

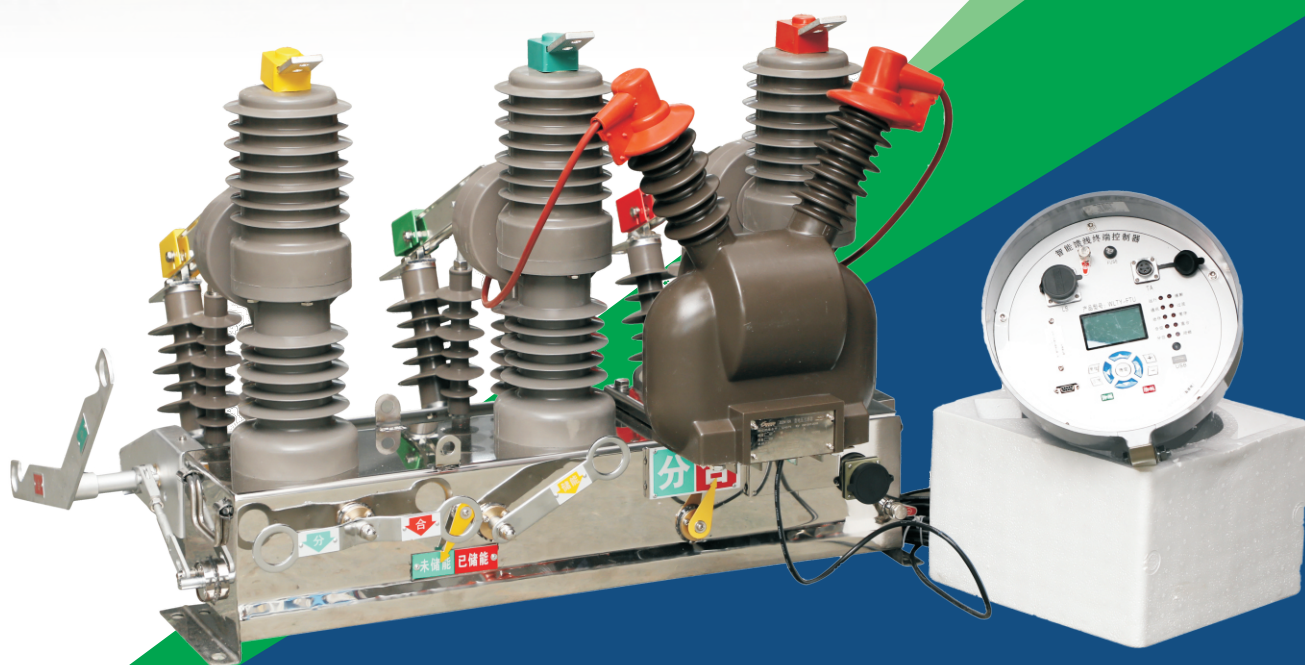




阿埃凯
— AAIKAI —

ZW32-12

Outdoor high-voltage vacuum circuit breaker Product Instruction Manual



Zhejiang Aikai Electric Co., Ltd.

