

VCB1-24 model Indoor Vacuum Circuit Breaker

General And Application

VCB1-24 model indoor AC High-voltage Vacuum Circuit Breaker (hereinafter referre d to as circ uit breaker) is indoor switchgear equipment applicable for power system of three phase AC 50Hz or 60Hz, rated voltage up to 24kV , and serves as protection & control unit for power equipments of power grid and industrial and mining enterprises. This is the new generation of vacuum circuit breaker independently developed by GREEGOO aiming at the domestic and international markets and based on many years of production experience.
The circuit breaker accords with the standards of IEC 62271-100, GB1984, JB3855, DL/T 402/403 and so on.

Product Features

- The circuit breaker adopts the new generation of modular spring operation mechanism , with compact and simple structure, reasonable arrangement, reliable transmission and convenient installation;
- The operation mechanism and the body of circuit breaker are designed in integration; It not only can serves as a fixed installation unit, but also can be a handcart unit with combined special pushing mechanism.
- The main conductive circuit mainly adopts the solid sealed pole, and the insulation tube is optional;
- The main circuit adopts the integrated solid sealed pole in solid insulation structure, to realize maintenance free, high reliability and minaturization.
- The circuit breaker is E2 degree.
- It has perfect five-prevention interlocking function after installed in the switchgear.

Normal Service Conditions

- Altitude above sea level: 1000m and below;
- Ambient temperature: -15°C~+40°C;
- Relative humidity: daily average less than 95%, monthly average less than 90%;
  Saturated vapor pressure: daily average less than $2.2X10^{-3}$ Mpa, monthly average less than $1.8X10^{-3}$Mpa;
- Earthquake intensity: not exceed 8 degree;
- Site without flammable, explosive and corrosive material, and frequent violent vibration.
  Any special requirements, please consult the manufacturer.

Model And Meaning

VCB 1 - □ / □ - □
1 2 3 4 5

1. Vacuum Circuit Breaker
2. Design sequence
3. Rated voltage (kV)
4. Rated current (A)
5. Rate short-circuit breaking current (valid value kA)

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Main Technical Parameters

■ Main technical parameters of circuit breaker

No.	Name			Unit	Data		
1	Rated voltage			kV	24		
2	Rated frequency			Hz	50, or 60		
3	Rated current			A	630 1250	1250 1600 2000 2500 3150[a]	
4	Rated insulation level	1min P.F. Withstand voltage	Between phases, phase to ground	kV	65		
			Between gaps		65		
		Rated lightening impulse withstand voltage	Between phases, phase to ground		125		
			Between gaps		125		
5	Rated 4s short-time withstand current			kA	20	25	31.5
6	Rated short-circuit breaking current				20	25	31.5
7	Rated peak withstand current				50	63	80
8	Rated short-circuit making current				50	63	80
9	Rated short-circuit duration			s	4		
10	Rated outphase earth fault breaking current			kA	17.4	21.7	27.4
11	Rated operating sequence				O-0.3s-CO-180s-CO		
12	Rated operating voltage			V	DC(AC)220/110		
13	Electrical life				E2 degree[b]		
14	Mechanical life			time	20000		

Remarks:

a. When the rated current is 3150A forced air cooling is needed

b. According to E2 degree standard electrical life stipulated in IEC62271-100, breaking time of rated short-circuit breaking current is 274.

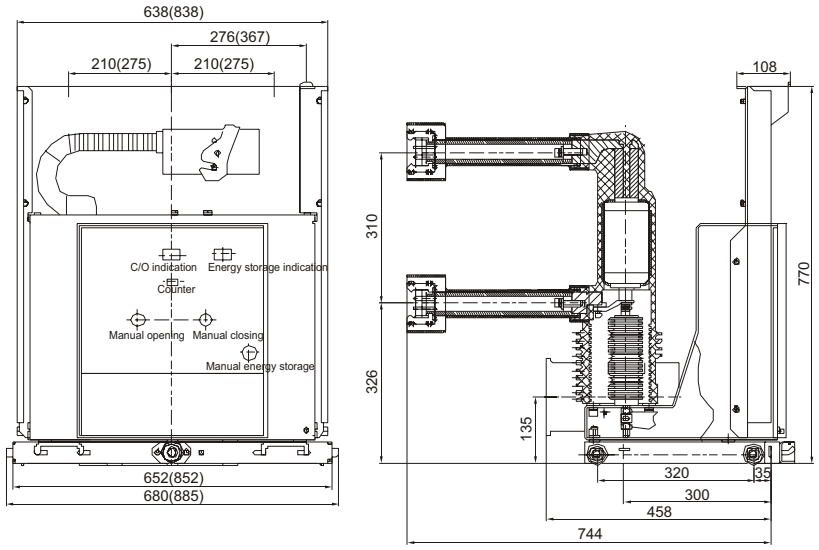
■ Mechanical parameters of circuit breaker

No.	Name		Unit	Data					
1	Open distance of contact		mm	13 ± 1					
2	Over travel of contact			4 ± 1					
3	Centre distance between phases			210, 275					
4	Allowable wear of contact			3					
5	Average opening speed (6mm)		m/s	1.3 ± 0.3					
6	Average closing speed			0.6 ± 0.2					
7	Bounce time of contact closing		ms	≤2					
8	Three phase closing, opening asynchronism			≤2					
9	Main circuit resistance	Rated voltage	A	630	1250	1600	2000	2500	3150
		Fixed type	μΩ	≤50	≤45	≤35	≤35	≤30	≤25
		Handcart type		≤55	≤50	≤40	≤40	≤35	≤30
10	Opening time		ms	≤50					
11	Closing time			≤75					
12	Operating characteristic of operating mechanism			Reliably close under 85% ~ 110% rated voltage					
				Reliably open under 65% ~ 120% rated voltage					
				Opening is prohibited under less than 30% rated voltage					

