

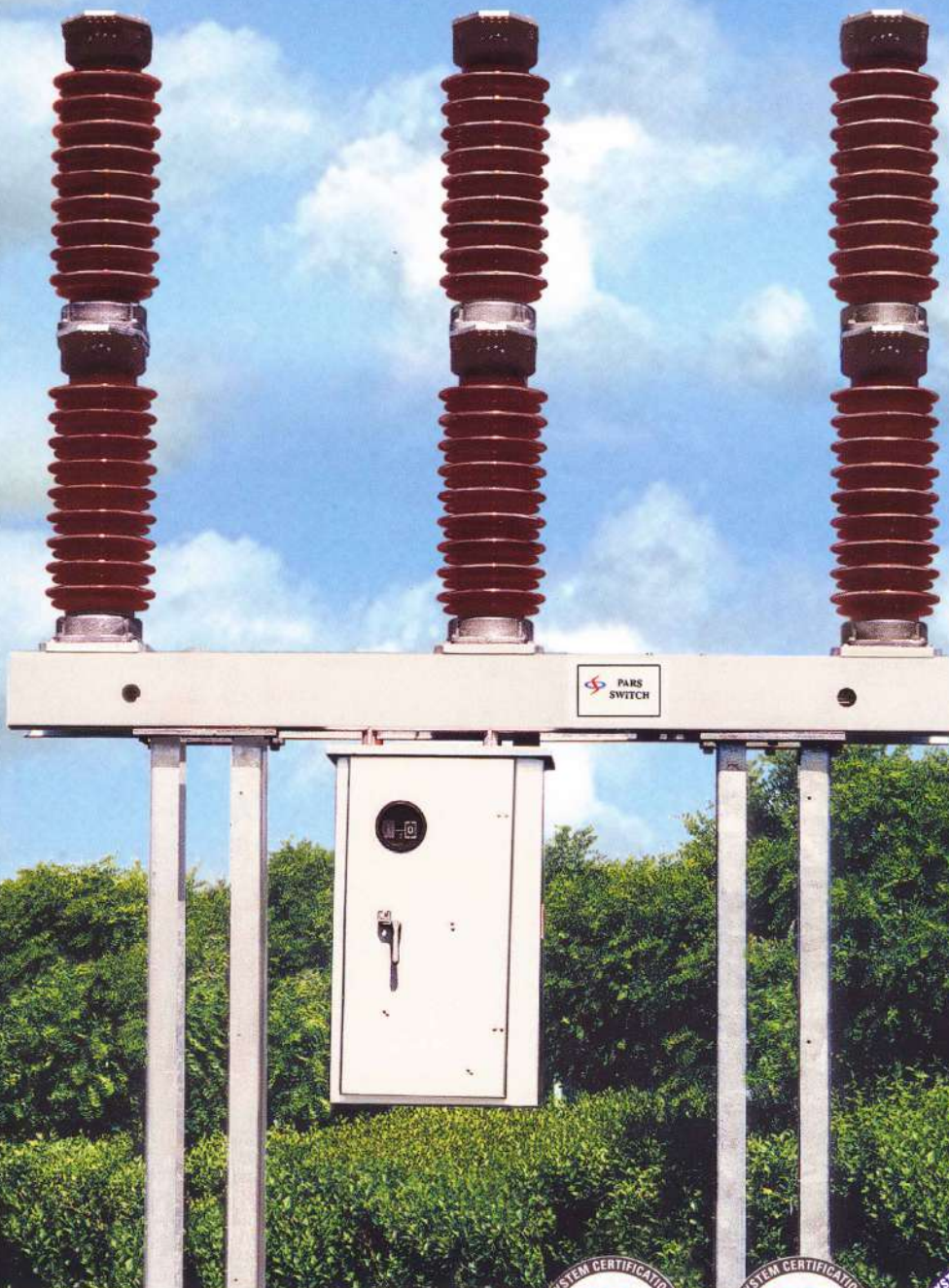


PARS SWITCH

EDF-SK SF₆ CIRCUIT-BREAKER

With Auto-Puffer System for outdoor installation

With silicon rubber or porcelain insulators Rated Voltage:72.5 kV Rated current:up to 2500 A
Rated breaking currents:25-31.5 kA Rated frequencies:50 and 60 Hz



EDF SK 1-1,72.5 kV,with porcelain insulators and spring operating mechanism type FSA

Pars switch Co. Manufacturer of Medium & High Voltage Circuit Breakers and Disconnectors



Type tested in
CESI

The EDF SK is a live tank SF₆ autopuffer circuit-breaker designed for 72.5 kV and with a rated breaking current of 25-31.5 kA.