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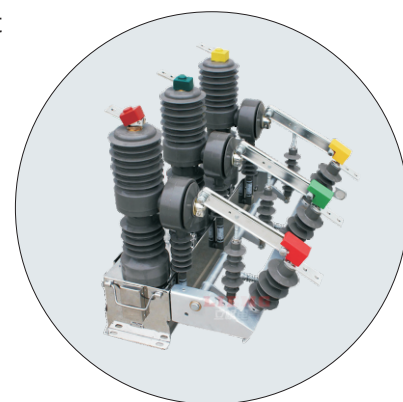
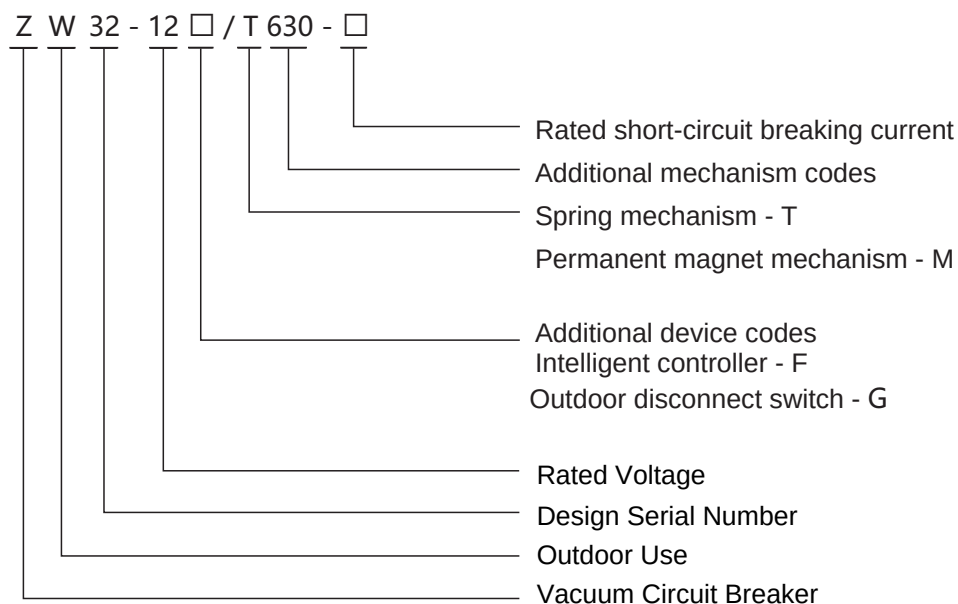
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I. Product Overview

The ZW32-12 outdoor AC high-voltage vacuum circuit breaker (hereinafter referred to as the circuit breaker) is an outdoor power distribution device with a rated voltage of 12KV and a three-phase AC 50Hz frequency. It is mainly used for breaking and closing load current, overload current, and short-circuit current in electronic systems. It is suitable for protection and control in substations and industrial and mining enterprise power distribution systems, as well as in rural power grids where frequent operation is required. It can also be used as a sectionalizing switch in the power grid; with the addition of a controller, distribution network automation can be achieved.

1. Model and Meaning

1.1 Outdoor High Voltage Vacuum Circuit Breaker



Example: ZW32-12FG/T630-25 indicates an outdoor AC high-voltage vacuum circuit breaker with intelligent controller, outdoor disconnect switch, electric mechanism, spring mechanism, and rated breaking current of 20KA.

1.2 Referenced Standards

GB1984-2014 《AC High-Voltage Vacuum Circuit Breakers》

GB11022 《General Technical Conditions for High-Voltage Switchgear》

GB311.1 《Insulation Coordination of High-Voltage Transmission and Transformation Equipment》

DL/T593 《Common Ordering Technical Conditions for High-Voltage Switchgear》

DL/T402 《Ordering Technical Conditions for AC High-Voltage Circuit Breakers》

GB2706 《Dynamic and Thermal Stability Test Methods for AC High-Voltage Electrical Apparatus》

GB3309 《Mechanical Tests of High-Voltage Switchgear at Normal Temperature》

DL403 《Ordering Technical Conditions for 10~35kV Indoor High-Voltage Vacuum Circuit Breakers》

1.3 Environmental Conditions**1.3.1** Altitude not exceeding 2000 meters;**1.3.2** Ambient air temperature: -45°C to +47.5°C; Daily temperature difference: 25°C;**1.3.3** Wind speed not exceeding 35m/s**1.3.4** No flammable, explosive, chemically corrosive, or violently vibrating environments.**II. Main Technical Parameters**

