VF12/24 kV
MEDIUM VOLTAGE VACUUM CIRCUIT-BREAKERS
The VF series vacuum circuit-breaker is the synthesis of modern construction principles and cutting age technologies of switching devices manufacturing. High-reliable operating mechanism, APG casting technology, smart technical solutions and modern materials ensure fail safe performance of VF series vacuum circuit-breaker within its wholelife cycle.

The VF series of vacuum circuit-breakers conform to the specifications of IEC 62271-100
# SPECIFICATIONS

## CHARACTERISTICS. DESIGNATION STRUCTURE

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage, U_r, kV</td>
<td>12</td>
</tr>
<tr>
<td>Rated insulation voltage, U_s, kV</td>
<td>12</td>
</tr>
<tr>
<td>Rated normal current, I_r, A *</td>
<td>630; 800; 1000; 1250; 1600; 2000; 2500; 3150; 4000 **</td>
</tr>
<tr>
<td>Rated breaking capacity (rated short-circuit breaking current symmetrical), I_sc, kA</td>
<td>20; 25; 31.5; 40</td>
</tr>
<tr>
<td>– making capacity, I_p, kA</td>
<td>51; 63; 81; 100</td>
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<tr>
<td>– rated short-time withstand current (3s), I_k, kA</td>
<td>20; 25; 31.5; 40</td>
</tr>
<tr>
<td>Rated voltage of control circuits, V</td>
<td>~110, ~220, ~110, ~220</td>
</tr>
<tr>
<td>Heating circuits rated voltage, V</td>
<td>~220</td>
</tr>
<tr>
<td>Motorized truck control circuits rated voltage, V</td>
<td>~220</td>
</tr>
<tr>
<td>Undervoltage release rated voltage, V</td>
<td>~110, ~220</td>
</tr>
<tr>
<td>Control circuits rated current, A</td>
<td>1; 1</td>
</tr>
<tr>
<td>– closing/tripping solenoids</td>
<td>3; 5</td>
</tr>
<tr>
<td>– overcurrent releases</td>
<td>3; 5</td>
</tr>
<tr>
<td>Control circuits operating limits (AC/DC), % of U_rated:</td>
<td></td>
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<tr>
<td>– closing solenoid</td>
<td>70–115 / 85–105</td>
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<tr>
<td>– tripping solenoid</td>
<td>65–120 / 70–110</td>
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<tr>
<td>– closing spring charging electric motor</td>
<td>85–110</td>
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<td>Main circuit testing voltage, kV</td>
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<td>– withstand voltage at 50 Hz</td>
<td>42; 65</td>
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<td>– 1.2/50 μs impulse withstand voltage</td>
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<td>Opening time, ms, max.</td>
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<td>Closing time, ms, max.</td>
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<td>Total breaking time, ms, max.</td>
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<td>Closing spring charging time, s, max.</td>
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<td>Mechanical life, operations</td>
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<tr>
<td>– for circuit-breakers 630; 800; 1000; 1250; 1600 A</td>
<td>30,000; 10,000</td>
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<tr>
<td>– for circuit-breakers 2000; 2500; 3150 A</td>
<td>10,000; 10,000</td>
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<tr>
<td>Switch operations of rated short-circuit breaking current, operations</td>
<td>50; 25</td>
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<tr>
<td>Life cycle, years</td>
<td>30; 30</td>
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* For 40 kA version, rated currents 1250, 1600, 2000, 2500 and 3150 A.  ** Up to 4000 A with forced ventilation

## DESIGNATIONS STRUCTURE

**VFXX - X - XX - XXX - X - XXXX - XX, XX**

- **VFXX** - Digital combination for optional row of INTERLOCKS (table 2)
- **X** - Digital combination for circuit-breaker version and optional row of operating mechanism equipment with additional devices (table 1)
- **XX** - Rated current, A
- **XXX** - Phase-to-phase distance: A – 150 mm, B – 210 mm, C – 275 mm, D – 150 mm with interphase barriers
- **XX, XX** - Rated breaking capacity, kA
- **X** - Rated voltage, kV
- **S** - Circuit-breaker version: S – fixed; M – withdrawable; E – on motorized truck
- **Alphanumeric combination for circuit-breaker voltage class: 12, 24**