In the most common version, the circuit-breaker is operated with one operating mechanism. In case of single pole operation each pole is supplied with its own operating mechanism.

Main advantages of EDF C.B.

The EDF-SK circuit-breaker, which satisfies the highest demands and is based on the latest developments in arc-research, provides the following advantages :

- Restrike-free interruption of capacitive currents on account of high inherent dielectric strength of the SF₆ gas and optimized contact movement.
- Low overvoltages when switching inductive currents as a result of optimum quenching at current zero.
- High dielectric strength even at atmospheric SF₆ pressure, due to wide contact gap.
- Low operating energy requirement, resulting in reduced mechanical stress, and low reaction forces on the foundation.
- Low noise level, hence suitable for installation in residential areas.
- Easy installation and commissioning. Each circuit breaker is pre-tested and shipped to the site in the form of a few easily inter-connectable units.
- High making capacity also in the case of parallel connected capacitor banks.
- High seismic capability due to optimized pole and structure design.
- Porcelain or silicon rubber insulators

The circuit-breaker pole includes the breaking unit, the porcelain or silicon rubber supporting insulator and the pole linkage housing.

The three poles of the breaker are mounted on a common supporting frame. The operating mechanism is arranged below the same frame. The breaker poles have a common SF₆ gas system, which is filled with SF₆ gas to a pressure of 0.7 MPa(abs) at temperature +20° C, for operation down to -30° C. For applications at temperatures down to -50° C the breaker is filled with mixed gas SF₆/ N₂ or SF₆/ CF₄. The SF₆/ CF₄ mixture permits operation without reduction of breaking capacity. When the SF₆/ N₂ gas mixture is used, the breaking capacity is normally reduced one IEC-step, from 31.5 kA to 25 kA.

The operational reliability and the service life of an SF₆ circuit-breaker are very much dependent on its ability to maintain the pressure of the SF₆ gas and to neutralize the effects of moisture and decomposition products in the gas.

- Double O-rings of nitrile rubber are used for sealing purposes with excellent results.
- Each breaking unit is provided with an absorber. The absorption agent absorbs the moisture and the gaseous decomposition products from the interruption process.
- Since the interrupting capability is dependent on the density of the SF₆ gas. The EDF-SK circuit-breaker is provided with a density monitor common for the three poles. The density monitor consists of a temperature independent pressure switch. Temperature dependent pressure variations in the breaker poles will be compensated by a hermetically sealed reference gas volume and, for this reason, an alarm signal is issued only if the pressure drops due to leakage

Technical data of EDF circuit breaker

Values complying with IEC 62271-100 (50 Hz) and ANSI C37 (60 Hz)

| | | | |
|--|----------|----|-------------|
| Rated Voltage | IEC | kV | 72.5 |
| | ANSI | kV | 72.5 |
| Power frequency withstand voltage | | | |
| - 1 min dry | IEC | kV | 140 |
| - 1 min wet | IEC | kV | 140 |
| - 1 min dry | ANSI | kV | 160 |
| - 10 sec wet | ANSI | kV | 140 |
| Lightning impulse withstand voltage (LIWL) | | | |
| - Full wave 1.2/50 μs | ANSI | kV | 350 |
| - Chopped wave 2 μs | ANSI | kV | 452 |
| - Chopped wave 3 μs | ANSI | kV | 402 |
| Creepage distance to earth 1) 2) | | mm | 1995 |
| Creepage distance across break 1) 2) | | mm | 1995 |
| Rated normal current | | A | 2000 / 2500 |
| Rated breaking current | at 50 Hz | kA | 31.5 |
| | at 60 Hz | kA | 25 |
| First pole to clear factor | | | 1.5 |
| Making current / peak | | kA | 62.5 / 79.0 |
| Closing time | | ms | 60 |

PARS SWITCH

| | | |
|-----------------------------|--------------|-------------------------------|
| Opening time | ms | 30 |
| Total break time | ms | 50 |
| Dead time | ms | 300 |
| Duration of short circuit | s | 3 |
| Rated reclosing time, 60 Hz | ANSI cycles | 20 |
| Rated operating sequence | IEC and ANSI | O - 0.3 sec - CO - 3 min - CO |
| | ANSI | CO - 15 sec - CO |

1) Other values on request.