NO	Name	Unit	Numerical values	
1	Rated Voltage	KV	12	
2	Rated Frequency	Hz	50	
3	Rated Current	A	630	
4	Rated Short-Circuit Breaking Current	kA	20	25
5	Rated Peak Withstand Current (Peak)	kA	50	
6	Rated Short-Time Withstand Current	kA	20	
7	Rated Short-Circuit Making Current (Peak)	kA	50	
8	Mechanical Life	bout	10000	
9	Rated Short-Circuit Breaking Current (Number of Breaking Times)	bout	30	
10	Rated Operating Sequence	separate-0.3s-Combined and divided	separate-0.3s-Combined and divided	
11	Power frequency withstand voltage (1min): (wet) (dry) phase-to-phase, to ground/break	KV	34/42/48	
12	Lightning impulse withstand current (peak) phase-to-phase, to ground/break	KV	75	85
13	Secondary circuit 1min power frequency withstand voltage	KV	2	
14	Contact opening distance	mm	9±1	
15	Contact overtravel	mm	2±0.5	
16	Opening speed	m/s	1.2±0.2	
17	Closing speed	m/s	0.6±0.2	
18	Contact closing bounce time	ms	≤2	
19	Phase-to-phase center distance	mm	340±1.5	
20	Three-phase opening and closing asynchrony	ms	≤2	
21	Resistance of each phase's conductive circuit	μΩ	≤80	
22	Closing time	ms	25~60	
23	Opening time	ms	20~45	

III. Structural Features

3.1 Structure The circuit breaker consists of three parts: a support column, a base, and a suspension system for installation, fixing, and handling (lifting).

See Figure 1 for the external structure and installation dimensions.

3.1.1 The pole-mounted vacuum circuit breaker equipped with a vacuum interrupter has stable and reliable breaking performance, featuring no risk of combustion or explosion, safety, maintenance-free operation, small size, light weight, and long service life.

3.1.2 The circuit breaker adopts a fully enclosed structure with good sealing performance, providing moisture and condensation resistance, making it suitable for use in high-temperature and humid areas.

3.1.3 The circuit breaker's closing and opening operations can be manual, electric, or remotely controlled.

3.1.4 The operating mechanism is novel, simple, reliable, compact, and has a mechanical life of up to 10,000 cycles. The energy storage motor is a DC permanent magnet motor, with voltage ratings of -220V, 110V, 48V, and 24V selectable.

3.2 Main Performance

3.2.1 Equipped with an external dry-type voltage transformer, enabling the circuit breaker to have its own operating power supply; and a surge arrester can be added (installed on the power supply side or load side according to user requirements).

3.2.2 The circuit breaker and outdoor disconnect switch are integrated, and the circuit breaker and disconnect switch have a reliable mechanical interlocking device.

3.2.3 Can be used in conjunction with a power load monitoring system.

3.2.4 50/5~600/5 bushing current transformers can be installed according to user needs.

3.2.5 External electronic PT can be added.

3.2.6 The electrical principle and wiring diagram of the operating mechanism are shown in Figure 3.

3.2.7 The energy storage motor adopts a unidirectional permanent magnet DC motor (with a rectifier bridge, it can be used for AC), and its technical data is shown in Table 3

Name	53ZY-CJD01B	53ZY-CJD02B	53ZY-CJD03B	53ZY-CJD04B
Rated operating voltage (V)	-220	-110	-48	-24
Rated power (W)	40			
Normal operating voltage range	85%~110%			
Rated operating current (A)	0.5	1.0	1.8	3.6
Energy storage time (s)	≤8			

3.2.8 The manual energy storage operation uses the energy storage handle provided with the mechanism for normal operation (with a rectifier bridge, it can be used with both AC and DC power), and its operating force is less than 100 N·m.

3.2.9 The closing/opening electromagnet is a solenoid electromagnet, and its technical parameters are shown in Table 4:

Rated operating voltage (V)	~220	~110	~220	~110	~48	~24
Rated operating current (A)	1.7	4.4	1.69	3.4	10	6.8
Rated power (W)	374	484	372	374	480	165
Coil resistance (Ω) at 20°C	56	15	130	33	4.8	3.5
Normal operating voltage range	Opening voltage should be 60%~120% of the rated operating voltage; opening voltage should not be less than 30% of the rated operating voltage. Closing voltage should be 85%~120% of the rated operating voltage.					

3.2.10 The technical parameters of the overcurrent trip unit are shown in Table 5:

Rated current 5A	The DC resistance of the coil at 20°C is 2.5 Ω .
Normal operating current range	Reliable tripping at 90%-110% of rated current; must not trip at less than 90% of rated current.

