Vacuum Circuit Breakers
3.6 to 36kV Classes
Vacuum circuit breakers are compact designed for safe operation, high reliability and easy maintenance, and are widely used for various types of high voltage circuits. Fuji HS series vacuum circuit breakers (VCB) have been developed through the use of our many years of successful experience and advanced technology. They are compact and light-mass (weight), and are available in a number of current ratings.

### Features

#### Compact, light-mass design
Vacuum circuit breakers have a small switching stroke as compared with other types of circuit breakers, so their breaking unit is small in size. To take full advantage of this feature, the operating mechanism has been designed to reduce the size and mass of the circuit breakers.

#### Spring closing system
The vacuum circuit breakers use a motor-spring stored-energy mechanism (rapid auto-reclosing type) to provide stabilized electrical and mechanical characteristics and to reduce the closing operating current.

#### Safe operation and simplified maintenance
- The operating mechanism is mounted on the front of the frame and the live parts are mounted on the rear. Thus, the operating mechanism is completely isolated from the live parts (dead front type).
- The draw-out type (Y) can be fitted with a misoperation-protection-interlock complying with the IEC and JEM standards (available by designation).

#### Stable breaking performance
The excellent insulation recovery characteristics of the vacuum interrupter allow it to react quickly from small current to short-circuit currents, and also to exhibit a stable interrupting performance in double earth fault and out-of-phase currents.

### Scope of VCB basic type

<table>
<thead>
<tr>
<th>Rated voltage [kV]</th>
<th>3.6/7.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated breaking current [kA]</td>
<td>20, 25, 31.5, 40, 50</td>
</tr>
<tr>
<td>Rated current [A]</td>
<td>600, 1200, 2000, 3000, 4000</td>
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<thead>
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<th>Rated voltage [kV]</th>
<th>12</th>
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<tbody>
<tr>
<td>Rated breaking current [kA]</td>
<td>12.5, 16, 20, 25, 31.5, 40, 50</td>
</tr>
<tr>
<td>Rated current [A]</td>
<td>600, 1200, 2000, 3000, 4000</td>
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<th>Rated voltage [kV]</th>
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<tbody>
<tr>
<td>Rated breaking current [kA]</td>
<td>12.5, 16, 25, 40, 25</td>
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<tr>
<td>Rated current [A]</td>
<td>600, 1200, 2000, 3000</td>
</tr>
</tbody>
</table>

[Unit: mm]
# Ratings and Specifications

## Standard ratings and specifications of HS series VCB

### Type

<table>
<thead>
<tr>
<th>Type</th>
<th>Voltage</th>
<th>Normal current</th>
<th>Short-circuit breaking current</th>
<th>Short-circuit breaking capacity</th>
<th>Short-time withstand current</th>
<th>Breaker time</th>
<th>Rated withstand voltage</th>
<th>Rated normal current switching</th>
<th>Rated current sharing</th>
<th>Rated current sharing</th>
<th>Rated current sharing</th>
<th>Rated current sharing</th>
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<tbody>
<tr>
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<td>250</td>
<td>50</td>
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<tr>
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</table>

**Notes:**
*1 Contact Fuji for the information concerning to the 3s time rating of IEC.
*2 If capacitor tripping mechanism is required, connect a capacitor tripping unit VCB-T1PB, T1A or VCB-T2PB, T2A (optional accessories) to an AC power supply.
*3 Contact Fuji for dimensions of the types not listed here.
### Type designations

#### Ratings

<table>
<thead>
<tr>
<th>Type</th>
<th>Voltage [kV]</th>
<th>Normal current JEC [A]</th>
<th>IEC [A]</th>
<th>Short-circuit breaking current [A]</th>
<th>Short-circuit breaking capacity (reference value) [MVA]</th>
<th>Short-circuit making current (peak value) [kA]</th>
<th>Short-time withstand current JEC, 2s [kA]</th>
<th>Short-time withstand current IEC, 1s*1 [kA]</th>
<th>Breaking time [cycle]</th>
<th>Rated withstand voltage 1 min power JEC [kV]</th>
<th>Frequency IEC [kV]</th>
<th>Impulse (1.2 x 50µs) [kV]</th>
<th>No-load closing time [s]</th>
<th>Rated operating sequence</th>
<th>Opening time [s]</th>
<th>Motor-spring stored-energy (rapid auto-reclosing) (M)</th>
<th>Closing system</th>
<th>Tripping system*2</th>
<th>Operating voltage and current for closing AC, DC</th>
<th>Control voltage and current for closing AC, DC</th>
<th>Operating voltage and current for closing DC</th>
<th>No. of auxiliary switches (for external circuit)</th>
<th>Service life</th>
<th>Rated normal current switching</th>
<th>Installation</th>
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</table>

#### Notes:
- *1 Contact Fuji for the information concerning to the 3s time rating of IEC.
- *2 If capacitor tripping mechanism is required, connect a capacitor trip unit VCB-T1PB, T1A or VCB-T2PB, T2A (optional accessory) to an AC power supply.
- *3 Contact Fuji for dimensions of the types not listed here.
- For closing and tripping systems, specify the type and operating voltage.
The Fuji VCB features a dead front structure; the operating mechanism and control circuit are mounted on the front of the circuit breaker, and the vacuum interrupter and main circuit terminals are on the rear to avoid accidental touching with the live parts. These parts are enclosed in a metal cover to prevent them from making contact with the live parts during operation.