■ Main technical parameters of operating mechanism

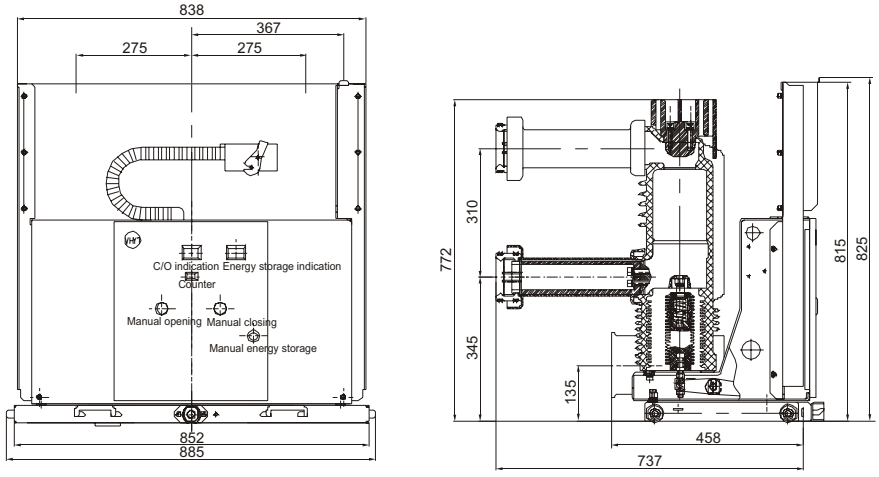
No.	Name	Unit	Data
1	Rated opening operating voltage	V	DC(AC)220/DC(AC)110
2	Rated closing operating voltage		DC(AC)220/DC(AC)110
3	Rated instantaneous over-current tripping current	A	5/3.5
4	Rated voltage of energy storage motor	V	DC(AC)220/DC(AC)110
5	Rated output voltage of energy storage motor	W	70
6	Energy storage time	S	≤10
7	1 min P.F. withstand voltage of secondary circuit	V	2000

Outline Dimension



Forward travel of handcart: 300mm
Fig.1 Outline diagram of VCB1-24 model handcart type Circuit Breaker
(Rated current ≤1250A)

Rated current (A)	630	1250
Rated short-circuit breaking current (kA)	20, 25	20, 25, 31.5
Dim. of matched fixed contact (mm)	ϕ35	ϕ49



Forward travel of handcart: 300mm
Fig.1 Outline diagram of VCB1-24 model handcart type Circuit Breaker
(Rated current ≥1600A)

Rated current (A)	1600	2000	2500	3150
Rated short-circuit breaking current (kA)	31.5			
Dim. of matched fixed contact (mm)	ϕ55	ϕ79	ϕ109	

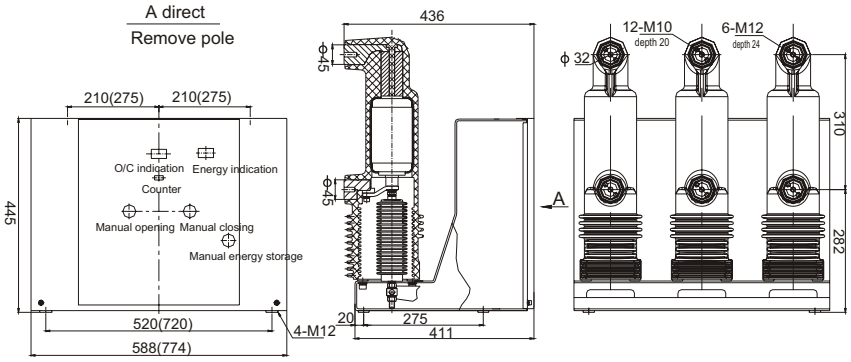
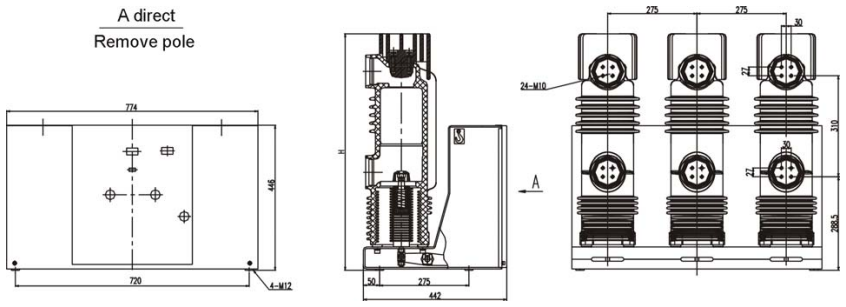


Fig.3 Outline diagram of VCB1-24 model Fixed type Circuit Breaker
(Rated current ≤1250A)



Remarks: H for 1600A and 2000A is 639mm, H for 2500A and 3150A is 728mm.
Fig.4 Outline diagram of VCB1-24 model Fixed type Circuit Breaker
(Rated current ≥1600A)

Product Structure And Functions

■ General structure of circuit breaker

The circuit breaker is designed in a front-rear(operating mechanism- pole) arrangement structure, and three poles are directly assembled on the frame. The interrupter and all the parts of main circuit of each phase are directly solid sealed inside the epoxy resin through the special mould and APG process, to be a pole with compact structure and beautiful appearance.

■ Vacuum interrupter and solid sealed poles

The circuit breaker adopts TD porcelain vacuum interrupter, whose contacts are made of chromiu m copper and are in cup-shape longitudinal magnetic field structure. The contacts have long electrica l life as a result of low elect ric wear r ate, have stable insulation strength as result of high withstand voltage level, can quickly recover after ar c-exting uish, and has low damming level and strong breaking capacity.

The circuit breaker adopts solid seal technology, namely, the miniaturized low-resistance interrupter and all the parts of main circuit are directly solid sealed inside the epoxy resin through APG process without any other fastening pieces. This not only simplifies the assembly process of poles, prevents the connecting bolts of the conductive circuit f rom loosening due to vibration during transportation and improves the reliability as well, but also protects the surface of interrupter from the external mechanical force and external environment (e.g.: dust, moisture, small animal), to further improve t he distr ibution status of electric field of the poles.

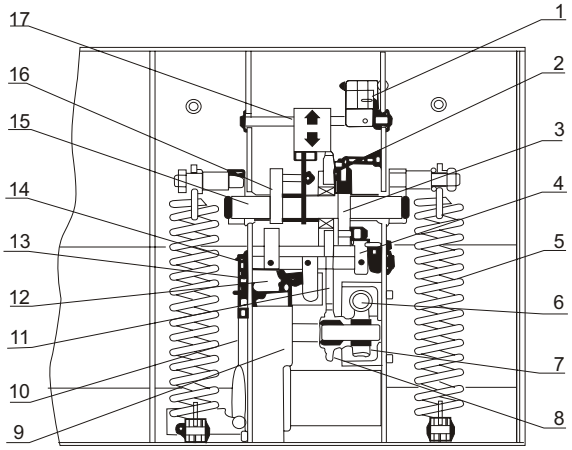
■ Structure of operating mechanism

The operating mechanism is designed in a plane layout structure, and has the functions of manual energy storage and electrical energy storage. It is inside the mechanism box in front of interrupt er and the mechanism box also se rves as the frame of operating mechanism. The mechanism box is divided into five assembly spaces by the middle partition plates, which respectively contain energy storage part, transmission

part, trip part, buffer part and interlocking part. The operating mechanism and interrupter are arranged into a front-rear unified whole, namely, integral arrangement. This structure makes the operating performance of operating mechanism further tally with the required opening/closing performance of interrupter, simplifies the unnecessary intermediate transmission links, reduces the energy consumption and noise, so as to make the operating performance of circuit breaker be more reliable.
The circuit breaker can be installed inside both the handcart type switchgear and the fixed type one.

