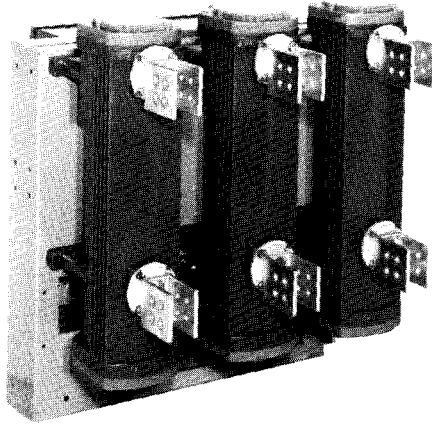
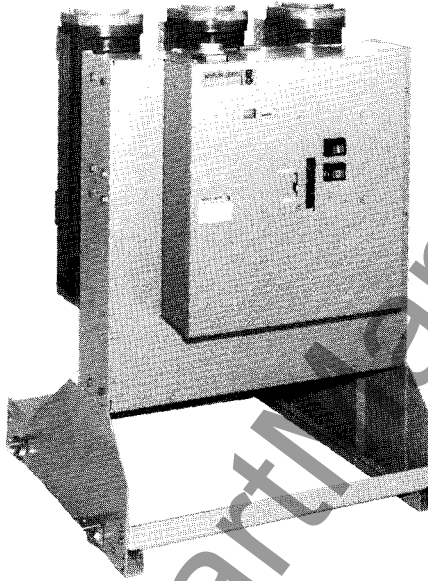


# MERLIN GERIN

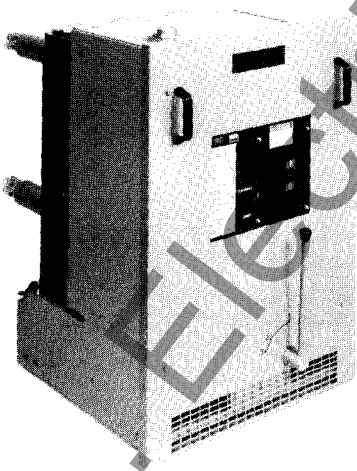
**Fluarc FG3**  
**24 - 25.8 kV**



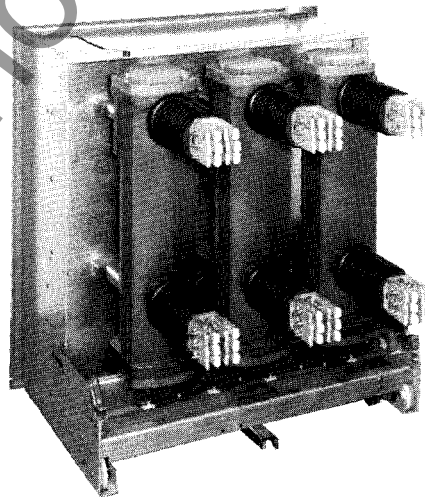
fixed FG3



fixed FG3 with support frame



withdrawable FG3 630 A and 1250 A



withdrawable FG3 2500 A

*mastering electrical power*



# description

## presentation

The Fluarc FG3 three-pole indoor circuit-breakers are designed for control and protection of medium voltage public distribution and industrial networks. These circuit-breakers use sulphur hexafluoride (SF6) for insulation and breaking. They are made up of three pole-units and an operating mechanism on a support frame. Each pole-unit encloses all active parts in an insulating enclosure. This enclosure is filled with SF6 to a relative pressure of 2.5 bars.

It is of the sealed pressure system type according to the IEC 56 definition, appendix EE, 1987 edition.

Their main qualities are as follows :

- long life expectancy,
- no maintenance of active parts,
- high electrical endurance,
- very low surge level,
- operating safety,
- insensitivity to the environment,
- possibility of permanent circuit-breaker pressure control (optional pressure switch),
- well-suited to high-speed reclosing and capacitor bank switching.

## characteristics

The characteristics given below are as defined by the IEC regulations, publication 56 and 694, UTE volume C 64.100/101, VDE 0670, BS 5311 and ANSI C37-06.