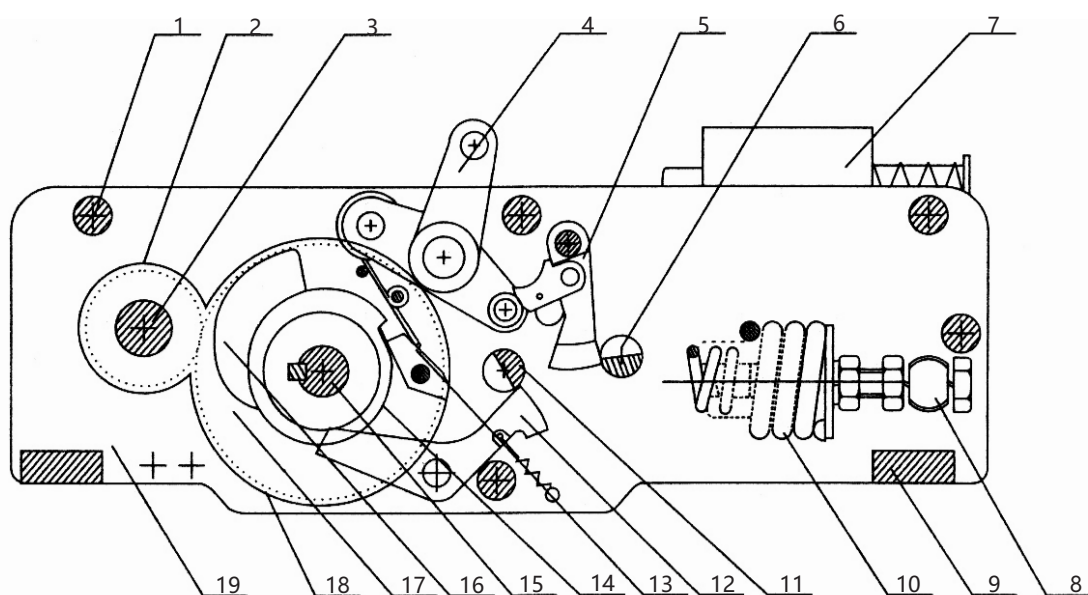
3.2.11 The technical parameters of the disconnecting switch are shown in Table 6:

NO	Name	Unit	Numerical values
1	Rated voltage	KV	12
2	Rated current	A	630
3	Thermal stability current (RMS)	kA	20
4	Dynamic stability current (peak value)	kA	50
5	1minPower frequency withstand voltage	kV	42
6	Resistance of each phase loop	$\mu\Omega$	≤ 60
7	The contact blades close at different times, and the position of the contact blades is skewed.	mm	≤ 2

IV. Structure and Motion Principles

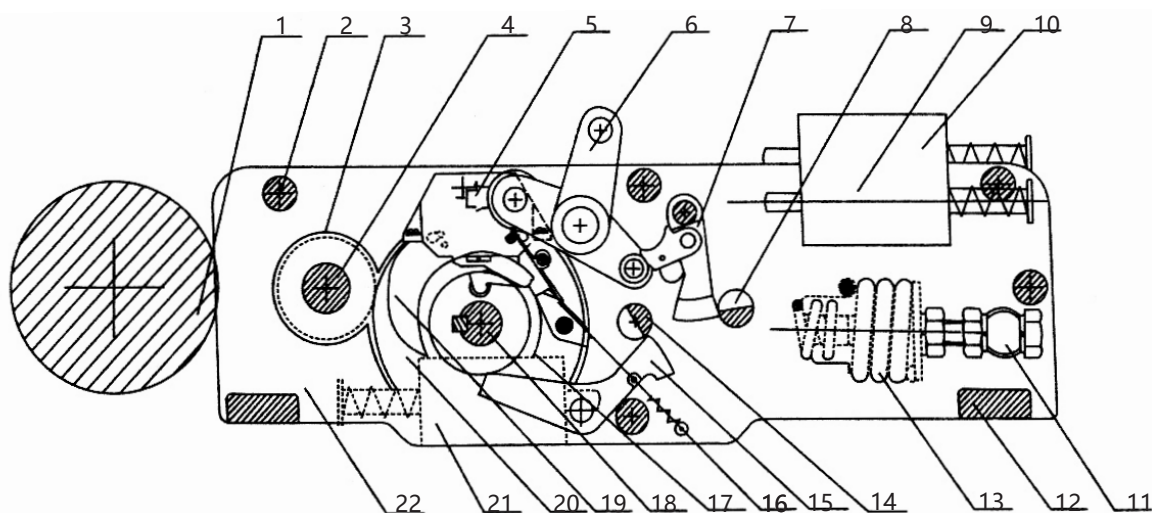
The structure of the CTB-D mechanism is shown in Figure 1 (page 5).