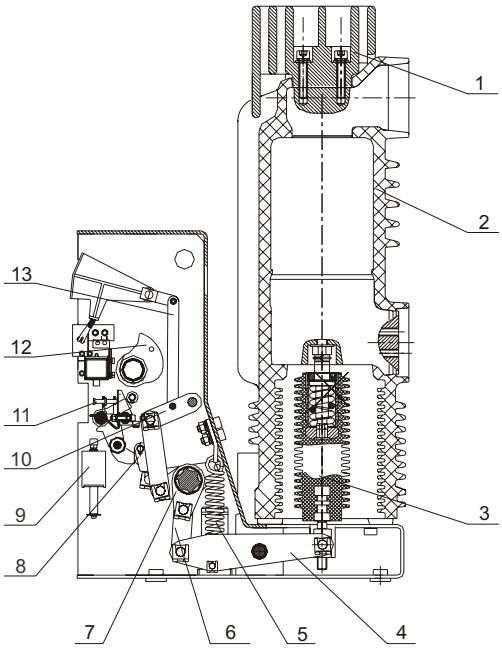
■ Functions

About the operating schematic of operating mechanism, please refer to Fig.5 & Fig. 6.



1. Changeover micro switch in energy-stored state
2. Energy storage transmission chain wheel
3. Energy storage transmission wheel
4. Energy storage holding detent
5. Closing spring
6. Manual energy storage worm rod
7. Manual energy storage transmission worm gear
8. Electrical transmission chain wheel
9. Energy storage deceleration & motor
10. Interlocking transmission bending plate
11. Transmission chain
12. Locking electromagnet
13. Locking iron core of locking electromagnet
14. Energy storage holding shaft
15. Transmission cam shaft
16. Cam
17. Energy storage indication

Fig.5 Operation schematic of operating mechanism



1. Heat dissipation bracket
2. Solid sealed pole
3. Insulation pulling rod
4. Transmission crutch arm
5. Opening spring
6. Transmission connecting plate
7. Transmission crutch arm of main shaft
8. Opening holding detent
9. Opening tripper
10. Connecting plate
11. Manual opening push rod
12. Cam
13. Connecting plate of O/C indication

Fig.6 Operation schematic of operating mechanism

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Arc extinguishing principle

The combined vacuum interrupter has extreme vacuum degree. When the movable, fixed contacts open with electricity under the effect of operating mechanism, vacuum arc will be generated between the contacts. Meanwhile, due to the special structure of contacts, a proper longitudinal magnetic field will also be generated between the contacts to keep vacuum arc diffusion type, accordingly cause the electric arc to evenly distribute on the contact surface and burn as well, and maintain low electric arc voltage. When current is naturally below zero, the residual ion, electron and metal steam are compounded or condensed on the contact surface and shield cover in few micro-seconds, and the dielectric insulation strength of the gap of interrupter will quickly recover, then the electric arc is extinguished, and opening operation is realized. Because the circuit breaker adopts the longitudinal magnetic field to control the vacuum electric arc, it has strong and stable breaking capability.

Secondary Wiring & Principle Diagram

About wiring & principle diagram of circuit breaker, please refer to Fig.8 & Fig. 15.

Debugging And Operation

The debugging and operation of circuit breaker shall be done by the professional person who has receiveD special training and knows the performance of circuit breaker well, and the corresponding protection and prevention measures shall be considered during working process.

1 Preparation work (Before the primary circuit is electrified.)
1.1 Check if the circuit breaker is damaged;
1.2 Clear the dirty, special for the dirty on the surface of insulators;
1.3 Check the wiring of the primary, secondary circuits and the connection with the earthing body.
1.4 Carry out manual energy storage operation and manual opening/closing operation, and observe the corresponding indications at the same time. (Attentions: If the circuit breaker is equipped wi th the c losing locking device, please add the auxiliary power supply to the locking device.)
1.5 Remove the dust cover of insulation drums except the exceptional ones. Please pay attention to the marks on the dust cover.

2 Operation of circuit breaker
2.1 Energy storage of closing spring
a. Manual energy storage: Insert the special energy storage handle into the hole (vi z. No.7 in Fig.1 6), rotate about 20 circles until the energy storage indication points at 'energy stored' (see Fig. 7), that can be seen through the observation window of energy storage indication (viz. No.5 in Fig.16).
b. Electrical energy storage: Electrify the motor and energy storage operation will be automatically done, the power supply of motor will be automatically cut off once the spring of mechanism is in the right position.
2.2 Closing and opening operation
a. Closing operation: Manual operate the closing button (viz. No.6 in Fig.16) or the electric control components.