**Rated frequency** : 50-60 Hz.

**Operating times** at rated voltage (indicative values) :

■ opening time between application of voltage to the opening device and arc contact separation : 45 to 65 ms ;

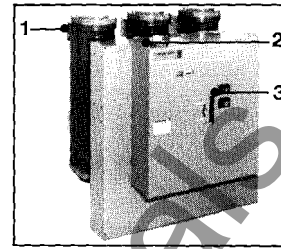
■ breaking time between application of voltage to the opening device and final arc extinction : 60 to 80 ms ;

■ closing time between application of voltage to the closing device and contact closing : 60 to 90 ms.

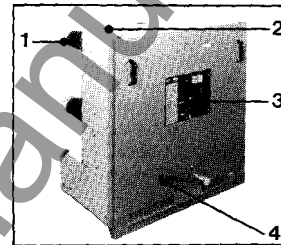
**Rated operating sequences** :

0-3 mn - CO - 3 mn - CO (standard)

0-0.3 s - CO - 15 s - CO (option)



fixed FG3



withdrawable FG3

1. pole-unit
2. auxiliaries LV connector
3. operating mechanism
4. racking lever

## ratings to IEC 56, VDE 0670, BS 5311, UTE C64.100/101

rated voltage kV	rated insulation level impulse (1) 1 mn 1.2 / 50 μs		breaking capacity kA	rated continuous current A	making capacity (2) kA peak	3-second withstand current kA rms	capacitor breaking capacity for a rated current of		
	kV peak	kV rms					630 A	1250 A	2500 A
24 25.8	125	50	12.5 25 31.5	630-1250-2500	31 63 79	12.5 25 31.5	440	875	1750

## ratings to US Standards ANSI C37-06 fixed outdoor circuit-breaker (DFE)

rated voltage max. voltage kV	voltage range factor $= \frac{U_{max.}}{U_{min.}}$	rated insulation level		symmetrical breaking capacity (Isc) kA at rated kV	rated continuous current at 60Hz A rms	3-second withstand current kA rms	closing and latching capability (2.7 Isc) kA peak
		impulse (1) 1.2 / 50 μs kV peak	1 mn 60 Hz kV rms				
25.8	1	150	60	25	1200 - 2000	25	68

(1) For installation in cubicles, the dielectric withstand is the responsibility of the cubicle designer. Merlin Gerin can provide recommendations upon specific request.

(2) The making capacity corresponds to 2.5 times the breaking capacity at rated voltage.

# operating mechanism and auxiliary devices

## operating mechanism

The Fluarc circuit-breaker is equipped with a GMh type spring stored-energy operating mechanism for fast opening and closing independent of operator action.

It is equipped with either a manual or an electrical charging mechanism.

These two systems comprise :

- an operations counter,
- a position indicator (ON/OFF).

The electrical operating mechanism can also be charged manually by a removable lever in front in the event of auxiliary power failure.

The electrical spring charging system includes a motor (M), automatically recharging the operating mechanism as soon as the breaker is closed (recharging time < 15 s).

### Rated supply voltages

D.C. : 24 - 48 - 60 - 110 - 125 - 220V

A.C. : 110 - 127 - 220V

### Closing

Manual closing by mechanical action via a pushbutton on the front panel.

Electrical closing by a closing release (YF) and anti-pumping relay (KN).

### Consumption at rated voltage

	charging motor	closing release
in D.C.	220 to 600 W	70 W
in A.C.	350 to 700 VA	100 VA

### Opening

Manual opening by mechanical action via a pushbutton on the front panel.

Electrical opening via indirect releases.

Several types of indirect releases can be fitted.

The 17 possible combinations are set out in the table herebelow.

### Release type

n°	shunt trip	under voltage (1)	over-current (2)	Mitop (3)
1	■ 1 coil			
2	■ 1 coil	■		
3	■ 1 coil		■ 1 coil	
4	■ 1 coil		■ 2 coil	
5		■		
6		■	■ 1 coil	
7		■	■ 2 coil	
8			■ 1 coil	
9	■ 2 coil			
10			■ 2 coil	
11	■ 2 coil	■		
12	■ 2 coil		■ 1 coil	
13				■
14	■ 1 coil			■
15			■ 1 coil	■
16	■ 2 coil			■
17			■ 2 coil	■

### Consumptions at rated voltage

release type	D.C. W	A.C. VA
single-coil shunt	70	100
undervoltage	15	75
single-coil overcurrent		120

self-current MITOP : 1 VA

## auxiliary devices

### Auxiliary contacts

Fluarc FG3 incorporates :

- 5 auxiliary contacts if manually charged :

- 1 used for the closing release
- 1 used for the opening shunt trip release (Y01)

- 3 contacts remain available for customer's use

- 14 auxiliary contacts if electrically charged :

- 2 used for the electrical operating mechanism

- 1 used for the opening shunt trip release (Y01)

- 11 contacts remain available for customer's use.