The structure of the CTB-S mechanism is shown in Figure 2 (page 5).



CTB-S Type Spring Operating Mechanism (Figure 1)

1. Support Rod 2. Pinion Gear 3. Shaft 4. Output Crank Arm 5. Opening Clamp 6. Opening Half Shaft 7. Overcurrent Coil 8. Hanging Spring Shaft 9. Mounting Block 10. Closing Spring 11. Closing Half Shaft 12. Closing Clamp 13. Energy Storage Claw 14. Offset Gear 15. Energy Storage Shaft 16. Cam 17. Large Gear 18. Closing Coil 19. Front and Rear Clamping Plates



CTB-D Type Spring Operating Mechanism (Figure 2)

1. Motor 2. Support Rod 3. Pinion Gear 4. Gear 5. Limit Switch 6. Output Crank Arm 7. Opening Clutch 8. Opening Half Shaft 9. Opening Coil 10. Overcurrent Coil 11. Hanging Spring Shaft 12. Mounting Block 13. Closing Spring 14. Closing Half Shaft 15. Closing Clutch 16. Energy Storage Claw 17. Offset Gear 18. Energy Storage Shaft 19. Cam 20. Large Gear 21. Closing Coil 22. Front and Rear Clamping Plates

V. Institutional Energy Storage Principle

5.1.1 The energy storage principle of the mechanism is shown in Figure 3 (Energy Storage Principle Diagram of the Mechanism).

In the figure, the drive block 7, cam 17, and energy storage crank arm 9 are all connected to the energy storage shaft 6 via a flat key. The drive pawl 5 is mounted on the large gear 4 and fitted onto the energy storage shaft 6 via a composite bushing. A one-way bearing is mounted on the gear shaft 3. When the motor is powered on and rotates, it drives the small gear 2 to rotate clockwise. The small gear 2 drives the meshing large gear 4 and drive pawl 5 to rotate counterclockwise. The movement of the drive pawl 5 drives the drive block 7, cam 17, energy storage shaft 6, and energy storage crank arm 9 to rotate counterclockwise. The counterclockwise rotation of the energy storage crank arm 9 drives the closing spring 15 to store energy. When the energy is stored to a certain position, the switching pin opens the drive pawl 5, and at the same time, the limit switch switches, the motor stops rotating, and the spring's excessive force and slow speed cause the roller on the drive block to act on the energy storage holding stop 10. The other end of the energy storage holding stop 10 acts on the closing half shaft 11, making the system stable and the mechanism in the energy storage state. (See Figure 4 (c, d) for energy storage status. The energy storage principle of CTB-S is the same as that of CTB-D's manual energy storage. Pulling the energy storage handle drives the gear shaft and pinion to rotate clockwise via the one-way bearing mounted on gear shaft 3. The rest is the same as motor energy storage.