2) Tolerances according to IEC 60233

FSA type Operating mechanism of EDF C. B.

The circuit-breaker is operated by a motor charged spring operating mechanism, which is installed in a splash-proof cubicle of corrosion-protected steel or Aluminium.

The operating mechanism is characterized by an especially robust, simple, and thereby functionally reliable design of application. It is suitable for three pole as well as single pole application.

- One FSA is used for three-pole operation.
- Three FSA are used when single pole operation is required.

Features

- The stored energy is immediately available without losses, thereby ensuring a constant contact travel behaviour.
- A minimum of mechanical components increases the availability.
- Easy access to all components without obstruction, after lowering the outer housing.
- The closing spring can be tensioned manually.
- Maximum availability and reliability.

Design and mode of operation of FSA

Design

The principle components and the design can be seen in *Fig 2,3*. The generously proportioned position and spring tension indicators are readily visible through the observation window in the door, and allow positive identification of the breaker position and of the state of tension of the closing spring. The electrical monitoring and control units are easily accessible after opening the door. The electrical leads are all taken to the terminal block. The sheet-metal housing including the door can be removed, for ready access to all the internal components. The closing and opening springs are arranged on the two sides. All movements are frictionless damped by means of a dashpot.

Mode of operation

The spring operating mechanism, the design of which is shown schematically in *Figure 4*, consists essentially of two tension spring systems. Closing spring 5 is tensioned by means of motor 13, over the worm-gear drive. This provides the energy for a closing operation, and tensions the opening spring 6 during the closing operation.

Charging of closing spring

The main shaft 1 is rotated through 180 degrees via the worm-gear drive, by means of the motor 13 or the hand-crank 14, in this way tensioning the closing spring 5.



Fig.1 - VIEW OF FSA OPERATING MECHANISM

Closing operation

At the closing signal, the locking-latch 7 is released from the main shaft and closing spring 5 discharges itself. In this way, the transfer cams rotate via the transfer lever 9. Switching shaft 2 is actuated and the breaker closes, simultaneously tensioning and locking the opening spring 6. Motor 13 re-tensions the closing spring 5 after every closing operation. It is controlled via the motor limit switch 16.

Opening operation

With an opening signal locking-latch 8 is released from switching shaft 2 and the opening spring 6 discharges, thereby resulting in opening of the breaker. Auxiliary switch 15 is mechanically linked to the switching units and follows the breaker operation exactly.

Mounting of the operating mechanism

The operating mechanism cubicle (*Fig. 2,3*), containing the spring operating mechanism FSA as well as the control and monitoring units, is easily attached to the circuit-breaker. After mounting the mechanism cubicle to the pole support, the operating rod is coupled to the breaker poles. In case of single pole operation the control and monitoring elements are positioned in each mechanism cubicle. Special provisions for supporting the operating mechanism during assembly are not required.