### Characteristics of auxiliary contacts

rated current : 10 A

breaking capacity :

- in D.C. : 3 A at 110 V or 220 V

- in A.C. : at 0.3 pf : 10 A at 220 V

### Options

- 9 additional auxiliary contacts with manually-charged mechanisms,

- open-position locking facility by Ronis EL S 11A key-lock (lock not supplied),

- a closing contact pressure switch (SP) for indication of any SF6 pressure drop (1 per pole unit),

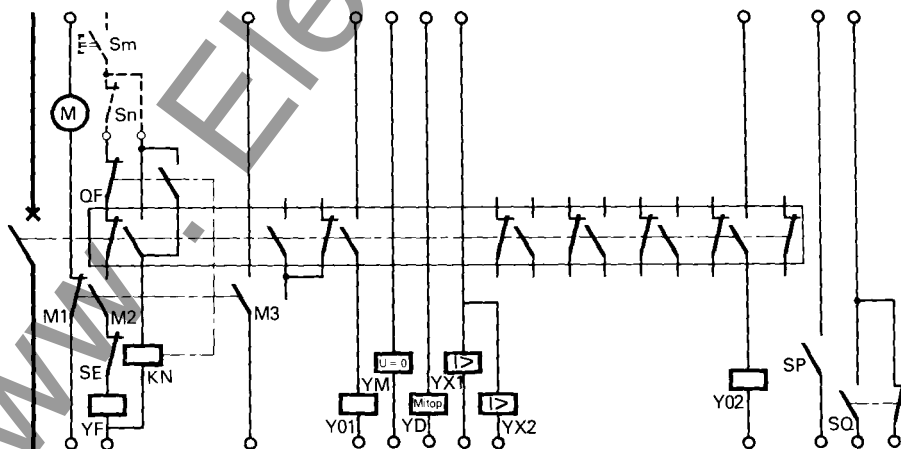
- a STATIMAX protection device, without auxiliary power supply, with MITOP release,

- operating mechanism charged indication contact (M3),

- green-red open/closed indicator instead of green-white (standard).

(1) A withdrawable circuit-breaker fitted with an undervoltage release must always be provided with an operating mechanism automatic discharging system.  
 (2) Overcurrent release power supply : 2 A - 5 A  
 (3) The MITOP release is made up of a low consumption bi-stable electromagnet designed to receive a low power order from the Statimax protection system ensuring protection without the use of an auxiliary source (see leaflet AC 42)

## Electrical operating mechanism wiring diagram

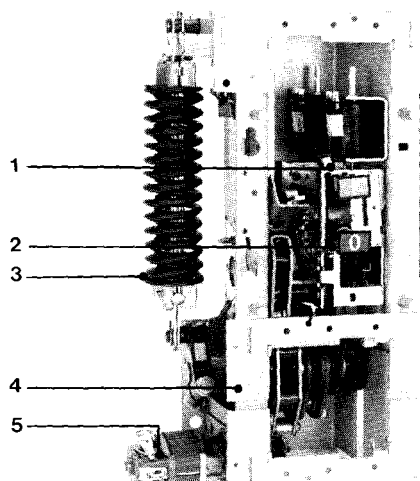


### Always supplied

- M spring charging motor
- YF closing release
- M1-M2 end-of-charging switch
- QF auxiliary contacts
- KN anti-pumping relay

### Options

- Y01-Y02 shunt trip release
- YM undervoltage release
- YX overcurrent release
- YD MITOP release
- M3 operating mechanism charged indication contact



### GMh electrically charged operating mechanism

- 1 closing and opening release
- 2 latching unit
- 3 closing springs
- 4 frame
- 5

# fixed FG3

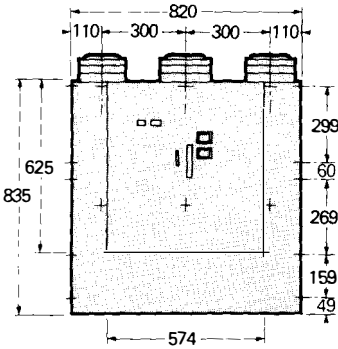
## fixed unit

The fixed FG3 is equipped with the operating mechanism and the auxiliary devices mentioned on page 3. It is supplied with its connection pads.