**EXAMPLE:**

**VF12-M-10-20-A-1250-02.04** – withdrawable vacuum circuit breaker with 12 kV rated voltage, 20 kA rated breaking capacity, 150 mm phase-to-phase distance, 1250 A rated current, 220 V control circuits voltage with over current releases, operating mechanism locking electromagnet
The operating mechanism and the poles are fixed to a metal frame which is also the support for the fixed version of the circuit-breaker. The compact structure ensures sturdiness and mechanical reliability. Apart from the isolating contacts and the cord with plug for connection of the auxiliary circuits, the withdrawable version is completed with the truck for racking it into and out of the switchgear or enclosure with the door closed.

1 – Frame
2 – Contact system
3 – Pole
4 – Truck
VF SERIES | 12/24 kV VACUUM CIRCUIT-BREAKERS

DESIGN

VACUUM INTERRUPTER. POLE

VACUUM INTERRUPTER

The special geometry of the contacts and the material used, as well as the limited duration and low voltage of the arc, guarantee minimum contact wear and long life. Furthermore, the vacuum prevents their oxidation and contamination. The special geometry of the spiral contacts generates a radial magnetic field in all areas of the arc column, concentrated over the contact circumferences. An electromagnetic force is self-generated and this acts tangentially, causing rapid arc rotation around the contact axis.

This means the arc is forced to rotate and to involve a wider surface than that of a fixed contracted arc.

POLE

The VF series vacuum circuit-breakers use vacuum interrupters embedded in the poles. This construction technique makes the circuit-breaker poles particularly sturdy and protects the interrupter from impacts dust deposits and humidity.
Highly reliable operating mechanisms thanks to a low number of components which are manufactured using production systems for large quantities

- Extremely limited and simple maintenance
- Accessories common to the entire range
- Electrical accessories that can be easily and quickly installed or replaced thanks to wiring pre-engineered with plug-socket connectors
- Mechanical anti-pumping device is supplied as standard
- Protective covering over the opening and closing pushbuttons to be operated using a special tool (optional)

The low speed of the contacts, together with the reduced run and low mass, limit the energy required for the operation and therefore guarantee extremely limited wear of the system. The circuit-breaker therefore only requires limited maintenance.

The VF series vacuum circuit-breakers use a mechanical operating mechanism, with stored energy and free trip. These characteristics allow opening and closing operations independent of the operator. The operating mechanism is of simple conception and use and can be customised with a wide range of accessories which are easy and rapid to install. This simplicity converts into greater reliability of the apparatus.
The VF series of vacuum circuit-breakers are available in the fixed and withdrawable version with front operating mechanism.

Each version can be completed with options, increasing operational capabilities of equipment.

There is a wide range of the VF series circuit-breakers implementations:
- 2 voltage classes (12/24 kV);
- 4 rated breaking capacities (20/25/31.5/40 kA);
- 8 rated normal currents (630/800/1000/1250/1600/2000/2500/3150 A).

**FIXED VERSION**

The fixed versions of the circuit-breakers are always three-pole and fitted with:
- mechanical signalling device for closing springs charged/discharged
- mechanical signalling device for circuit-breaker open/closed
- closing pushbutton
- opening pushbutton
- cord with connector (plug and socket)
- charging spring lever (the quantity must be defined according to the number of pieces of apparatus ordered)

