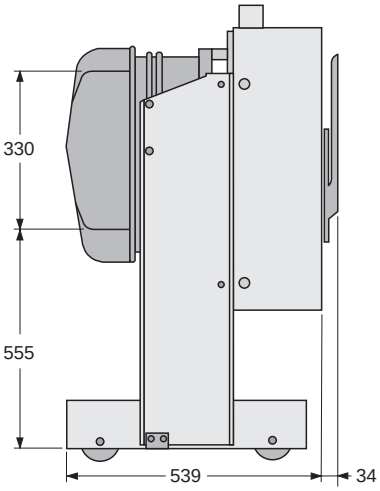




Fixed assembly
with supporting frame
LF1 - LF2 - LF3

	LF1	LF2	LF3
B	542	602	776
C	160	180	240
D	145	165	225
E	145	165	225
weight (kg)	124	148	168

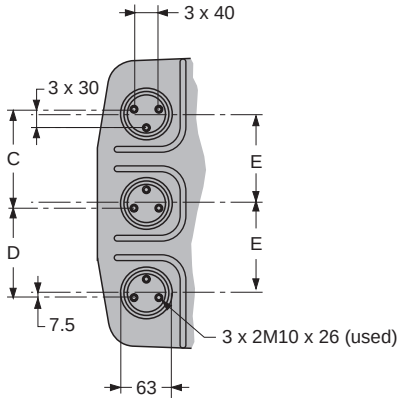




Connections

Direct connection on device:

- LF1
- LF2 < 2000 A
- LF2 < 95 kV impact



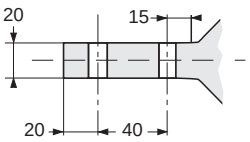
Connection on pads:

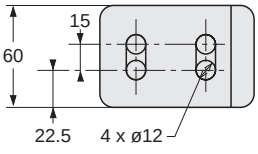
- LF2:

2000 A

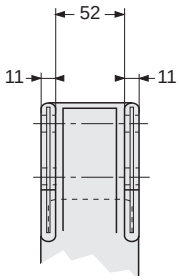
1250 A (at 95 kV impact)

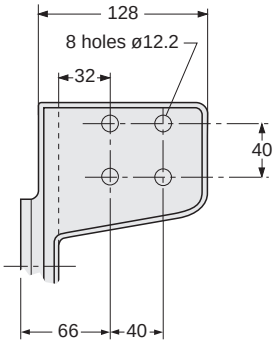
630 A (at 95 kV impact)





- LF3





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