ZN63A(VS1)-12
Indoor M.V Vacuum Circuit Breaker
The Quality Assurance System
ISO9001 Certificate

Type test reports authorized by
Xian H.V Apparatus Research Institute
& Holland KEMA Test Station
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1 Summary

ZN63A indoor M.V vacuum circuit breaker is suitable for indoor system of 3-phases, A.C, 50Hz, for controlling and protecting in the circuits of 12kV. Conformity with the standards GB1984, DL403, and IEC56.

1.1 Technical features

- Long mechanical service life and short-circuit breaking times
  At rated current, the mechanical service life is 20000 times;
  At rated short-circuit current, the breaking times is 30 and 50.
- Full function
  Breaking and making the all sorts of loads on the standard stipulated by the electricity ministry reliably, such as capacitor, out of phase conditions of method 1-5.
- Few maintenance
  Just cleaning and lubricating the operating mechanism.
- Insulating sleeve
  Avoided all kinds of effects of ambient condition
- Full series modulus
  The rated current from 630A to 3150A
  The rated short-circuit breaking current from 20kA to 40kA.
- Full series, fine currency and maintenance and service conveniently.
- Before delivery 500 times mechanical endurance operations would be done according to the reliable theory to guarantee the reliability of the products.
- Providing the best after-sale service.

1.2 Ambient conditions

a) Air temperature
   Max: +40°C
   Min: -10°C
b) Altitude
   When products used in 12kv, altitude should not exceed 1000m.
   When products used in 7.2kv, altitude should not exceed 3000m.

c) Air relative humidity
   Daily average: ≤ 95%
   Monthly average: ≤ 90%
d) Saturated steam pressure
   Daily average:  \[< 2.2\text{Kpa}\]
   Monthly average:  \[< 1.8\text{Kpa}\]

e) Site free from usual violent shock.

f) Environmental air should not be obviously polluted by corrosive or flammable gas or steam.

g) Site should be dry and clean.

1.3 type and designation

Z  N  63A – 12 / T  \[\square\]  -  \[\square\]  indoor M.V vacuum circuit breaker

- Rated short-circuit breaking current (kA)
- Rated current (A)
- Spring operating device
- Rated voltage(Kv)
- Designing serial No
- Indoor type
- Vacuum circuit breaker
1.4 Dimension

Drawing1: the dimension for ZN63A type C.B of the following specification: 12kv, 630A, 1250A, ……20KA, 25KA, 31.5KA

H = dustproof cover board
I = up primary outgoing terminal
K = down primary outgoing terminal
L = transit hole
T = secondary wiring inlet

a. Fixed type
b. Truck type

Drawing2: the dimension for ZN63A type C.B of the following specification: 12kv, 1600A, 2000A, 2500A, 3150A, …… 31.5KA, 40KA

a. Truck type
b. Fixed type

**1.5 selection data for cinquefoil contact of the ZN63A type circuit breaker**

<table>
<thead>
<tr>
<th>Rated current (A)</th>
<th>630</th>
<th>1250</th>
<th>1600,2000</th>
<th>2500,3150</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated short-circuit breaking current (kA)</td>
<td>20,25</td>
<td>31.5</td>
<td>31.5~40</td>
<td>31.5~40</td>
</tr>
<tr>
<td>Diameter of the fixed contact (mm)</td>
<td>φ35</td>
<td>φ49</td>
<td>φ79</td>
<td>φ109</td>
</tr>
</tbody>
</table>
2 Structure and main features

The basic design structure of the ZN63A-12 vacuum circuit breaker is composed of the following:

- Full enclosed structure of the main circuit
- All-in-one layout of the frame
- Operating device of the circuit breaker

2.1 Full enclosed structure of the main circuit

The main circuit of the ZN63A type vacuum C.B adopted the full-enclosed structure. The parts of the main circuit is installed in a tubular insulating sleeve lengthways. The insulating sleeve is provided with good performance as withstand arcing, resisting aging and high intensity, which is cast in the epoxy resin with new APG technics. These could prevent the vacuum interrupter from damage of the external factor and add the capacity of the peak withstand current and the short-time withstand current of the electric circuit.