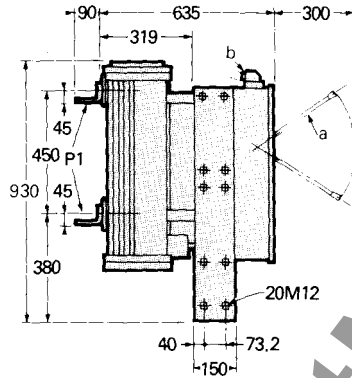
### Options for fixed units :

- male and female LV 36-pin connection comprising a fixed connector on the circuit-breaker and a socket equipped with a 2 m cable.
- Support frame (see below)

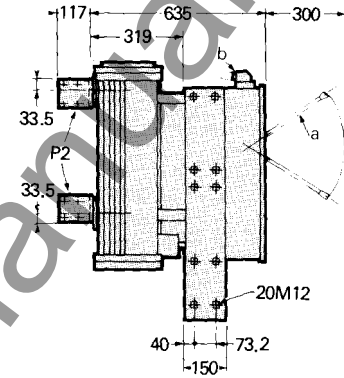
### dimensions (mm) and weights (kg)



FG3 front view

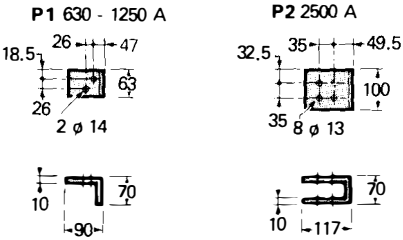


FG3 : 630 - 1250 A



FG3 : 2500 A

### connection pads



a : removable charging lever  
b : LV connector

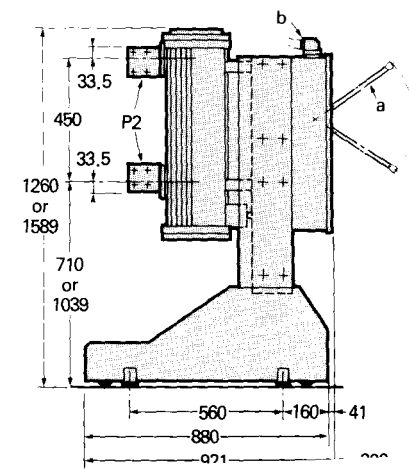
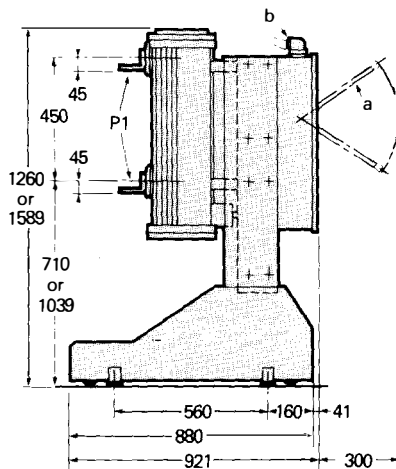
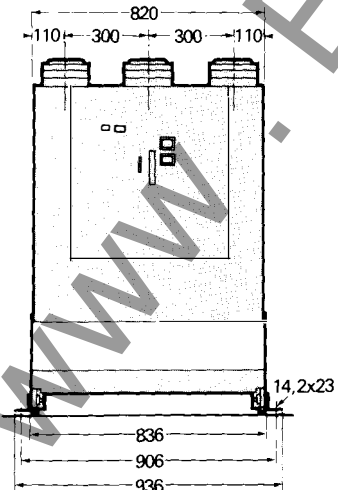
FG3 circuit-breaker weight :  
630 A - 1250 A = 240 kg  
2500 A = 275 kg

## fixed unit mounted on a support frame

The FG3 may be supplied with an optional support frame. The support frame is fitted with rollers for easy circuit-breaker handling and installation.