5.1.2 Closing

See Figure 3 (Energy Storage Principle Diagram of the Mechanism). After the mechanism has stored energy, manually pull the closing handle or energize the closing coil to push the closing half-shaft to rotate counterclockwise. The energy storage holding stop loses its balance and rotates counterclockwise, releasing the energy storage state. The closing spring releases energy, driving the cam to rotate counterclockwise. The cam acts on the roller of the output crank arm, causing the output crank arm to rotate clockwise. After the cam has finished acting, the output crank arm has rotated approximately 43 degrees and no longer continues to rotate clockwise. Instead, under the action of the opening spring force, it rotates counterclockwise by 3 degrees and is then balanced by the opening system composed of the opening half-shaft, fastener, and opening stop. The mechanism is in the closing state. See Figure 4 (c, d).

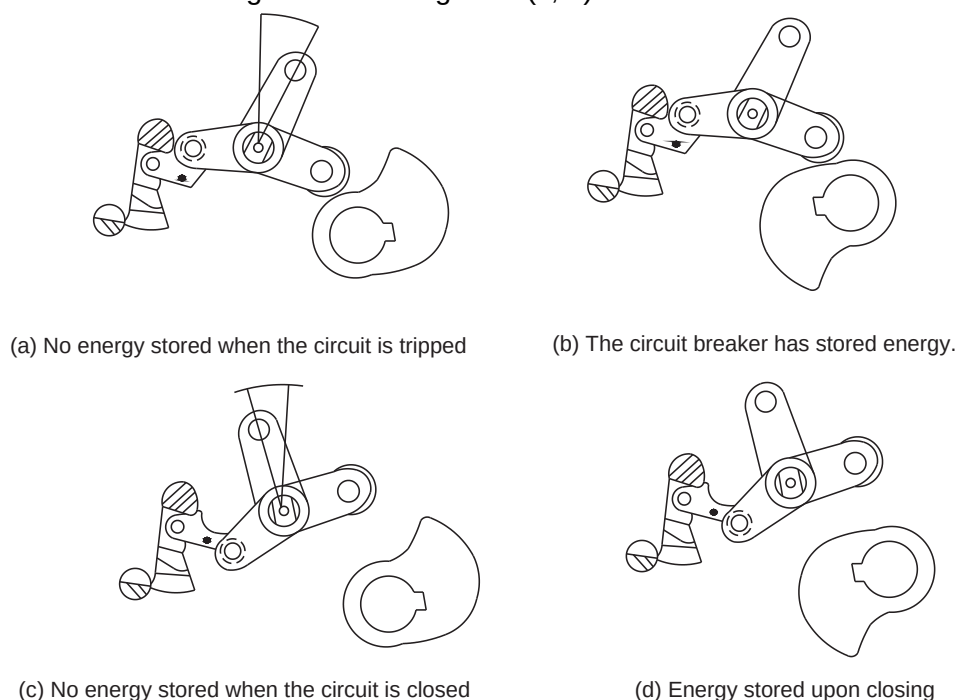


Figure 4. Location and Schematic Diagram

5.1.3 Closing and Overcurrent Tripping

See Figure 4 (c, d). The circuit breaker and mechanism are in the closed state. Pulling the manual trip handle or energizing the trip coil pushes the trip half-shaft clockwise, causing the fastener to lose balance, releasing the closed state. The output crank arm rotates counterclockwise under the force of the trip spring, and the mechanism trips. The electrical principle of overcurrent tripping is shown in Figure 6, the overcurrent protection principle diagram of the mechanism. When the current transformer ratio current reaches a certain value, the overcurrent tripping circuit is connected, the overcurrent coil is energized and actuates, pushing the trip half-shaft clockwise, causing the mechanism to trip.

5.1.4 Reclosing When the mechanism is in the closed, unenergized state (see Figure 4 (c)), the mechanism can continue to store energy, changing it to the closed, energized state (see Figure 4 (d)). At this time, a "trip-0.3S-close-trip" reclosing operation can be achieved.

5.2 Electrical Control and Overcurrent Tripping

The overcurrent protection circuit principle is shown in Figure 5.