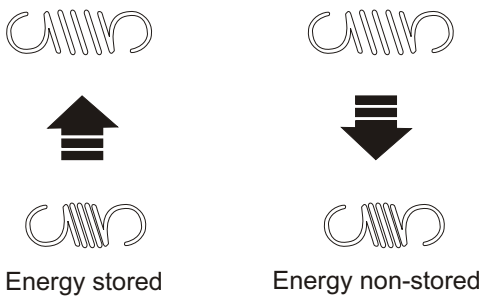
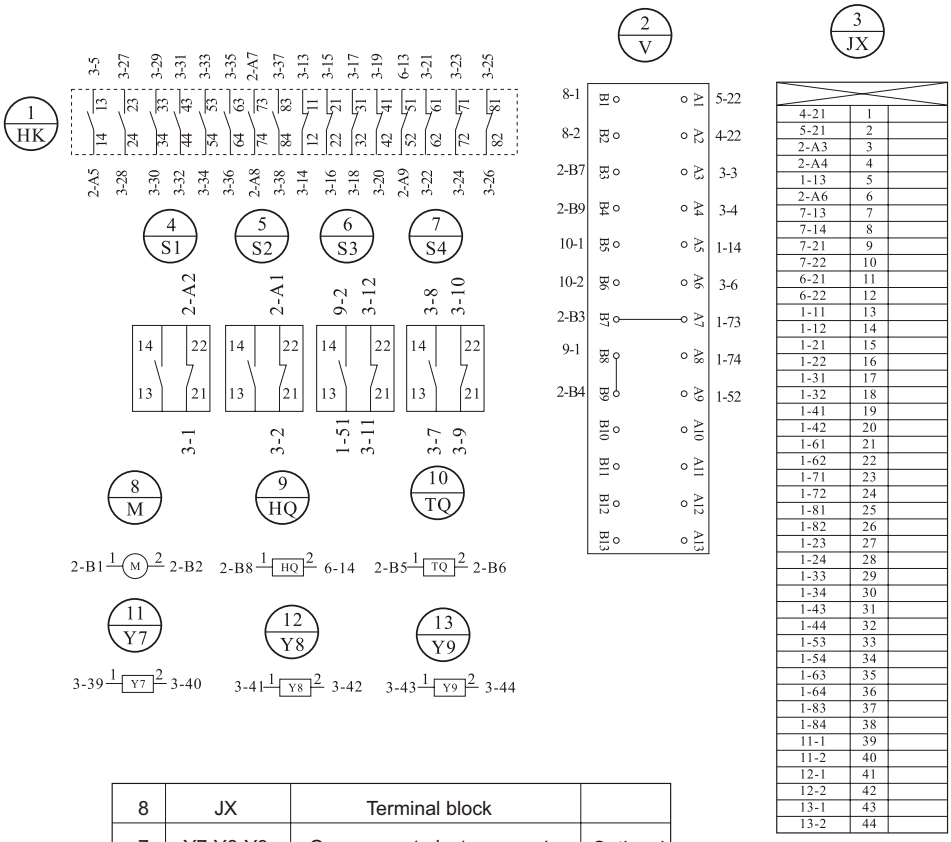


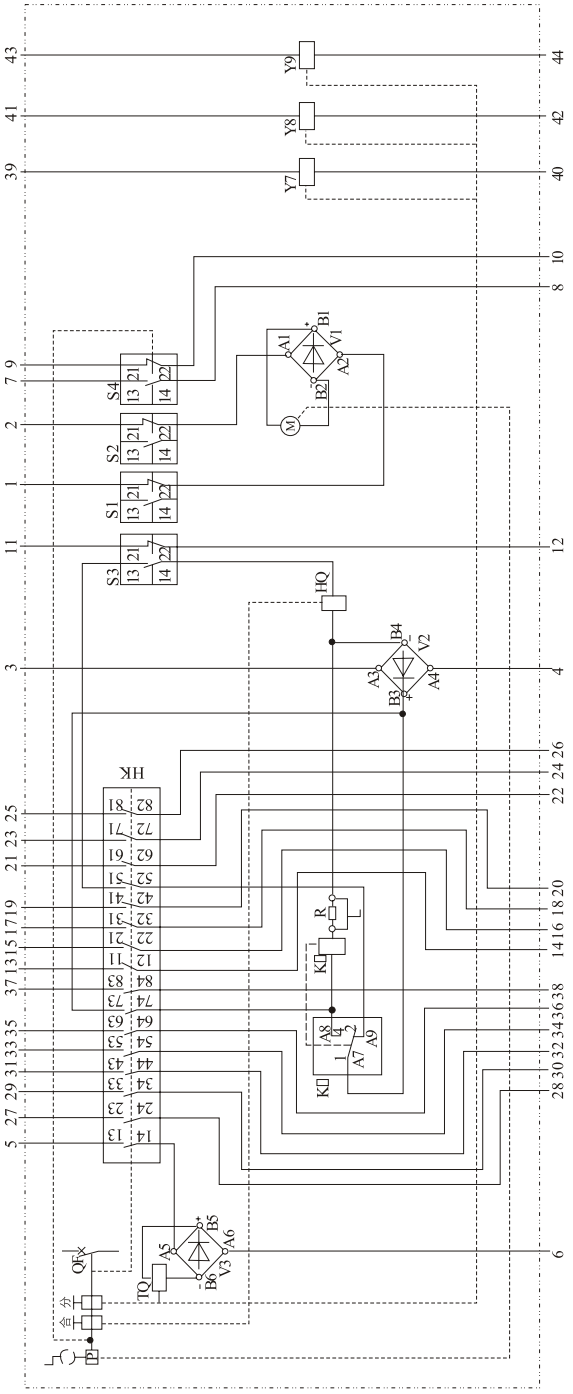
Fig.7 State indication of energy storage



8	JX	Terminal block	
7	Y7-Y8-Y9	Over-current electromagnet	Optional
6	V	Rectifying element	
5	HQ	Closing tripper	
4	TQ	Opening tripper	
3	M	Energy storage motor	
2	S1.S2.S3.S4	Micro switch	
1	HK	Aux. switch of main contact	

Fig.8 Secondary wiring diagram
of VCB1-24 model fixed type Vacuum Circuit Breaker without locking electromagnet