The frame is provided with fixing lugs for anchoring to the floor.

### dimensions (mm) and weight (kg)



# withdrawable FG3

## withdrawable unit

For easy installation and maintenance as well as upstream and downstream disconnection with visible break, the Fluarc FG3 can be supplied as a withdrawable unit.

### The circuit-breaker is fitted with :

- the operating mechanism and auxiliary devices mentioned on page 3,
  - a frames earthing contact,
  - a guide rail at the bottom (c)
  - a mechanical system securing the breaker in "service" or "disconnected" position.
- The circuit-breaker can be moved by positioning the removable racking lever (d) to marks 1, 2 or 3 on the front panel :

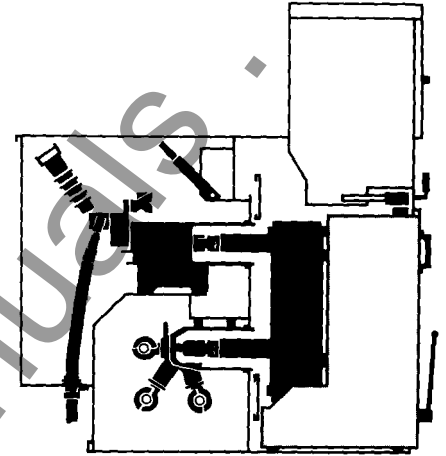
□ **mark 1 :**  
breaker secured in "service" or "test" position, or free in "removed" position. Breaker operation (closing/opening) is only possible with the lever on mark 1.

□ **mark 2 :**  
the lever releases the securing system and allows the breaker to be moved from "service" to "test" position and vice versa. The lever can only be positioned on mark 2 if the circuit-breaker is open.

□ **mark 3 :**  
the lever releases the securing system allowing the breaker to be fully removed from the cubicle. It also provides a stop function when the breaker is reinserted in the cubicle.

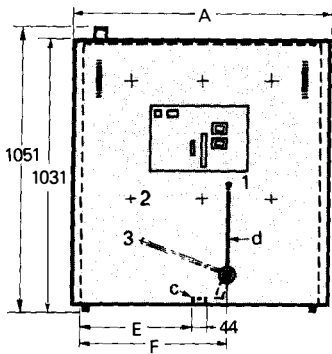
### Options for withdrawable unit :

- a LV female 36-pin connector comprising a socket equipped with a 2 m. cable,
- automatic discharging system for the operating mechanism when the breaker is moved beyond "test" or "disconnected" position (see footnote 1 on page 3),
- racking lock-out system preventing breaker insertion if the LV cable is not connected,
- auxiliary contact indicating that the breaker is secured in "service" position (SQ).

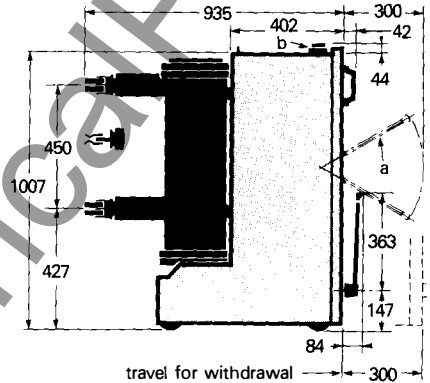


FG3 circuit-breaker installed in an Fluair F300 cubicle.

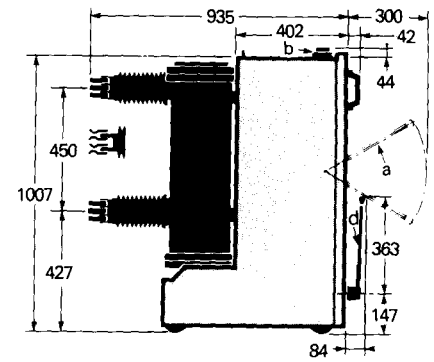
## dimensions (mm) and weights (kg)