2.2 All-in-one layout of the frame

The main circuit and the operating device of the ZN63A type indoor M.V. vacuum C.B are located at the front and backsides of an abnormal frame, i.e. the all-in-one layout. This kind of structure design make the operating performance of the mechanism coincide with the breaking and making characteristic of the interrupter, reduce the unnecessary driving tache, depress the energy consumption and noises, thus make the C.B operating performance reliably, the custom could dive into service directly at the condition of no adjusting. The ZN63A type indoor M.V. vacuum C.B is flexible for equipping with truck type cubicle or fixed type cubicle.

2.3 Operating mechanism of the C.B (drawing3)

The operating mechanism as the stable composition part of the C.B has no partitions. The charging unit, driving unit, tripping unit and cushioning unit of the operating device are all in it. This kind of all-in-one layout structure could realize the logical mechanical efficiency and stability and have high stress and rigidity, thus guaranteed the mechanical characteristic of the C.B reliable and stable.

2.3.1 Charging system

Adopted the chain driving charging system is provided with the following features: drive calmly, low noise and high efficiency. The charging motor or the output torque of the manual charging components drive the chain wheel 27 running through single roller bearing, then through chain 30 drive chain wheel 22 running, thus the hanging spring crank 24 on the driving charging axis is running deasil and the closing spring 33 is elongated.

As the precondition of the auto-reclosing order when the C.B is at the closing position the closing pulling spring of the operating mechanism should be at the charged state. After the C.B closing the charging process should be done
automatically by the charging motor.

The charging system consists of three functions:

- **Mechanical separating at the charging completed**
  Chain drives the charging axis and release at the middle, the motor racing.
- **Manual charging separation**
  The manual charging mechanism separated with electric charging mechanism, the manual charging could not drive the motor axis moving.
- **The single bearing is installed in the charging mechanism to prevent the charging axis reversing during the charging process.**

### 2.3.2 Closing theory

After charging, press the manual closing button 34 to push the manual closing flexing board 32 running or make the closing electromagnet 29 moving to push the electric closing flexing board 31 running, the axis drive the charging keeping detent 26 turning, thus the restriction between the charging keeping detent 26 and the rolling wheel 25 is released, then the energy of the closing spring 33 is set free and the closing cam 18 would running clockwise. The moving electric lever of the vacuum interrupter 4 moved upwards through the driving of the secondary four lever operating mechanism 19,12 and the insulating pulling level 8, thereby the closing is completed.

### 2.3.3 Opening theory

After the closing completed press the manual opening button 17 or make the closing electromagnet 15 moving to push the tripping flexing board running, thus the opening half axis 16 would running clockwise, then the secondary tripping parts 14 is free from the restriction of the half axis. The moving electric lever of the vacuum interrupter 4 moved downwards through the action of the contact dishing spring in the insulating pulling level 8 and the opening pulling spring, thereby the opening is completed.

### 2.3.4 Arc-extinguishing theory of the vacuum interrupter

The static pressure of the interrupter is low about 10^-3 ~10^-5 pa, so the high dielectric intensity could be realized just quite small contact clearance is required. During opening the vacuum electric arc produced between the moving and the fixed contact would be extinguished easily. The proper vertical magnetic field produced from the contact clearance make the vacuum electric arc keeping diffusion type because of the special structure of the contacts. The electric arc distributed on the contact surface uniformly is burning and maintaining the low electric arc voltage. The residual plasma, electron and the metal vapor produced at the electric arc burning could condense on the contact surfaces and the shield at the first natural current zero in a few microseconds. The dielectric strength of the interrupter across the isolating distance would be recovery extremely fast, thus the electric arc are quenched and the opening is completed.
1 upper bracket  2 upper outgoing socket
3 insulating canister  4 vacuum interrupter
5 down bracket  6 down outgoing socket
7 inductive nip  8 insulating pulling level
9 C.B frame  10 oil cushion
11 opening spring  12 four lever mechanism
13 main axis  14 opening second tripping parts
15 opening electromagnet  16 opening half axis
17 opening button  18 cam
19 four lever mechanism

20 charging indicating plate  21 dialing board
22 chain wheel  23 wheel assembling
24 hanging spring crank  25 rolling wheel
26 charging keeping detent  27 chain wheel
28 motor  29 closing electromagnet
30 chain  31 electric closing flexing board
32 manual closing flexing board
33 closing spring  34 manual closing button