**WITHDRAWABLE VERSION**

The basic versions of the withdrawable circuit-breakers are always three-pole and fitted with:
- mechanical signalling device for closing springs charged/discharged
- mechanical signalling device for circuit-breaker open/closed
- closing pushbutton
- opening pushbutton
- isolating contacts
- cord with connector (plug and socket)
- racking-in/out lever (the quantity must be defined according to the number of pieces of apparatus ordered)
- charging spring lever (the quantity must be defined according to the number of pieces of apparatus ordered)
- truck could be with manual operation (version «M») or motorized with electric drive (version «E»)
### OVERALL DIMENSIONS

<table>
<thead>
<tr>
<th>CIRCUIT-BREAKER TYPE</th>
<th>MAXIMUM OVERALL DIMENSIONS, MM</th>
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<td>S</td>
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<td>VF12-S-10-20, 25, 31,5-A-(D)-630, 800, 1000, 1250</td>
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<td>VF12-S-10-20, 25, 31,5-B-630, 800, 1000, 1250, 1600</td>
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<td>VF12-S-10-20, 25, 31,5-B-2000</td>
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<td>VF12-S-10-20, 25, 31,5-C-2500</td>
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<td>VF12-S-10-20, 25, 31,5-C-3150*</td>
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<td>VF24-S-20-20, 25, 31,5-B-630, 1000, 1250, 1600</td>
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<tr>
<td>VF24-S-20-20, 25, 31,5-C-2000, 2500, 3150</td>
<td>770</td>
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</tbody>
</table>

* 4000 A with forced ventilation
OVERALL DIMENSIONS

**FIG. 1.**

**FIG. 2.**

Torque:
M18 – 110–140 Nm, M10 – 18–23 Nm.
Torque:
M18 – 110–140 Nm, M10 – 18–23 Nm.
Torque:
M18 – 110–140 Nm, M10 – 18–23 Nm.
**12/24 kV VACUUM CIRCUIT-BREAKERS | VF SERIES**

**FIXED VERSION**

**ELECTRICAL CIRCUIT DIAGRAM**

Legend:
- EK6, EK5 – heating unit, 200 W
- KBS – reed relay
- M – geared motor of spring charging drive
- KT1 – time-delay relay with 0.1-4 s lag time
- S1, S3 – spring state contacts
- SK2 – thermostat
- OF – circuit-breaker state contacts
- YAT – operating device interlocking solenoid
- SAC – closing solenoid
- X1 – VF control board
- V1, V4 – operating device interlocking solenoid
- V2, V5 – overcurrent releases
- R1, R6 – resistors
- R7 – varistor
- C – capacitor
- YAU – undervoltage release (UVR)
- Y6 – UVR tripping solenoid
- X2 – UVR control board
- KRX1 – control circuit connector
- KRX2 – truck connector

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*Only for "Undervoltage release" option*