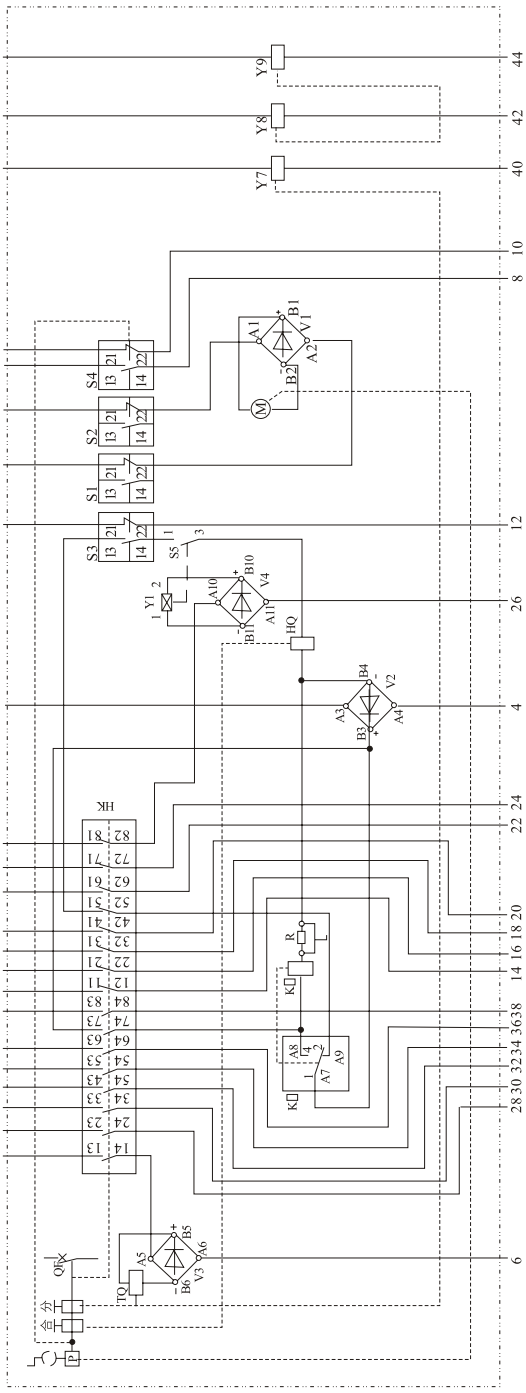
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7	Y7-Y9	Over-current electromagnet	
6	V	Rectifying element	
5	HQ	Closing tripper	Optional
4	TQ	Opening tripper	
3	M	Energy storage motor	
2	S1.S2.S3.S4	Micro switch	
1	HK	Aux. switch of main contact	

Remarks: L shall be short connected under AC110V, DC110V.

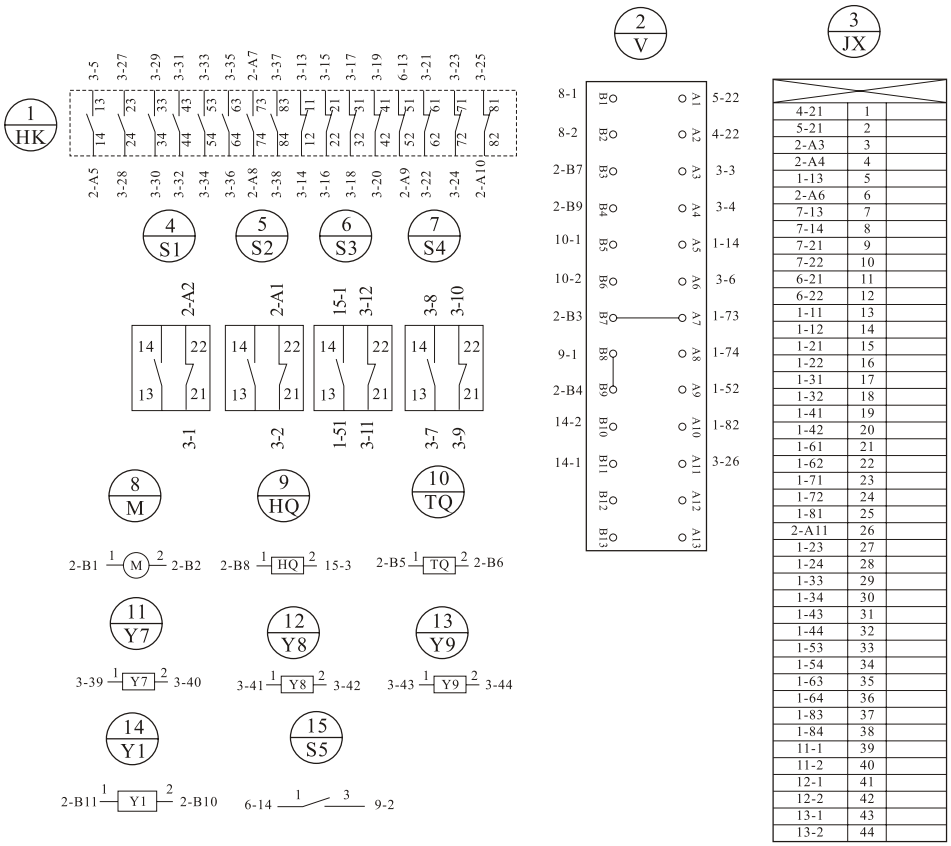
Fig.9 Secondary principle diagram
of VCB1-24 model fixed type Vacuum Circuit Breaker without locking electromagnet



9	S5	Limit switch
8	Y1	Locking electromagnet
7	Y7-Y9	Over-current electromagnet Optional
6	V	Rectifying element Optional
5	HQ	Closing tripper
4	TQ	Opening tripper
3	M	Energy storage motor
2	S1.S2.S3.S4	Micro switch
1	HK	Aux. switch of main contact

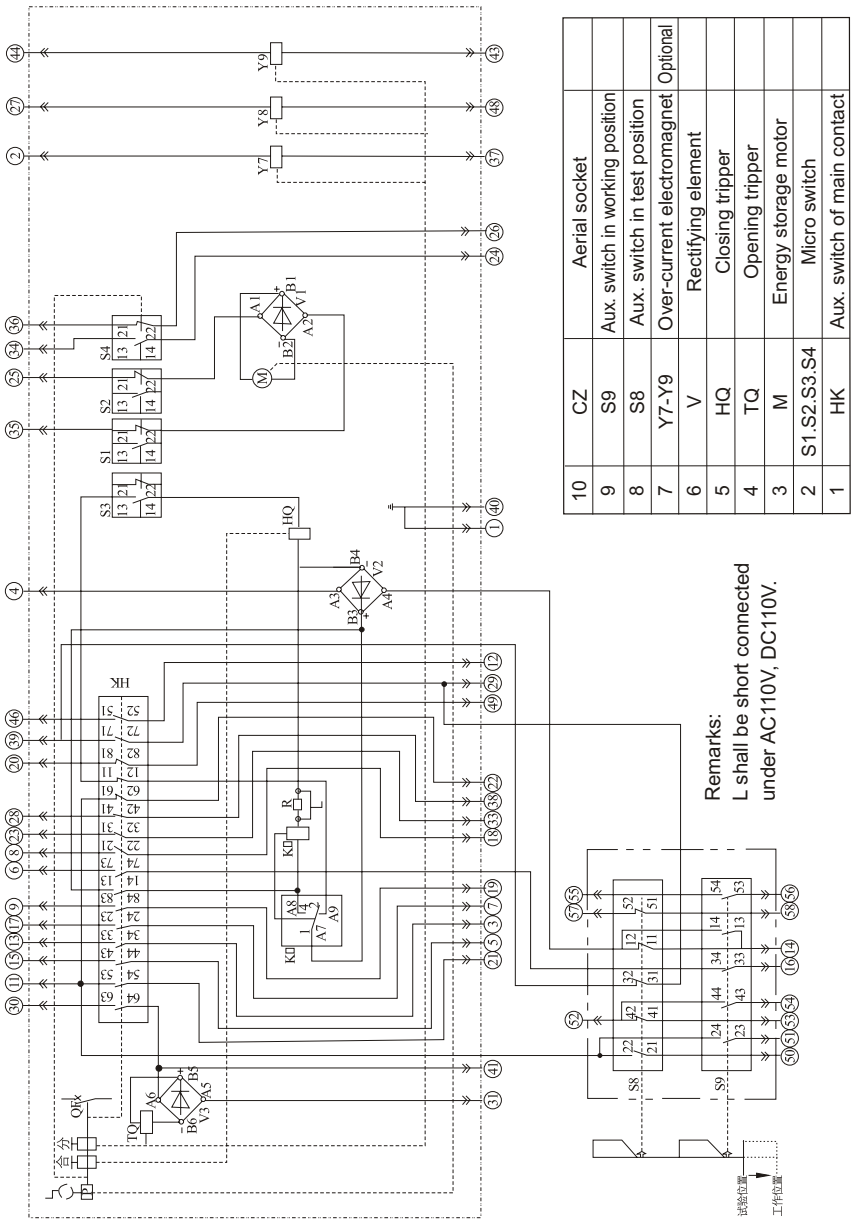
Remarks: L shall be short connected under AC110V, DC110V.