### Closing mechanism

The closing mechanism is simple in design and provides high reliability. The circuit breakers use a motor-spring stored-energy closing mechanism of the rapid auto-reclosing type.

#### Motor-spring operation

The motor-spring operating mechanism of Fuji VCB is designed to carry out the closing sequence using the stored-energy in the closing spring supplied by the motor. The operating mechanism incorporates springs capable of storing the energy required for an OFF-ON-OFF sequence when the breaker has been closed. The closing spring is recharged automatically after closing. This breaker model is suitable for rapid auto-reclosing duty. It can be used for reclosing since the charging time for the motor mechanism is 15s or less.

#### Closing mechanism

- **E, K types**
  - Open position (spring free)
  - Open position (spring charged)
  - Closed position (spring free)
  - Closed position (spring charged)

- **N, NA types**
  - Closed spring (spring free)
  - Closed spring (spring charged)

### Tripping system

The VCB normally employs a shunt trip utilizing 100V DC or 200V DC. If it is desired to use the capacitor tripping type, connect a capacitor trip unit, available as an optional accessory, to the shunt trip unit.

### Capacitor trip unit (separate mount, option)

#### Connection

![Connection Diagram]

#### Specifications

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Rated input voltage AC [V]</th>
<th>Effective time for tripping VCB shunt trip coil DC [V]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacitor trip unit</td>
<td>VCB-T1PB, T1A</td>
<td>100/110</td>
<td>Within 30s after AC power disappeared</td>
</tr>
<tr>
<td></td>
<td>VCB-T2PB, T2A</td>
<td>200/220</td>
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</tbody>
</table>

#### Shunt trip (f)

![Shunt Trip Diagram]

#### Installation

<table>
<thead>
<tr>
<th>Fixed type</th>
<th>M draw-out type</th>
<th>M draw-out unit type</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>HS-Y</td>
<td>Y</td>
</tr>
<tr>
<td>U</td>
<td>HS-M (for HS2530)</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>HS-X</td>
<td>-</td>
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<tr>
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<td>HS-U</td>
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</table>

#### Terminal

<table>
<thead>
<tr>
<th>Main circuit</th>
<th>Screw</th>
<th>Plug</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aux. circuit</td>
<td>Connector</td>
<td></td>
</tr>
<tr>
<td>Earth (ground)</td>
<td>Screw</td>
<td>Shoe</td>
</tr>
</tbody>
</table>

#### Insulation shutter

- -

#### Interlock

- With draw-out interlock
In the vacuum interrupter, there is a pair of cup contacts, each having oblique slots. This contact structure allows a current to flow along a winding path as shown by “1” in the illustration below. When the contacts open, the arc deflects in the direction shown by “2” and rotates in the direction shown by “3”. The arc is driven round the contact surface without arc stagnation, and is extinguished in a short time. This prevents local overheating of the contact surface and uneven wear of the contacts, thereby providing a longer service life. Since the contacts are made of a special material, chopping current flowing into the contacts, thereby providing a longer service life.

Service life

Judgment of vacuum condition

The vacuum condition in the vacuum interrupter is an important factor for operation of the VCB. The interrupter of Fuji VCB is designed to maintain a high vacuum for a long period of time. It is factory tested to insure reliable performance. When checking the vacuum condition, use the following procedure. With VCB in the “open” condition, apply a commercial frequency voltage (ex.22kV effective value for VCB rated at 7.2kV) for 1min time across the poles of the same phase. When the vacuum interrupter withstands this voltage, the vacuum condition is normal.

Mechanical life

The VCB has a simple and excellent operating mechanism, so the mechanical stress developed at the time of operation remains the constant and hence the mechanical characteristic is kept stabilized for many years of use. For the mechanical life, refer to the table on pages 3 to 6. Fuji VCB is equipped with an operating counter for check of the mechanical life.

Electrical life

The electrical life of the vacuum interrupter is determined by the switching of load as shown in the table on pages 3 to 6. It can be checked by observing the amount of wear of the contacts which is indicated by the wear indication mark (for “-N” and “-NA” types). The indication mark can be visually checked from the front of the VCB (except for “-E” and “-EA” types) without removing it from the switchgear.

