

H.V. Distribution Equipment

Vacuum circuit breakers

Advantages

■ Description

3.6kV to 36kV, 600 to 4000A, 12.5 to 50kA

The revolutionary arc extinguishing system

● Rotary

FUJI VCBs have employed a unique design principle in which the contacts are provided with a succession of slits having toroidal-type CrCu contacts mounted on them.



The arc is driven round the circular contact surface as it is being extinguished. Since the arc is not localized at one point there is no fear of overheating.

This results in much improved inter-electrode dielectric strength so ensuring excellent breaking capability. Moreover, uneven contact wear is minimized.

● Getter

FUJI vacuum interrupters make use of the gettering effect. The toroidal-type contacts are made of a special chromium-copper (CrCu) alloy specially developed by FUJI so as to ensure a large "getter" quality.

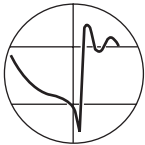


The metallic gases thus produced at interruption and left in the vacuum are quickly absorbed by the getter. The gases are neutralized so maintaining the high degree of vacuum.

The interrupters require a minimum of attention over their long service life.

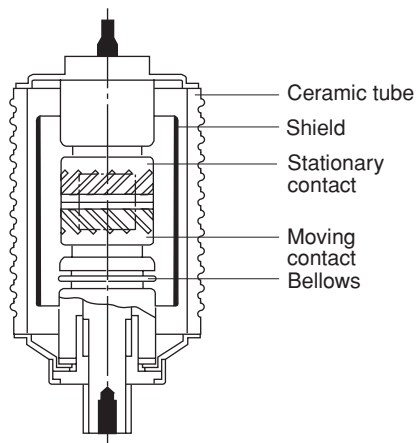
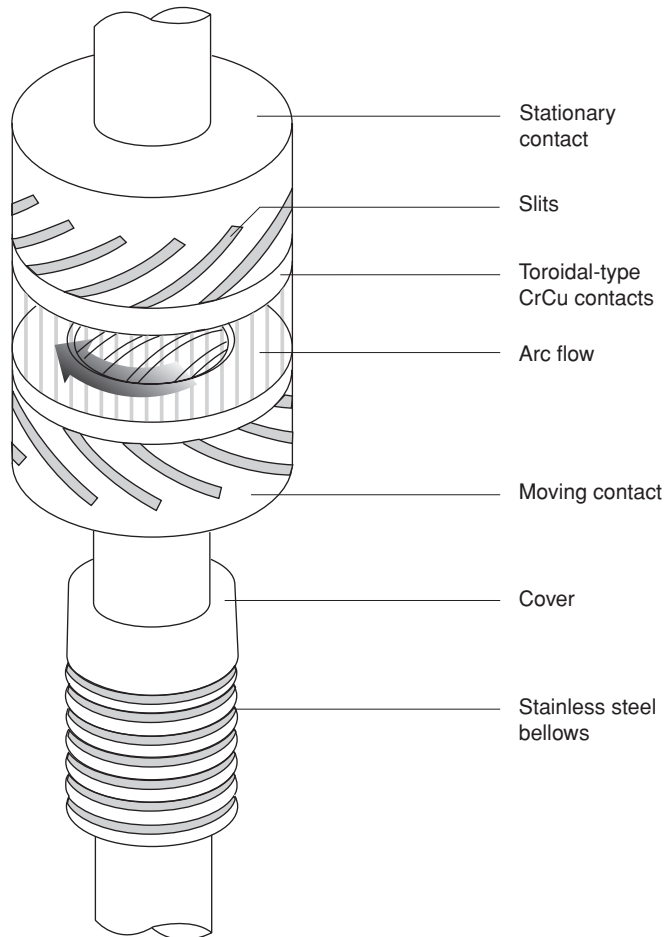
● Surge

Switching surges can be generated at small current breaking due to the VCB inherent chopping current.