Fig.10 Secondary principle diagram
of VCB1-24modelfixedtypeVacuumCircuitBreakerwithlockingelectromagnet



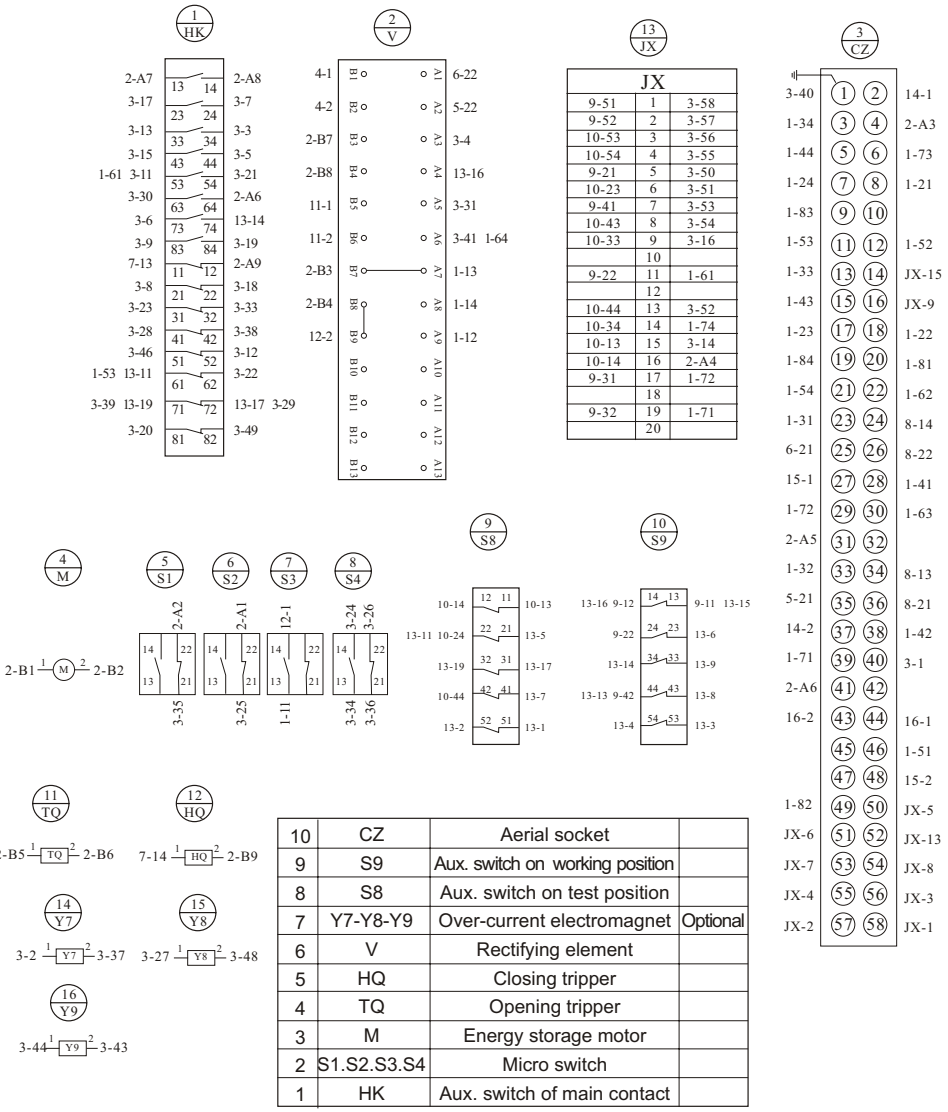
10	S5	Limit switch	
9	Y1	Locking electromagnet	Optional
8	JX	Terminal block	
7	Y7-Y8-Y9	Over-current electromagnet	Optional
6	V	Rectifying element	
5	HQ	Closing tripper	
4	TQ	Opening tripper	
3	M	Energy storage motor	
2	S1.S2.S3.S4	Micro switch	
1	HK	Aux. switch of main contact	

Fig.11 Secondary wiring diagram
of VCB1-24 model fixed type Vacuum Circuit Breaker with locking electromagnet