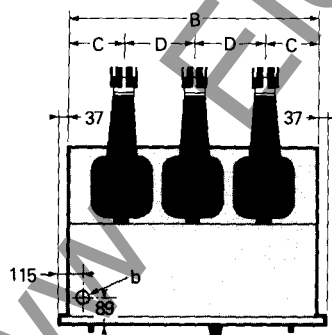
FG3 front view



FG3 : 630 - 1250 A



FG3 : 2500 A



top view

rated current	inter-phase distance D (mm)	A (mm)	B	C	E	F	weights
A							kg
630 - 1250	200	718	644	122	300	428	250
2500	260	968	894	187	425	553	300

# FG3 pole unit

## pole-unit description

The FG3 pole-unit consists of :

■ **a main circuit** including the fixed contact 21 and the self-wiping, self-compensated blades making up the moving contact 20

■ **a breaking circuit** including the fixing arc contact 4, moving arcing contact 6, main rod 10, flexible connector 18, moving piston 7, and insulating nozzle 5 directing the SF6 flow towards the arc.

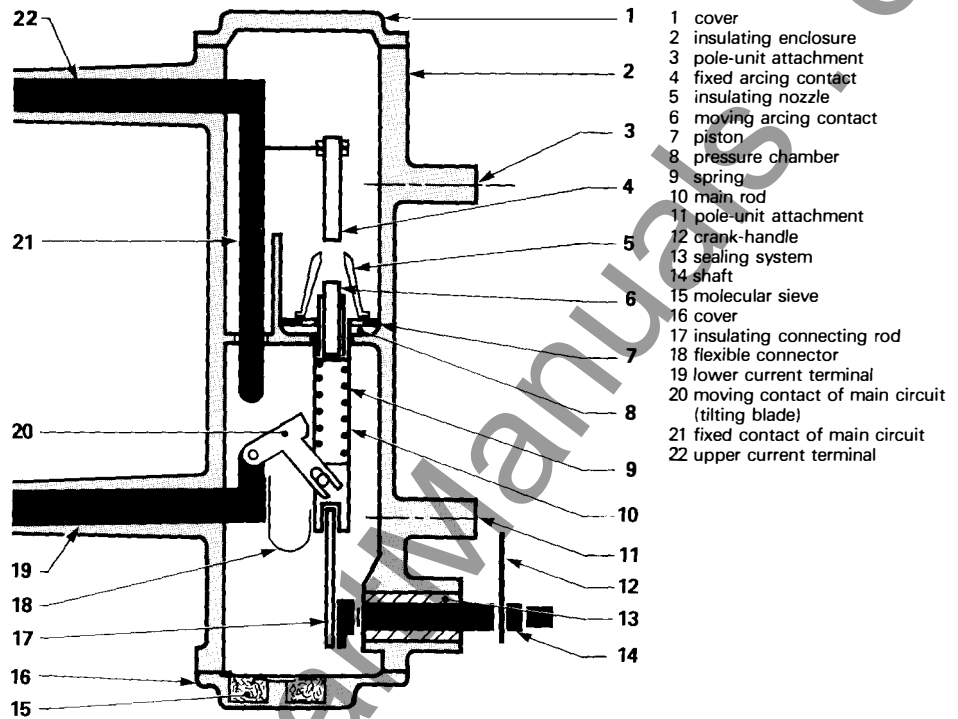
The main circuit, designed for the continuous flow of current, is distinct from the breaking circuit subjected to the arc.

■ **a transmission mechanism** conveying the mechanical energy to the moving contacts, including the crank-handle 12, shaft 14, insulating connecting rod 17, main rod 10, and spring 9.

■ **a sealing system 13** highly reliable for any number of operations,

■ **an insulating enclosure 2** enclosing all active parts.

The filling pressure and breaker performance characteristics are maintained for at least 20 years, corresponding to the operating life of a circuit-breaker on a normally disturbed network.



## FG3 operation

The main contacts and the arcing contacts are initially closed (fig. 1)

■ **Precompression** (fig. 2)

From the beginning of the movement, the SF6 gas is compressed by the piston. The main contacts separate and the current flows via the arcing contacts, which are still closed.

■ **The arcing time** (fig. 3)

The arc then forms between the arcing contacts and the piston continues its downward movement.

A small quantity of gas leaves the pressure chamber. It is directed by the insulating nozzle and injected onto the arc.