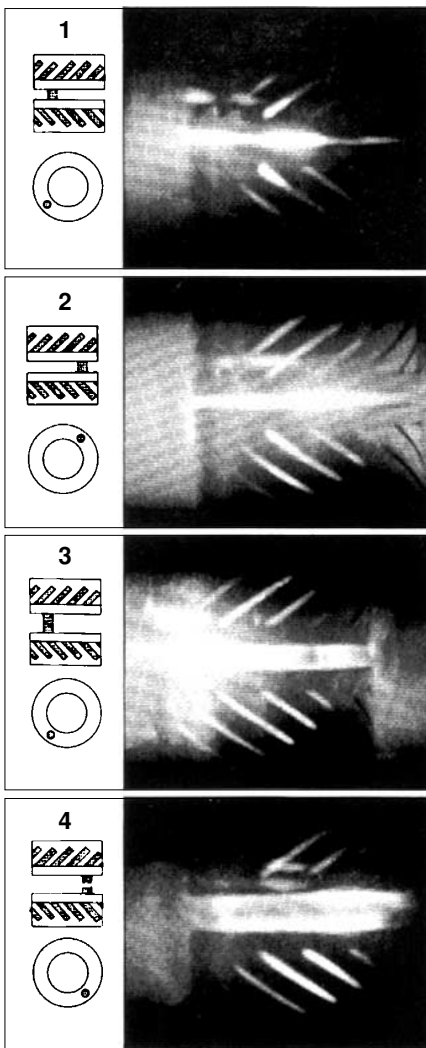
FUJI has paid much attention to this problem, and after much effort on design and materials research it has been possible to reduce the chopping current to 3.5 Amps. This very small chopping current means that the corresponding surge voltage will be reduced and cost efficient surge protection can be carried out for motors, transformers and other load equipment.

The revolutionary arc extinguishing system



● Progress of arc extinction

Arcs generated by VCBs have inherent characteristics that change when approximately 10kA is reached. Less than 10kA a dispersed arc occurs, over this value the arc is concentrated. The photos were taken consecutively and illustrate an interruption in the 25kA range (concentrated arc). About 4 1/2 rotations occurred (10ms at 50Hz). This time is typical, but varies according to breaking current and arcing times.



Explanation

1. The contacts begin to open and the arc moves from the center to the left hand side.
2. 3. The arc is driven round the toroidal-type contact surface.
4. The contacts are in the full open position just before interruption is completed.

■ Definitions

● **What is the action of the “getter”?**
Sometimes called a “degasser” the “getter” uses a special material such as zirconium alloy that has the property of absorbing metallic gases in a vacuum. This allows the high degree of vacuum to be maintained.

● Switching surges and VCBs?

Switching surges can be generated when breaking currents within several hundreds range.

VCB inherent switching surges are generated under certain specific conditions which mainly comprise current chopping surges and multiple current reignition surges. No problem is posed by switching surges when breaking current exceeds several hundred amperes.

Surge voltages

The value of the surge voltage due to switching surges varies according to the ↑

load circuit conditions.

This can be expressed in the following simple formula:

$$\text{Surge voltage} = \text{Surge impedance} \times \text{Chopping current}$$

Therefore, it is necessary to keep the chopping current low in order to reduce the surge voltage to the minimum. The peak transient voltage is obtained by adding to the above calculation the voltage on the load side at the time of current chopping.

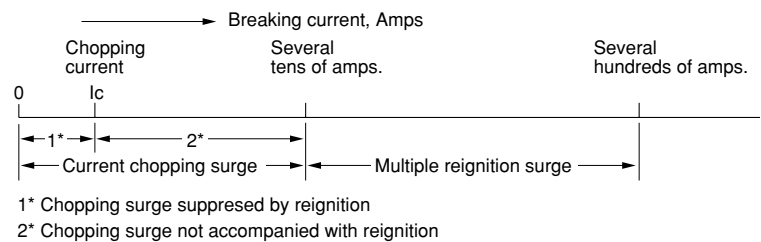
Chopping surge

The chopping surge occurs when a low current is interrupted, the arc is unstable before current becomes zero and the current is forcedly chopped. At this time a surge is generated by the energy remaining in the load inductance.

Example:

When the no-load interruption of a transformer is carried out the exciting current only is interrupted.

Chopping surge



Multiple reignition surge

The multiple reignition surges can occur when breaking currents range from tens to hundreds of amperes. Although no problem is normally posed even when breaking these currents,

a high surge voltage can be generated when breaking an inrush current on starting the motors.

Switching surge