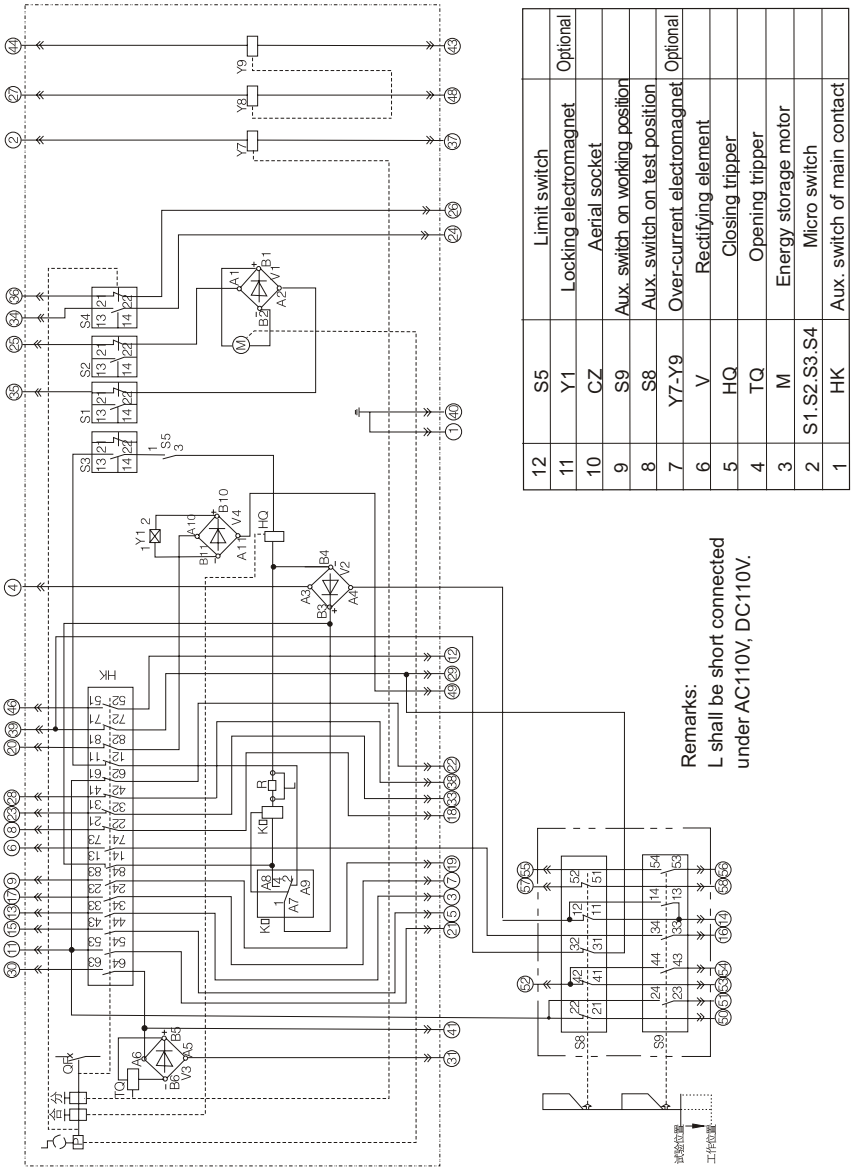
10	CZ	Aerial socket	
9	S9	Aux. switch in working position	
8	S8	Aux. switch in test position	
7	Y7-Y9	Over-current electromagnet	Optional
6	V	Rectifying element	
5	HQ	Closing tripper	
4	TQ	Opening tripper	
3	M	Energy storage motor	
2	S1.S2.S3.S4	Micro switch	
1	HK	Aux. switch of main contact	

Fig.12 Secondary principle diagram
of VCB 1-24modelhandcarttypeVacuumCircuitBreakerwithoutlockingelectromagnet



10	CZ	Aerial socket	
9	S9	Aux. switch on working position	
8	S8	Aux. switch on test position	
7	Y7-Y8-Y9	Over-current electromagnet	Optional
6	V	Rectifying element	
5	HQ	Closing tripper	
4	TQ	Opening tripper	
3	M	Energy storage motor	
2	S1.S2.S3.S4	Micro switch	
1	HK	Aux. switch of main contact	

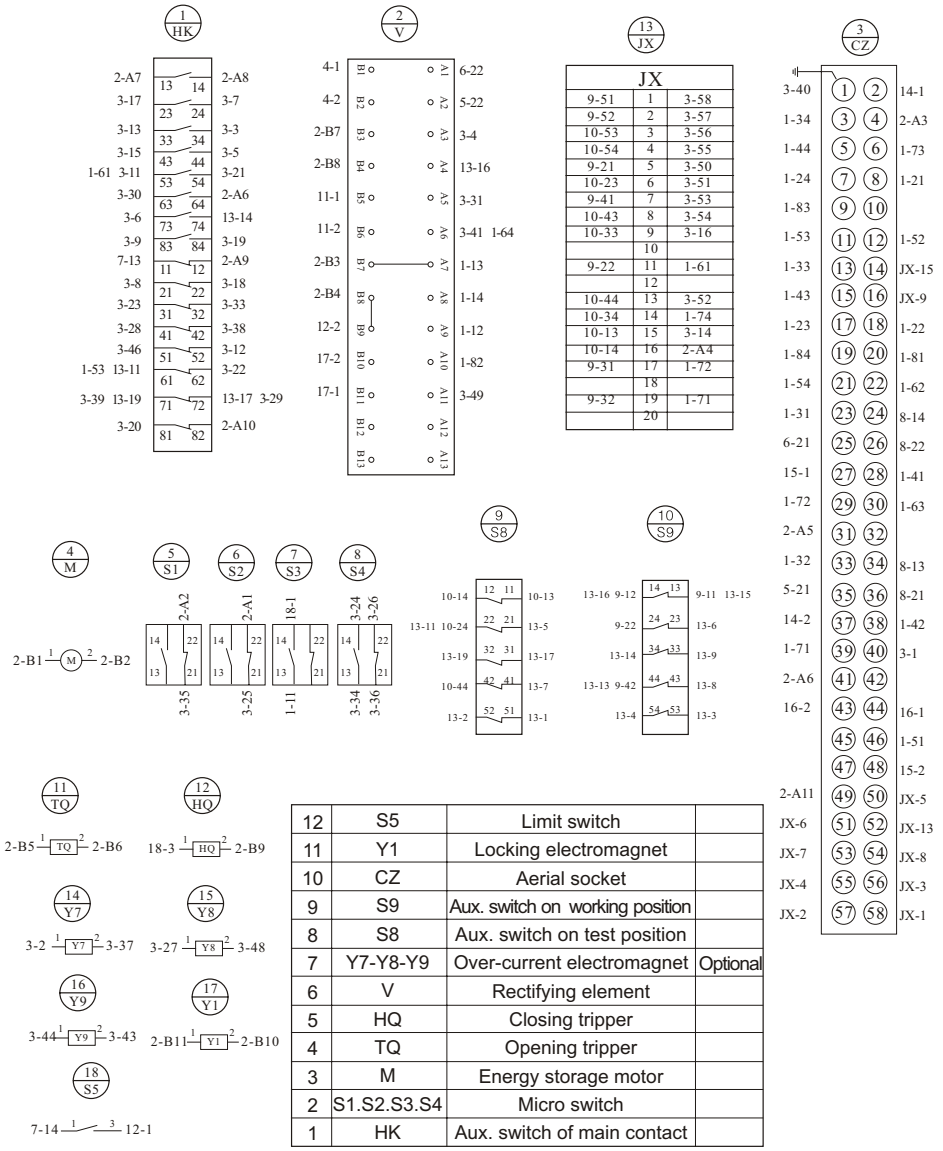
Fig.13 Secondary wiring diagram
of VCB1-24 model handcart type Vacuum Circuit Breaker without locking electromagnet