DESIGN AND INTERNAL VIEW OF FSA

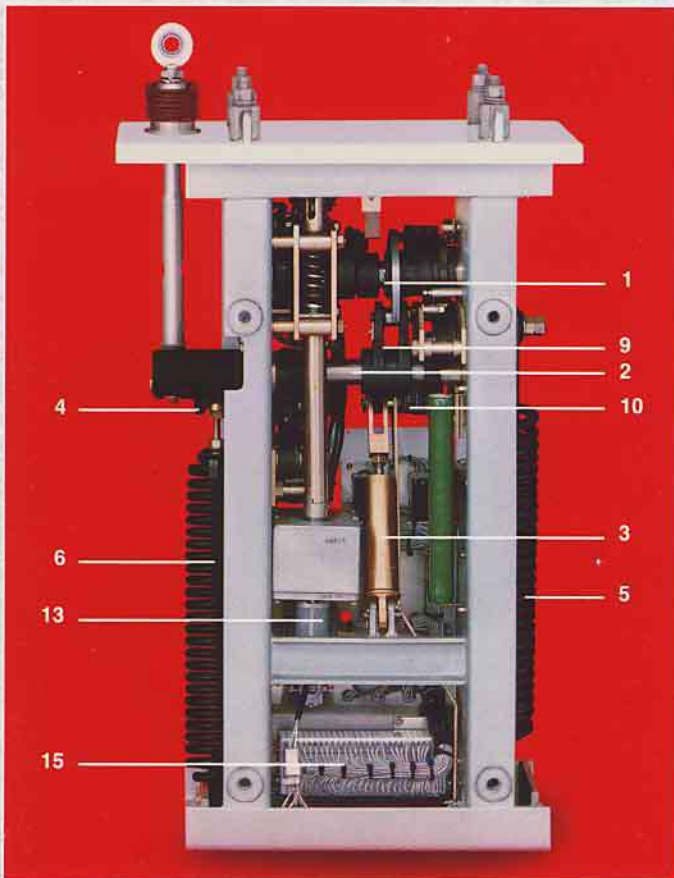


Fig. 2

Design and internal view of the spring operating mechanism FSA

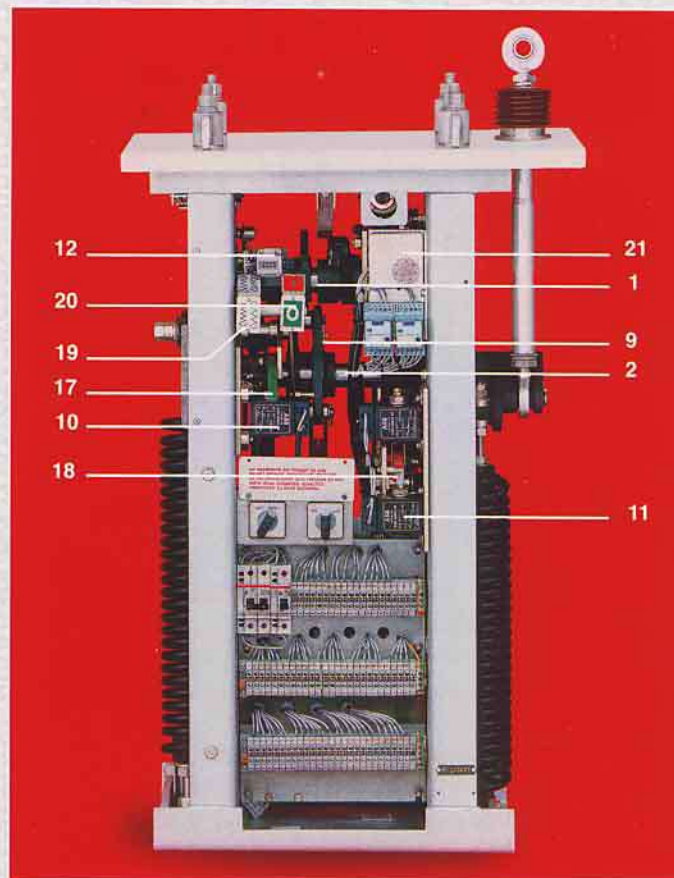
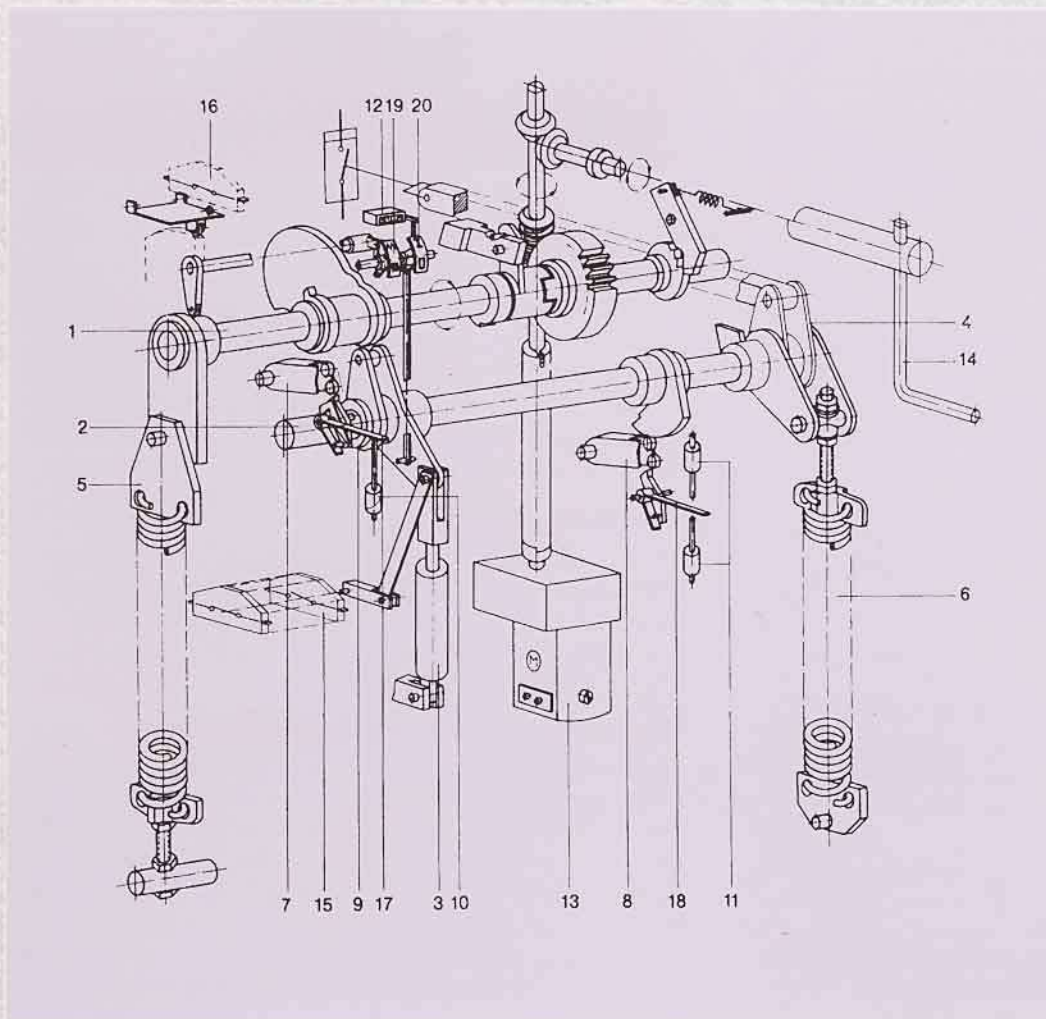