Drawing 3
2.3.5 Wiring drawing of the ZN63A truck

**Fig 4**

<table>
<thead>
<tr>
<th>Item</th>
<th>Signal</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>S1</td>
<td>micro switch using charging</td>
</tr>
<tr>
<td>2</td>
<td>S2</td>
<td>Auxiliary switch linking with C.B main axis</td>
</tr>
<tr>
<td>3</td>
<td>V1~v3</td>
<td>Series rectifier</td>
</tr>
<tr>
<td>4</td>
<td>HQ</td>
<td>Closing electromagnet</td>
</tr>
<tr>
<td>5</td>
<td>TQ</td>
<td>Opening electromagnet</td>
</tr>
<tr>
<td>6</td>
<td>M</td>
<td>Charging motor</td>
</tr>
<tr>
<td>7</td>
<td>SW</td>
<td>Limited switch (testing position)</td>
</tr>
<tr>
<td>8</td>
<td>YW</td>
<td>Limited switch (servicing position)</td>
</tr>
<tr>
<td>9</td>
<td>K0</td>
<td>Anti-pumping relay</td>
</tr>
<tr>
<td>10</td>
<td>Y1~Y3</td>
<td>Overcurrent tripping electromagnet</td>
</tr>
</tbody>
</table>
### 3 Technical data

#### 3.1 C.B technical data

<table>
<thead>
<tr>
<th>Item</th>
<th>Name</th>
<th>Unit</th>
<th>ZN63A-12-20</th>
<th>ZN63A-12-25</th>
<th>ZN63A-12-32</th>
<th>ZN63A-12-40</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rated voltage</td>
<td>Kv</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Rated current</td>
<td>A</td>
<td>630</td>
<td>1000</td>
<td>630</td>
<td>1600</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1250</td>
<td>1250</td>
<td>1250</td>
<td>2000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2500</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3150</td>
</tr>
<tr>
<td>3</td>
<td>1 min power frequency</td>
<td>Phase to phase /phase to earth</td>
<td>KV</td>
<td>42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Frequency</td>
<td>Across the isolating distance</td>
<td>KV</td>
<td>48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Impulse withstand voltage</td>
<td>Phase to phase /phase to earth</td>
<td>KV</td>
<td>75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Across the isolating distance</td>
<td>KV</td>
<td>85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Rated short-circuit breaking current</td>
<td>KA</td>
<td>20</td>
<td>25</td>
<td>31.5</td>
<td>40</td>
</tr>
<tr>
<td>8</td>
<td>Breaking times of the rated short-circuit breaking current</td>
<td>Times</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>30</td>
</tr>
<tr>
<td>9</td>
<td>Percent of direct component</td>
<td></td>
<td></td>
<td>40%</td>
<td>40%</td>
<td>405</td>
</tr>
<tr>
<td>10</td>
<td>Rated peak withstand current</td>
<td>KA</td>
<td>50</td>
<td>63</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>11</td>
<td>Rated short-time withstand current/4s</td>
<td>KA</td>
<td>20</td>
<td>25</td>
<td>31.5</td>
<td>40</td>
</tr>
<tr>
<td>12</td>
<td>Rated operating sequence</td>
<td></td>
<td>★</td>
<td>★</td>
<td>★</td>
<td>☆</td>
</tr>
<tr>
<td>13</td>
<td>Rated out of phase breaking current</td>
<td>KA</td>
<td></td>
<td></td>
<td>12.6</td>
<td>16</td>
</tr>
<tr>
<td>14</td>
<td>Rated breaking current of asynchronism phase earthed fault</td>
<td>KA</td>
<td>17.3</td>
<td>21.7</td>
<td>27.4</td>
<td>34.6</td>
</tr>
<tr>
<td>15</td>
<td>Rated breaking current of single capacitor bank</td>
<td>A</td>
<td></td>
<td></td>
<td>630</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Rated breaking current of back to back capacitor bank</td>
<td>A</td>
<td></td>
<td></td>
<td>400</td>
<td></td>
</tr>
</tbody>
</table>

★ O-0.3s-CO-180s-CO  ☆ O-180s-CO-180s-CO
3.2 Charging motor of the operating device technical data

Single-phase DC motor is adopted

<table>
<thead>
<tr>
<th>Rated voltage (v)</th>
<th>Rated input power (w)</th>
<th>Normal servicing voltage range (v)</th>
<th>Charging time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC220, DC110</td>
<td>75</td>
<td>85%~110% of rated voltage</td>
<td>≤15</td>
</tr>
<tr>
<td>DC220, DC110</td>
<td>100</td>
<td>85%~110% of rated voltage</td>
<td>≤15</td>
</tr>
</tbody>
</table>