12	S5	Limit switch	Optional
11	Y1	Locking electromagnet	
10	CZ	Aerial socket	
9	S9	Aux. switch on working position	
8	S8	Aux. switch on test position	
7	Y7-Y9	Over-current electromagnet	Optional
6	V	Rectifying element	
5	HQ	Closing tripper	
4	TQ	Opening tripper	
3	M	Energy storage motor	
2	S1.S2.S3.S4	Micro switch	
1	HK	Aux. switch of main contact	

Remarks:
L shall be short connected under AC110V, DC110V.

Fig.14 Secondary principle diagram of VCB 1-24modelhandcarttypeVacuumCircuitBreakerwith locking electromagnet



12	S5	Limit switch	
11	Y1	Locking electromagnet	
10	CZ	Aerial socket	
9	S9	Aux. switch on working position	
8	S8	Aux. switch on test position	
7	Y7-Y8-Y9	Over-current electromagnet	Optional
6	V	Rectifying element	
5	HQ	Closing tripper	
4	TQ	Opening tripper	
3	M	Energy storage motor	
2	S1.S2.S3.S4	Micro switch	
1	HK	Aux. switch of main contact	

Fig.15 Secondary wiring diagram
of VCB1-24 model handcart type Vacuum Circuit Breaker with locking electromagnet

b. Opening operation: Manual operate the opening button (viz. No.4 in Fig.16) or the electric control components.
The counter automatically adds one after an opening operation. The counter (viz. No.3 in Fig.16) can be seen through the observation window on the name plate.

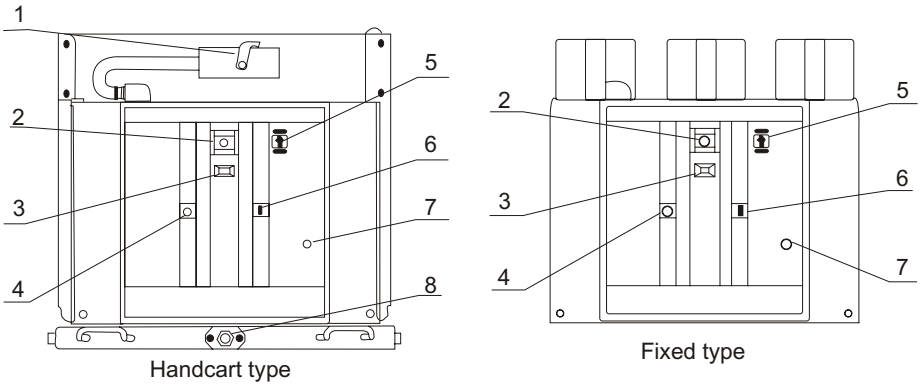


Fig.16 Indication diagram of name plate

1. Secondary aerial socket
2. Opening indication
3. Counter
4. Manual opening button
5. Energy storage indication
6. Manual closing button
7. Plug hole for manual energy storage
8. Chasis truck

Usage Of Each Function Unit And Realization Means

■ Coordination process with cubicle
1. Push the circuit breaker into the cubicle by the special handcart.
When the locking plate of the chasis truck and the cubicle enter into coordination state, the circuit breaker reaches the testing position, namely, the secondary socket is connected and the primary contact is open. Now opening/closing operation can be done.
2. Insert the special pushing handle into the square-head hole on the chasis truck (viz. No. 8 in Fig .16), an d rotate clockwise about 20 circles. When a clatter sound appears from the interior of handcart, it means the circuit breaker reaches the working position, meanwhile, the indication light on the cubicle shines. (ATTENTION: The force should be even during the process for fear that the position information of interlocking mechanism is damaged due to the severe force.
3. Opening and closing operation can be done only in the working or testing position, and forbid moving the handcart after closing. There is a mechanical interlocking device on the mechanism to ensure the circuit breaker can't be moved in the closing state.
■ Closing locking
The circuit breaker can be combined with the closing locking device according to the customer's requirement, namely, when the secondary power supply is off, only the closing operation can be done and the opening operation can not be done.
■ Internal 'anti-bounce' protection
The interlocking device is installed inside the circuit breaker to prevent the circuit breaker from bouncing several times.
■ Over-current protection
The over-current trip of the mechanism is connected from the secondary side of CT, and its quantity can be selected from one to three as required.

Transportation And Storage

■ Transportation
The circuit breaker shall be individually packed and fixed inside the frame with the corresponding protection measures. There are two lifting holes with mark for lifting the circuit breaker respectively on the left and right side plates of the enclosure of operating mechanism.
Attention: Lifting tackle should hook the lifting position of circuit breaker and avoid impact and strike during lifting process.

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■ Storage

Before it is put into operation, the circuit breaker shall be stored indoor, where is dry, ventilated and without dust. At the same time, it shall be in opening position, and the closing spring of mechanism is in energy non-stored state.

Maintenance

In order to satisfy the reliable operation of circuit breaker, the maintenance interval and maintenance scope lie on working environment, operation times, operating time and breaking time of short-circuit breaking current, etc. The maintenance should be done by the professional person who has received special training and knows the performance of circuit breaker well. The user can open the panel and do some appropriate maintenance (eg. Lubricating and tightening the fastener, etc.). Violationsto the circuit breaker is forbidden.

Attached Documents

Qualification certificate.....1;
Instruction for installation and usage.....1;
Packing list.....1.

Ordering Instruction

The user shall indicate the following information when ordering:

- Model, rated current and rated short-circuit breaking current, quantity;
- Rated voltage;
- The quantity of the optional pieces stipulated in the secondary principle diagram;
- Rated operating voltage;
- Name and quantity of spare parts;
- Other special requirements.