Fig. 3



- 1 Main shaft
- 2 Switching shaft
- 3 Hydraulic damper
- 4 Discharge lever
- 5 Closing spring
- 6 Opening spring
- 7 C.locking latch
- 8 O.locking latch
- 9 C.transfer lever
- 10 C.release coil
- 11 O.trip coil
- 12 Breaker operations counter
- 13 Motor
- 14 Hand crank
(for manual operation)
- 15 Auxiliary switch
- 16 Motor limit switch
- 17 C.manual operation
- 18 O.manual operation
- 19 Spring tension indicator
for the CO spring
- 20 Position indicator
- 21 Thermostat

Fig. 4
Schematic layout of the spring operating mechanism FSA

Auxiliary contacts. The operating mechanism can be supplied with 5 N/O plus 4 N/C additional auxiliary contacts.

Protective cover for the terminals (only for the incoming AC cables) .Made of transparent plexiglas.

Lockable cover for control panel. A hinged lockable cover protects the entire operator's panel.

Cubicle light.

Fuses. UK 10,3-HESi or HRC fuse link .Quantity,type and position in circuit diagram,to be stated when ordering.

Central control cubicle. If three-pole operation is required for single phase operated breakers,a central control cubicle is needed.

Technical data of FSA

Motor

Universal series motor for voltage 110-125 V or 220-250 V,a.c. or d.c.

| Rated voltage V | Starting current Instantaneous approx. A | Normal current at d.c. approx. A |
|--------------------|--|--|
| 220 | 20 | 4 |
| 110 | 40 | 8 |

Spring charging time 10-15 s

Operating coils

| Operating coil | Rated voltage V,d.c. | Power consumption approx. W |
|----------------|-------------------------|--------------------------------|
| Closing coil | 110-125,220-250 | 450 |
| Opening coil | 110-125,220-250 | 450 |

Voltage operating range for the motors and the operating coils meet the requirements in IEC 62271-100 and ANSI C 37.

Auxiliary contacts

| Rated voltage V | Rated current A | Closing current A | Breaking current | |
|--------------------|--------------------|----------------------|----------------------|---------------------------------|
| | | | DC L/R=40 ms A | AC $\cos\varphi = 0.95$ A |
| 110 | 25 | 20 | 4 | 25 |
| 220 | 25 | 10 | 2 | 25 |

The operating mechanism normally includes 5 N/O and 7 N/C spare auxiliary contacts.

The spring mechanism has passed type testing according to IEC 62271-100 and ANSI C 37.

Mechanical life test is performed up to 10000 operations. Before delivery each operating mechanism has to pass rigorous routine testing.

For each breaker a routine test report is issued showing the actual test result.