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**Standard accessories**

<table>
<thead>
<tr>
<th>Name</th>
<th>Mounting plate</th>
<th>Fixing parts</th>
<th>Cradle</th>
<th>Insulating shutter</th>
<th>Operating counter</th>
<th>Closing spring charge indicator</th>
<th>Auxiliary circuit plug</th>
<th>Manual charging handle</th>
<th>Operate spring charge indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mounting plate</td>
<td>Fixing parts</td>
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<td>Operate spring charge indicator</td>
</tr>
</tbody>
</table>

**Optional accessories**

- Capacitor trip unit
- Vacuum condition tester
- Lifter

**Vacuum condition tester**

- Type: Available VCB type
- Rated input voltage: 380V/380V AC, 200V/200V AC

**Lifter**

- Type: Carrying VCB type
- Remark: Other available equipment: MULT. VCB, VMC (HN46A), HD type truck

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**Capacitor trip unit**

- Type: Carrying VCB type
- Remark: Other available equipment: MULT. VCB, VMC (HN46A), HD type truck

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**Accessories**

- Type: Carrying VCB type
- Remark: Other available equipment: MULT. VCB, VMC (HN46A), HD type truck

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**Vacuum condition tester**

- Type: Available VCB type
- Rated input voltage: 380V/380V AC, 200V/200V AC

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**Capacitor trip unit**

- Type: Carrying VCB type
- Remark: Other available equipment: MULT. VCB, VMC (HN46A), HD type truck

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**Vacuum condition tester**

- Type: Available VCB type
- Rated input voltage: 380V/380V AC, 200V/200V AC

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**Capacitor trip unit**

- Type: Carrying VCB type
- Remark: Other available equipment: MULT. VCB, VMC (HN46A), HD type truck

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**Vacuum condition tester**

- Type: Available VCB type
- Rated input voltage: 380V/380V AC, 200V/200V AC

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**Capacitor trip unit**

- Type: Carrying VCB type
- Remark: Other available equipment: MULT. VCB, VMC (HN46A), HD type truck

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**Vacuum condition tester**

- Type: Available VCB type
- Rated input voltage: 380V/380V AC, 200V/200V AC
Note: a: approx.  d: depth  e: elec. parts equal to earth potential  h: height  p: pitch

HS3110Y(3000A), HS4010Y(3000A)

HS1220Y(600, 1200A), HS1620Y(600, 1200A)

HS2520Y..........E(600, 1200, 2000A)

HS2530M(600, 1200, 2000A)
Ordering Information

When your inquiring or ordering, please specify the following items.

Type designation and symbol

HS [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]

1. Basic type
   - 3.6/7.2kV, 20 to 40kA : HS ........ –E
     3000A max.
   - 12kV, 12.5 to 31.5kV : HS ........ –E
     2000A max.
   - 24kV, 16, 25kA : HS ........ –E
   - 3.6/7.2kV, 50kA 1200/2000A : HS ........ –NA

2. Short-circuit breaking current
   [A] 630 1250 1200 2000 3000 4000
   Symbol 1 2 3 4 5 6
   600 630 1200 1250 2000 3000 4000
   Symbol 1 2 3 4 5 6

3. Voltage
   [kV] 3.6/7.2 12 24 36
   Symbol 1 2 3 4

4. Frequency
   - 50/60Hz : C1
   - Special (50Hz) : C2
   - Ditto (60Hz) : C3

5. Closing system
   - Motor-spring stored-energy : M
     (rapid auto-reclosing)

6. Tripping system
   - Shunt trip : f

7. Closing operation voltage
   AC : Acceptable

8. Closing control voltage
   AC : Non-acceptable

9. Tripping control voltage
   AC : Acceptable

10. Limit switch for indication of service and isolating positions
    Without provision : F1
     Special (1 SPDT in each) : F2
     Ditto (2 SPDT in each) : F4

11. Limit switch for closing spring charged indication
    Without provision : G01
     Special (with) : G15

12. Shunt trip
    AC : Non-acceptable

13. No. of aux. contacts
    4NO, 4NC : 1
    Special (6NO, 6NC) : 2
    Ditto (9NO, 9NC) : 3

14. Aux. plug-in interlock
    Without : A1
    Special (with) : A2

15. Special (with)
    Ditto (9NO, 9NC) : 3
    Special (6NO, 6NC) : 2

16. Normal current
    [A] 600 630 1200 1250 2000 3000 4000
    Symbol 1 2 3 4 5 6

17. Applicable standards
    JEC, Japanese : B1
    IEC, English : B2
    Special (JEC, English) : B3

Application Guide of Surge Absorber

The surge absorber should be connected between the VCB and its load (device) as shown : connect each phase between the power line and the earth.

Connection of surge absorber

When using a C-R suppressor, it may be necessary to use a directional relay as a ground fault protection relay. Note that the C-R suppressor may be damaged due to higher harmonics.

Notes:
- Protection device is required.
- Protection device is not required.

- When applying the gapless arrester, withstand voltages (impulse) of transformer must exceed the values listed above.
- When interrupting a magnetizing inrush current, it is recommended that a protection device be used.
- A standard lightning arrester is sufficient.
- When using a C-R suppressor, it may be necessary to use a directional relay as a ground fault protection relay. Note that the C-R suppressor may be damaged due to higher harmonics.

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