The cooling of the arc is thus achieved through forced convection for the interruption of low currents, however, during the interruption of high currents, it is thermal expansion which is responsible for the transfer of the hot gases towards the cold parts of the pole-unit. Towards current zero, the dielectric strength between the contacts is recovered due to the intrinsic qualities of SF6.

■ **Sweeping overstroke** (fig. 4)

The moving parts finish their travel whereas the cold gas injection continues until the contacts are completely open.

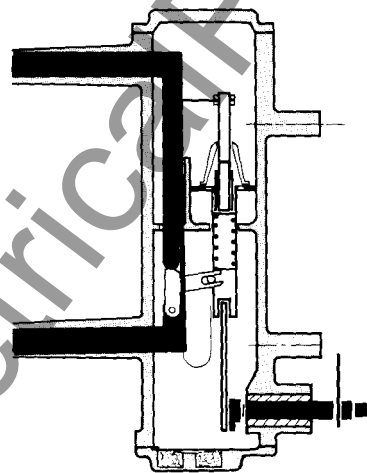


Fig 1. - Closed circuit-breaker

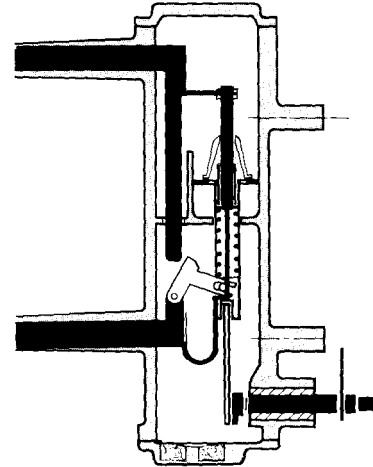
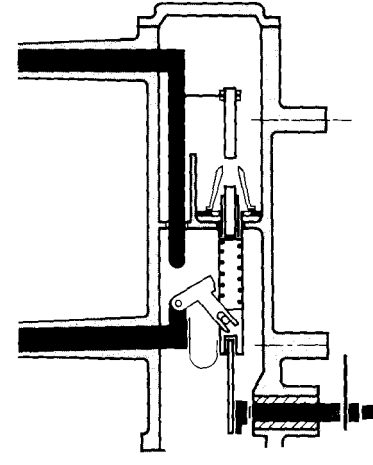
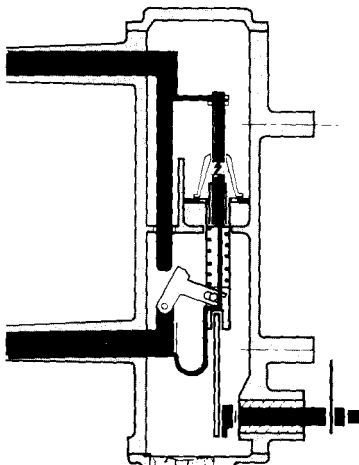
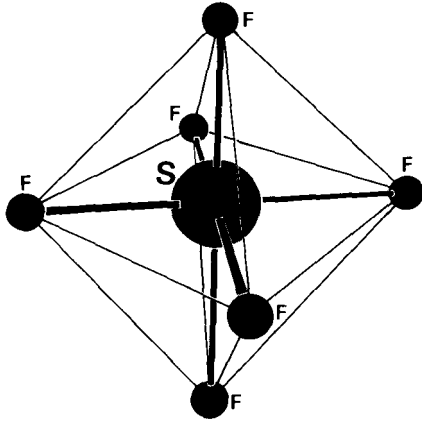


Fig. 2 - Opened main contacts



# Fluarc technology

## sulphur hexafluoride gas (SF6) properties



SF6 is an **unflammable**, very stable, **non toxic** gas, five times heavier than air. Its dielectric strength is much higher than that of air at atmospheric pressure.

## breaking gas

SF6 is "the" breaking gas, combining the best properties :

- **high capacity for carrying the heat** produced by the arc. The latter is strongly cooled by convection during the arcing period.

- **high radial thermal conduction and high electron captation capacity.**

When the current passes through zero, the arc is extinguished by the combination of these two phenomena :

- SF6 permits rapid heat exchange from the center of the arc towards the exterior,
- fluorine atoms, which are highly electronegative, act as veritable "traps" for electrons.