* The operating voltage should be AC or DC power supply

3.3 Opening and closing coils technical data

- Opening and closing coils

<table>
<thead>
<tr>
<th>Rated operating voltage (v)</th>
<th>Closing coil</th>
<th>Opening coil</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AC220</td>
<td>AC110</td>
</tr>
<tr>
<td>AC220</td>
<td>DC220</td>
<td>DC110</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coil current (A)</th>
<th>1.45</th>
<th>2.2</th>
<th>1.1</th>
<th>2.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal servicing voltage range</td>
<td>85%~110% of rated voltage</td>
<td>65%~120% of rated voltage</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4 Maintenance

The vacuum C.B possess the brief structure and serviceable, so its service life is long. During the servicing time the operating mechanism has less maintenance, and the vacuum interrupter is free from maintaining. Although the opening operation and the breaking short-circuit current are frequent the vacuum tolerance could not be affected.

4.1 Checking frequently
The C.B should be check frequently according to the relative servicing stipulation after the C.B has been servicing. The checking should be done on the condition of the main circuit out of electrification.

4.2 Cleaning
The servicing C.B should be cleaned termly to maintain the surface of the insulating and the electric components cleaning. The cleaning should be done on the condition of the main and auxiliary circuit all out of electrification.
4.3 lubrication

4.3.1 The relative parts of the C.B should be lubricated periodically. The lubricating should be done on the condition of the main and auxiliary circuit all out of electrification.

4.3.2 The main parts should be lubricated, such as,

All the C.B running parts besides operating mechanism;
The driving parts related with the C.B installation parts; (e.g. when the C.B is used in the movable type switchgear the driving parts of the C.B and the other parts of the cubicle interlocking)

4.3.3 When the C.B is used in the movable type switchgear the contact parts of the C.B up primary disconnecting plug should be cleaned and spread Vaseline oil termly.

4.4 Notice at the maintenance

a Check the rated voltage and current of the operating components before the C.B is servicing carefully. Do some test-operation with the charging, opening and closing mode of the mechanism to check the data right or wrong.

b During the C.B servicing the vacuum interrupter tolerance should be checked through measuring the power frequency periodically. The concrete way is: make the C.B opening and put 42kv 1 minute power frequency across the isolating distance of the interrupter, if there is continuous puncture the vacuum interrupter should be exchanged.

c The C.B servicing normally should be maintained termly. Clean the dust on the insulating surface and the entire grinding surface should be spread lubricating oil periodically.

d The vacuum interrupter shell must be stricken by the solid objects at installing and servicing.

e The customer could not exchange and use the components of which the specification is inconsistent with the original parts.

f The operator should understand the structure, performance, installation, adjusting and maintenance of the operating mechanism, record the questions produced at servicing and notify the manufacturer necessarily.
5 Ordering information

- Following information should be regarded stated before the order:

A The type, name and quantity of the C.B

B The rated voltage, rated current and the rated short-circuit breaking current of the C.B

C The rated operating voltage

D The name and quantity of the spare parts

E Customers' special requirements
Please write down the specification and the type according to the following mode at the order.

ZN63A-12 – 20 06 1 11 11 1A 0

<table>
<thead>
<tr>
<th>Type</th>
<th>Rated</th>
<th>Rated</th>
<th>Pole</th>
<th>Closing</th>
<th>Opening</th>
<th>Charging</th>
<th>Installation</th>
<th>Special</th>
</tr>
</thead>
<tbody>
<tr>
<td>voltage</td>
<td>short-circuit current</td>
<td>centre control</td>
<td>control</td>
<td>motor</td>
<td>mode</td>
<td>requirements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>breaking distance</td>
<td>voltage</td>
<td>voltage</td>
<td>voltage</td>
<td>yes 1 (specified in the technical agreement)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- truck type
- equipped with general chassis-1A
- equipped with ck type chassis-1B

- fixed type 2

- 110 DC 11
- 220 DC 21
- 110 AC 12
- 220 AC 22
- 110 DC 11
- 220 DC 21
- 110 AC 12
- 220 AC 22
- 110 DC 1
- 220 DC 2
- 110 AC 12
- 220 AC 22
- 210 1
- 275 2
- 630A 06
- 1000A 10
- 1250A 12
- 1600A 16
- 2000A 20
- 2500A 25
- 3150A 32
- 20 KA 20
- 25 KA 25
- 31.5 KA 32
- 40 KA 40