Maintenance of FSA

As far as maintenance is concerned,the spring operating mechanism FSA offers distinct advantages,which contribute to a reduction in operational costs.

Lubrication of the transmission shafts and worm-gears as well as the gear wheels,is only required after 2500 CO switching operation,while an overhaul of the complete operating mechanism should be carried out after 5000 CO operations.

Heating elements

| Rated voltage V, AC | Power consumption | |
|------------------------|-----------------------------|----------------------------------|
| | Continuously connected W | Thermostatically controlled W |
| 210-240 | 70 | 140 |
| 110-127 | 70 | 140 |

Power frequency test,one minute, 50 Hz

| | |
|-------------------|--------|
| Auxiliary circuit | 2.0 kV |
| Motor | 1.5 kV |

Degree of protection as per IEC 529 IP 55

Terminal blocks Connectable cable area 2x6 mm²

Cable-entry plate Size 135x200 mm

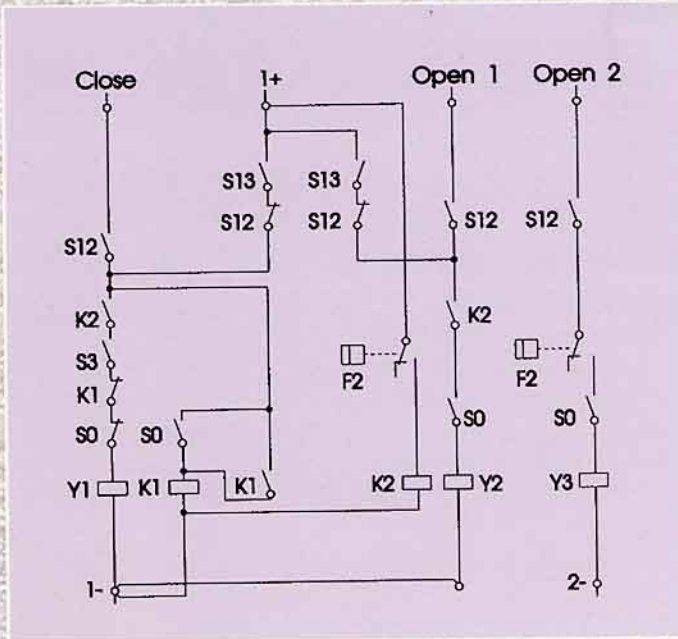


Fig. 5
Basic diagram of the electrical components in the spring operating mechanism FSA

| | | | |
|----|------------------------------------|-----|-------------------|
| F2 | Density switch | S0 | Auxiliary contact |
| F3 | Direct-on-line motorstarter | S3 | Limit switch |
| F4 | Moulded case breaker | S12 | Selector switch |
| K1 | Antipumping relay | S13 | Control switch |
| K2 | Interlocking relay, Close and Trip | Y1 | Closing coil |
| M | Motor | Y2 | Shunt trip coil 1 |
| R3 | Heater | Y3 | Shunt trip coil 2 |

The basic functions of the electrical components of the operating mechanism are shown in the basic circuit diagram (Figure.5,6)

Closing circuit

The closing coil Y1 can be activated manually via the operating switch 17 (Figure 2 & 3) in the operating mechanism, or electrically by means of local or remote control.

Interlocking at close

Auxiliary contact S0 ensures that the closing signal is only transmitted when the breaker is fully open. The gas-density monitor contact F2 controls auxiliary contactor K2 and blocks the switching command when the SF6 pressure is too low. Anti-pumping relay K1 cancels the persistent closing signal after successful completion of the closing operation.

Tripping circuits

The breaker is equipped with two tripping coil Y2 and Y3, each independent from the other. These can be manually activated via the manual switch 18 (Figure 2 & 3) in the operating mechanism, or electrically by means of local or remote control.

Interlocking at trip

Auxiliary contact S0 ensures that the tripping coil Y2 and Y3 only can be energized when the breaker is closed. In the event of too low SF6 density, the tripping circuits would be interrupted via the gas-density monitor contact in F2.

Monitoring and signalling

In order to monitor the operating condition of the SF6 gas and the operating mechanism, electrical signals are employed for remote indication.

- SF6 gas density too low
- Replenishment of SF6 gas
- Protection switch " Motor supply " tripped
- Protections switch " Heating supply " tripped
- Phase discrepancy via auxiliary contacts S0 (only for single pole operated breakers).

Heating circuit

The operating mechanism cubicle is fitted with a continuous heating system in order to avoid water condensation.