Since it is electrons which are mainly responsible for electric conduction in the gas, the gap between the contacts recovers its initial dielectric strength through this electron capture phenomenon at zero current ;

- **the decomposition of the SF6 molecule is reversible.**

The same mass of gas is therefore always available, making the device self-sustained throughout its operating life.

## advantages of the Fluarc

The Fluarc circuit-breaker with autocompression features a new design concept in which the injected gas is optimized and thermal expansion is used to its fullest advantage.

This produces the following advantages :

**long life**

This results from :

- high product reliability,
  - very low wear of the active parts which require no maintenance,
  - the excellent enclosure sealing.
- These units need no complementary filling.

**mechanical endurance**

The operating energy is reduced by using the natural expansion of the hot gases during breaking.

The operating mechanism is the standard GMh-type and benefits from over 20 years of experience.

The Fluarc circuit-breaker is able to carry out 10 000 operations without any parts being replaced.

Periodic lubrication of the operating mechanism is recommended, and depends on the environment and operation.

**electrical endurance**

The long life of the Fluarc is due to the negligible degeneration of the gas and to low wear of the contact.

The energy dissipated in the arc is low due to :

- the intrinsic properties of the gas,
- the short length of the arc,
- the very short arcing time.

Wear of the arcing contacts can be checked, without opening the poles, by means of a wear indicator.

The unit is capable of breaking all load and short-circuit currents for a period of 20 years, even in the case of frequent operation, and requires no maintenance of the active parts.

**low switching surges**

The intrinsic properties of the gas and the soft break resulting from this technology means that the switching surges are very low.

Concerning motor start-up, the unit provokes no multiple reignitions nor multiple reignitions which could damage the insulation between coil turns.

**operating safety**

the Fluarc operates at low pressure with a relative pressure of 1 to 2.5 bars. The pressure rise during the arcing phase occurs mainly in the confined volume between the arcing contacts. During short-circuit interruption, this pressure rise is limited to around 1 bar.

**insensitivity to external conditions.**

The Fluarc pole-unit provides a completely insulated system. It is a hermetically sealed enclosure filled with SF6 gas and housing the following essential parts :

- the breaking chamber,
- the insulating rod which activates the moving contacts,
- the electrical connection between the moving contact and the corresponding fixed terminal.

The Fluarc pole-unit is therefore a **Gaseous Insulated System (G.I.S.)**

permanent control of the circuit-breaker state  
Possibility of adding a pressure controlling device to the switchgear.

# order form for Fluarc FG3 circuit-breakers

## network characteristics

Requested service voltage .....  kV  
 Short-circuit current at requested service voltage .....  kA  
 Rated operating current .....  A  
 Frequency .....  Hz  
 Insulation level :  
 ■ Power frequency 1mn .....  kV  
 ■ Impulse 1.2 / 50  $\mu$ s .....  kV  
 Operating sequence : ■ standard : 0-3 mn - CO - 3 mn - CO .....   
 ■ on request : 0-0.3 s - CO - 15 s - CO .....

## installation and application characteristics

Standards IEC .....  or ANSI .....   
 Withdrawable unit .....  Fixed unit .....   
 Manual operating mechanism .....   
 Electrical operating mechanism .....   
 Withdrawable unit for MG cubicles .....

## Common auxiliary devices (fixed and withdrawable units)

Charging motor (M) .....  V  DC, or  AC  Hz  
 Closing release (YF) .....  V  DC, or  AC  Hz  
 Opening release (shunt trip release) .....  V  DC, or  AC  Hz  
 Others opening releases .....

## Common options (described on page 3)

9 additional auxiliary contacts (for manual operating mechanism) .....   
 Open-position breaker locking facility (lock not include) .....   
 Lock (for above locking device) RONIS ELS 11 A .....   
 Pressure switch (SP) .....   
 STATIMAX system with MITOP .....   
 Operating mechanism charged indication contact (M3) .....   
 O.C. green-red mech. indicator (instead of green-white) .....

## Options for fixed unit (described on page 4)

Male and female 36-pin LV connector with a 2 m conductor .....   
 Supporting frame .....

## Options for a withdrawable unit (described on page 5)

Female 36-pin LV connector with a 2 m conductor .....   
 Automatic discharging of the operating mechanism .....   
 Racking lock-out on LV connector .....   
 "Breaker secured in position" contact (SQ) .....