**When there is no time-delay relay, jumper must be installed**
# VF SERIES | 12/24 kV VACUUM CIRCUIT-BREAKERS

## WITHDRAWABLE VERSION

## OVERALL DIMENSIONS

### OVERALL DIMENSIONS

<table>
<thead>
<tr>
<th>Circuit-breaker type</th>
<th>S, mm</th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>L1</th>
<th>L2</th>
<th>H</th>
<th>h1, mm</th>
<th>h2, mm</th>
<th>Dimensions of Contact system</th>
<th>fig.</th>
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<tbody>
<tr>
<td>VF12-M(E)-10-20,25, 31,5-a-630, 800</td>
<td>525</td>
<td>490</td>
<td>467</td>
<td>496</td>
<td>436</td>
<td>601</td>
<td>656</td>
<td>83,5</td>
<td>69</td>
<td>87 49 150 275 282</td>
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<td>VF12-M(E)-10-20,25, 31,5-a-1000, 1250</td>
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<td>656</td>
<td>83,5</td>
<td>69</td>
<td>87 49 150 275 282</td>
<td>1</td>
</tr>
<tr>
<td>VF12-M(E)-10-20,25, 31,5-B-630, 800</td>
<td>677</td>
<td>638</td>
<td>617</td>
<td>644</td>
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<td>601</td>
<td>656</td>
<td>83,5</td>
<td>69</td>
<td>87 49 210 275 282</td>
<td>1</td>
</tr>
<tr>
<td>VF12-M(E)-10-20,25, 31,5-B-1000, 1250</td>
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<td>638</td>
<td>617</td>
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<td>83,5</td>
<td>69</td>
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<td>VF12-M(E)-10-20,25, 31,5-B-1600</td>
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<td>638</td>
<td>617</td>
<td>644</td>
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<td>83,5</td>
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<td>92 55 55 275 282</td>
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<tr>
<td>VF12-M(E)-10-20,25, 31,5-B-2000</td>
<td>677</td>
<td>638</td>
<td>617</td>
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<td>601</td>
<td>656</td>
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<td>81</td>
<td>128 79 210 310 296</td>
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<td>VF12-M(E)-10-20,25, 31,5-C-2500</td>
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<td>838</td>
<td>817</td>
<td>844</td>
<td>376</td>
<td>590</td>
<td>656</td>
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<td>83</td>
<td>148 109 275 310 296</td>
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<tr>
<td>VF12-M(E)-10-20,25, 31,5-C-3150*</td>
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<td>838</td>
<td>817</td>
<td>844</td>
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<td>590</td>
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<td>80</td>
<td>83</td>
<td>148 109 275 310 296</td>
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<td>VF24-M-20-20, 25, 31,5-B-630, 1000, 1250, 1600</td>
<td>680</td>
<td>638</td>
<td>617</td>
<td>652</td>
<td>463</td>
<td>740</td>
<td>656</td>
<td>71</td>
<td>116</td>
<td>92 55 210 310 346</td>
<td>5</td>
</tr>
</tbody>
</table>
WITHDRAWABLE VERSION

OVERALL DIMENSIONS

FIG. 1.

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FIG. 2.
WITHDRAWABLE VERSION

OVERALL DIMENSIONS

FIG. 3.

FIG. 4.
WITHDRAWABLE VERSION

OVERALL DIMENSIONS

FIG. 5.

FIG. 6.
Legend
EK4, EK5 – heating unit, 200 W
KB5 – reclosure interlocking relay
M – geared motor of spring charging drive
SK2 – thermostat
KT1 – time-delay relay with 0.1-4 s lag time
S1..S3 – spring state contacts
SQ3, SQ4 – withdrawable element position contacts
QF – circuit-breaker state contacts
YAT – tripping solenoid
YAC – closing solenoid
X1 – VF control board
Y1, Y4 – operating device interlocking solenoid
Y' 2, Y3 – overcurrent releases
R1, R6 – resistors
R7 – varistor
C – capacitor
YAU – undervoltage release (UVR)
Y6 – UVR tripping solenoid
X2 – UVR control board
XR1 – control circuits connector
XR2 – truck connector

"Terminal block" option
When activated, terminal block XT is installed instead of XR1 connector. Numbers of XT terminals are the same as the numbers of XR1 pins.

Control board jumper position:
X – set O – not set

Possible combinations of options

- Interlocking electromagnet
- Undervoltage release
- Undervoltage with lag
- Heating
- Overcurrent release

For "Undervoltage release" option activated, circuit-breaker state contacts QF 31-32 must not be used.
** When there is no time-delay relay, jumper must be installed.
ATTENTION: First operation with withdrawable element must be performed from "Intermediate" position.

LOGO! 230 RC CONTROL MODULE
OPERATIONAL ALGORITHMS

"Rack-in" command:
To execute "Rack-in" command an impulse of 20 ms maximum duration must be applied to "I3" input of LOGO! 230 RC module.

"Rack-out" command:
To execute "Rack-out" command an impulse of 20 ms maximum duration must be applied to "I4" input of LOGO! 230 RC module.

LOGO! 230 RC CONTROL MODULE
INTERLOCKING ALGORITHMS

Operational actions interlocking withdrawable VF series circuit-breaker:
Operational action interlocking (racking-in and racking-out) is ensured only when the contact of LOGO! 230 RC module "I5" input is closed.