For low temperature operation an extra thermostatically controlled heater is supplied (only for applications lower than - 30°C).

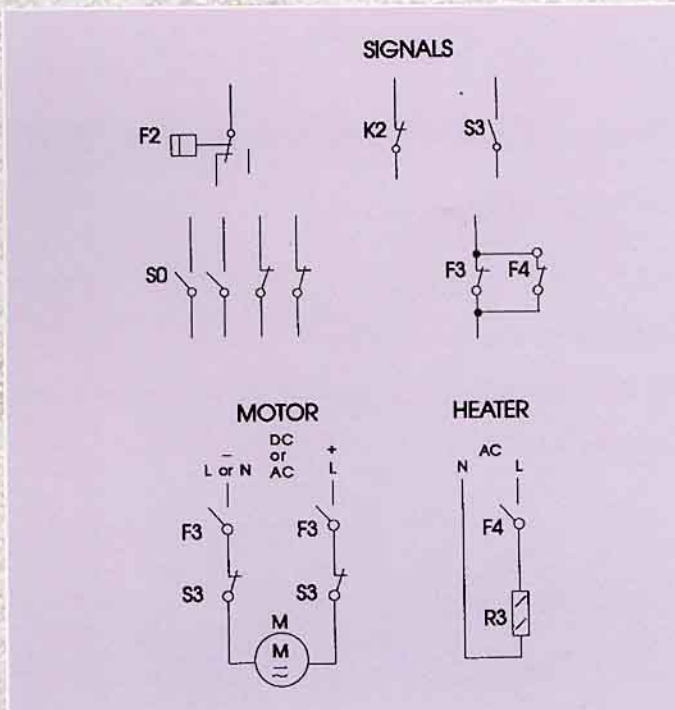
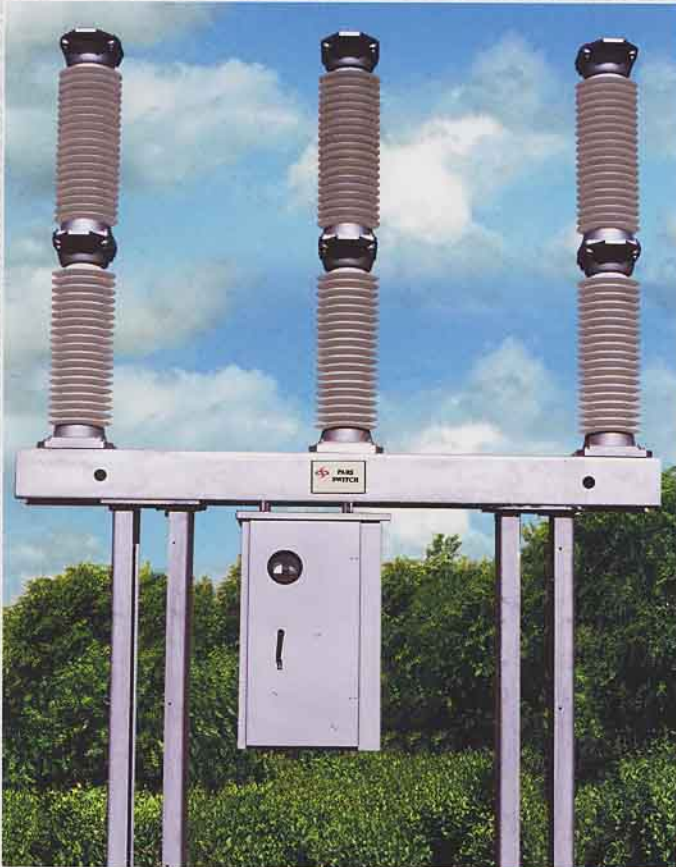


Fig. 6
Circuit diagram shows operating mechanism when circuit-breaker is in off position, not pressurized, closing spring uncharged, no power supply connected and selector switch in position : LOCAL

Optional versions for EDF circuit breaker

- One pole or three pole operation.
- Silicon rubber insulators.
- Different column & Frame height of C.B. ACC. to Schedule of last page.
- Different creepage distance to earth and across break.



Transport and erection

The EDF SK circuit-breaker is transported as a complete unit filled with SF₆ gas to a slight overpressure. As the circuit - breaker is assembled and routine tested in the factory the erection work at site is very simple and can easily be done in one day.