Racking-in interlocking when earth switch is switched on:
Racking-in interlocking is ensured only when the contact of LOGO! 230 RC module "I6" input is closed.

Racking-in interlocking when the door of withdrawable element compartment is opened:
Racking-in interlocking is ensured only when the contact of LOGO! 230 RC module "I7" input is closed.

Racking-in interlocking when earth switch is switched on:
Racking-in interlocking is ensured only when the contact of LOGO! 230 RC module "I8" input is closed.
## OVERCURRENT RELEASES

This option is used for VF series circuit-breaker shunt opening.

The option presumes installation of two overcurrent releases at vacuum circuit-breaker drive.

Rated current – 3; 5 A.

## UNDervoltage RELEASE

The undervoltage release opens the circuit-breaker when there is a sensible reduction or lack of the voltage that powers it.

- Operates if voltage at its terminals is lower than 35% of rated voltage $V_{\text{RATED}}$;
- do not operate if voltage at its terminals is higher than 70% of rated voltage $V_{\text{RATED}}$.

At the activation of undervoltage release with lag time option, circuit-breaker additionally equipped with time-delay relay with lag time from 0.5 to 4 s.

Lag time variation is performed with 0.1 s steps.

## OPERATING MECHANISM INTERLOCKING ELECTROMAGNET

This option is used for interlocking closing pushbutton and closing solenoid (YAC).

Solenoid is additionally installed at the drive of a circuit-breaker. This solenoid interlocks mechanically closing pushbutton and closing solenoid of VF series vacuum circuit-breaker.

## HEATING

This option is used for ensure VF series circuit-breaker operation at –40°C temperature of ambient air.

Thermostat and two 200 W heating units are additionally installed at the operating mechanism of a circuit-breaker.
TERMINAL BLOCK

This option is used for connection wirings without standard plug. Terminal block installs on a top of metal frame.

FRAMING

This option is used for localization capabilities increasing.

MECHANICAL INTERLOCK OF EXTERNAL SWITCHGEAR DEVICES

This option is used for mechanical linkage between vacuum circuit-breakers operation mechanism and interlocking mechanism of the other switching device. Equivalent mass of interlocking parts of mechanisms, joint to VF series circuit-breakers external devices interlocking mechanism, must not exceed 0.5 kg.

INTERPHASE BARRIERS

This option is used for strengthening of electric insulation between circuit-breaker poles of fixed version. Can be applied for VF12 circuit-breaker with 150 mm phase-to-phase distance.

TRANSIENT CONTACTS

This option is used for compensation space between pole terminal and bus-bare in case when bus-bar connects directly without standard contact system. Uses for 2000 A, 2500 A and 3150 A circuit-breakers of fixed version.

Transient contact 2000 A and 2500 A currents

Transient contact 3150 A current
## SELECTION AND ORDERING VF CIRCUIT-BREAKER

### TYPES. OPTIONAL ACCESSORIES

<table>
<thead>
<tr>
<th>VFXXX-X-XX-XXX-X-XXX-XX</th>
<th>Circuit-breaker type</th>
<th>Control circuits rated voltage $V_{\text{RATED}}$</th>
<th>Overcurrent releases, 2 pcs.</th>
<th>Optional accessories</th>
<th>Undervoltage release</th>
<th>Heating</th>
<th>Terminal block</th>
<th>Framing</th>
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<tbody>
<tr>
<td></td>
<td>~/= 110</td>
<td>~/= 220</td>
<td>5 A</td>
<td>3 A</td>
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## Optional Interlocks

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<th>Operating mechanism electromagnetic interlocking at the absence of control current</th>
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«VF12/24 kV. Medium voltage vacuum circuit-breakers» catalogue.
The data and illustrations are not binding. We reserve the right to make changes without notice in the course of technical development of the product.
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