Filling of the SF₆ gas to specified working pressure can be facilitated by using the following pressurising equipments:

- One special control valve, for connection of the SF₆ gas bottle, and a 25 m long hose with connector.
- Complementary control valve for connection to N₂ or CF₄ gas bottle (for mixed gas filling).
(Please note that national deviations for gas connections may occur).

Advantages of EDF C.B. with silicon rubber insulators :

- 1 - Light weight
- 2 - Suitable for highly polluted areas
- 3 - Easy to handle
- 4 - Easy pole replacement
- 5 - Suitable for mobile substation

EDF SK with Silicon Rubber insulators



Assembly line of high voltage circuit breakers



Shipping data

Preliminary shipping data (standard version)

| Type | Number of cases | Total Volume m ³ | Total Gross weight kgs | Total Net weight kgs |
|--|-----------------|-----------------------------|------------------------|----------------------|
| EDF SK 72.5 kV three pole operation, incl one op. mechanism and support columns | 2 | 3.8 | 1123 | 873 |
| EDF SK 72.5 kV single pole operation, incl. three op. mechanism and support columns. | 2 | 4.9 | 1490 | 1190 |



PARS SWITCH FACTORIES - ZANJAN

کارخانجات پارس سوئیچ - زنجان

PARS SWITCH Co's high voltage products:

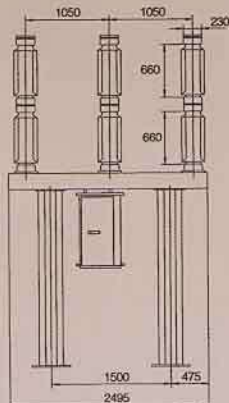
- 1- EDF SF6 gas type C.B 72.5 KV, 2500 A, 31.5 KA
- 2- LTB SF6 gas type C.B 145 & 170 & 245 & 420 KV, 3150-4000 A, 40-50 KA
- 3- HPL SF6 gas type C.B 245-420 KV, 2500-4000 A, 40-50 KA
- 4- NSA disconnector switch 36-420 KV, 1250-3150 A
- 5- VBP vertical break disconnector switch 72.5 KV, 1250 A
- 6- Compact Bay 145 KV
- 7- Urban substation 63 KV

After sales services:

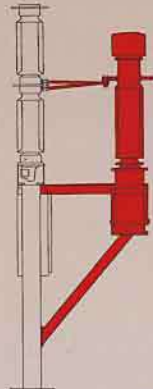
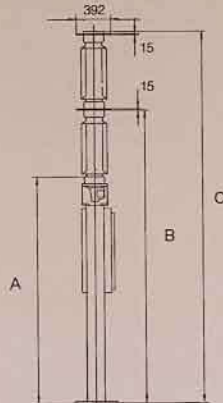
After sales services department is always ready to provide necessary accessories and spare parts and repair all Pars switch products.
Tel.: (+98241) 7290717

Dimensions

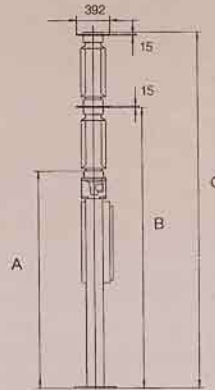
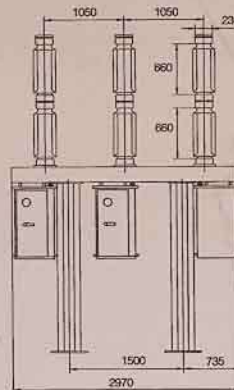
EDF SK 1-1,72.5 kV
2 - column stand
3 - pole operation



IMBD type current transformer can be installed with brackets on EDF circuit breaker.



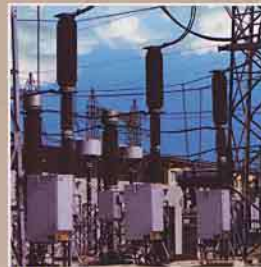
EDF SK 1-1,72.5 kV
2 - column stand
1 - pole operation



VBP



Urban substation



HPL



EDF



NSA



LTB

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| | | | | |
|---|------|------|------|------|
| A | 2325 | 2525 | 2705 | 3060 |
| B | 3065 | 3265 | 3445 | 3800 |
| C | 3940 | 4140 | 4320 | 4675 |

مَبسان

(مهندسی بازرگانی سیستم‌های انتقال نیرو)

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تهران، لاله زار جنوبی، کوچه بوشهری، مجتمع تجاری تهران الکتریک، طبقه دوم، واحد ۳۱۱