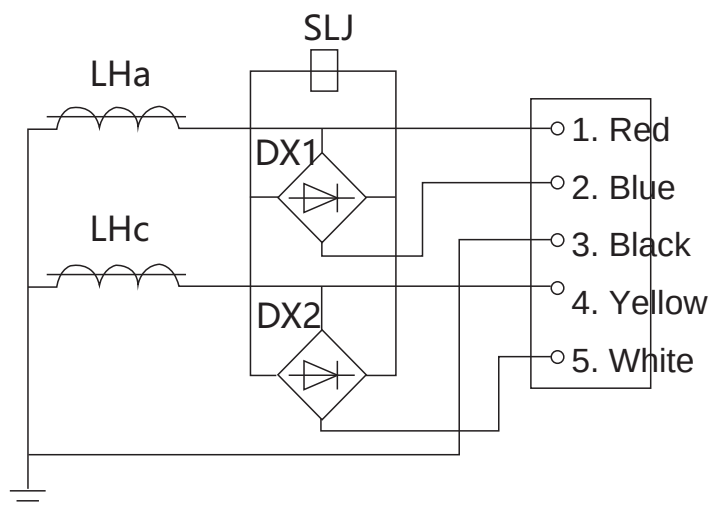


Figure 5. Schematic diagram of overcurrent protection mechanism

The control circuit principle is shown in Figure 6.

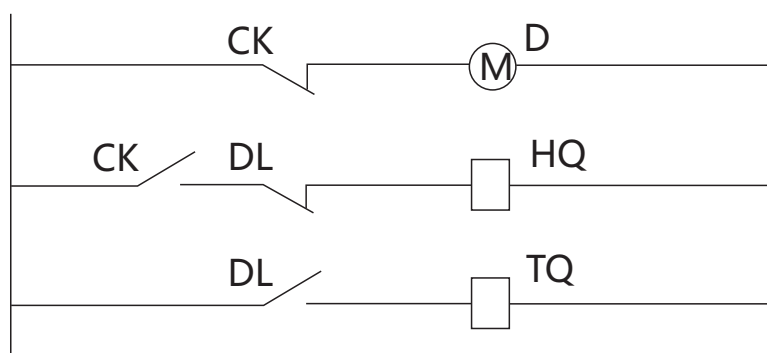


Figure 6. Mechanism Control Principle Diagram

VI. Routine Matters

6.1 Installation, Use, and Maintenance

6.1 Upon unpacking, check the pole-mounted circuit breaker's insulation supports for cracks, and verify that the product nameplate and certificate of conformity match the order form, and that the packing list matches the actual product.

6.2 Before putting the pole-mounted circuit breaker into operation, carefully check that the rated voltage and rated current of each operating element match the actual conditions. Operate the circuit using its closing and opening functions to check the accuracy of each indicator.

6.3 The circuit breaker can be installed on a single pole or with two mechanisms (as shown in Figure 2).

6.4 The water column circuit breaker's special design ensures long-term maintenance-free operation.

6.5 Operators should have a basic understanding of the mechanism's performance, installation, adjustment, and maintenance. Any problems encountered during operation should be recorded, and the manufacturer should be notified if necessary.

6.6.1 Transportation: The entire unit must be placed in a sealed packaging box and secured during transportation. It must not be overturned or tilted during transport; shockproof measures must be taken.

6.6.2 Upon receiving the pole-mounted circuit breaker, the user shall perform the following procedures:

6.6.3 Check for damage to the packaging.

6.6.4 Check against the product packing list to ensure all documents, accessories, and spare parts are complete.

6.6.5 Check that the technical parameters and product certificate on the pole-mounted circuit breaker nameplate meet the order requirements.

6.7 The pole-mounted circuit breaker should be stored in a dry, ventilated, moisture-proof, shockproof, and harmful gas-proof indoor environment. For long-term storage, the environment should be checked periodically to ensure it meets the requirements. Packing, unpacking, and storage should be carried out in a dry indoor environment, and the product and all components should be checked for completeness and conformity.

6.8 Factory Documents and Attachments

6.8.1 Product Instruction Manual/1 copy;

6.8.2 Product Certificate of Conformity/1 copy;

6.8.3 Product Factory Inspection Report/1 copy;

6.8.4 Packing List/1 copy;

6.8.5 Product Secondary Principle and Wiring Diagram/1 copy;

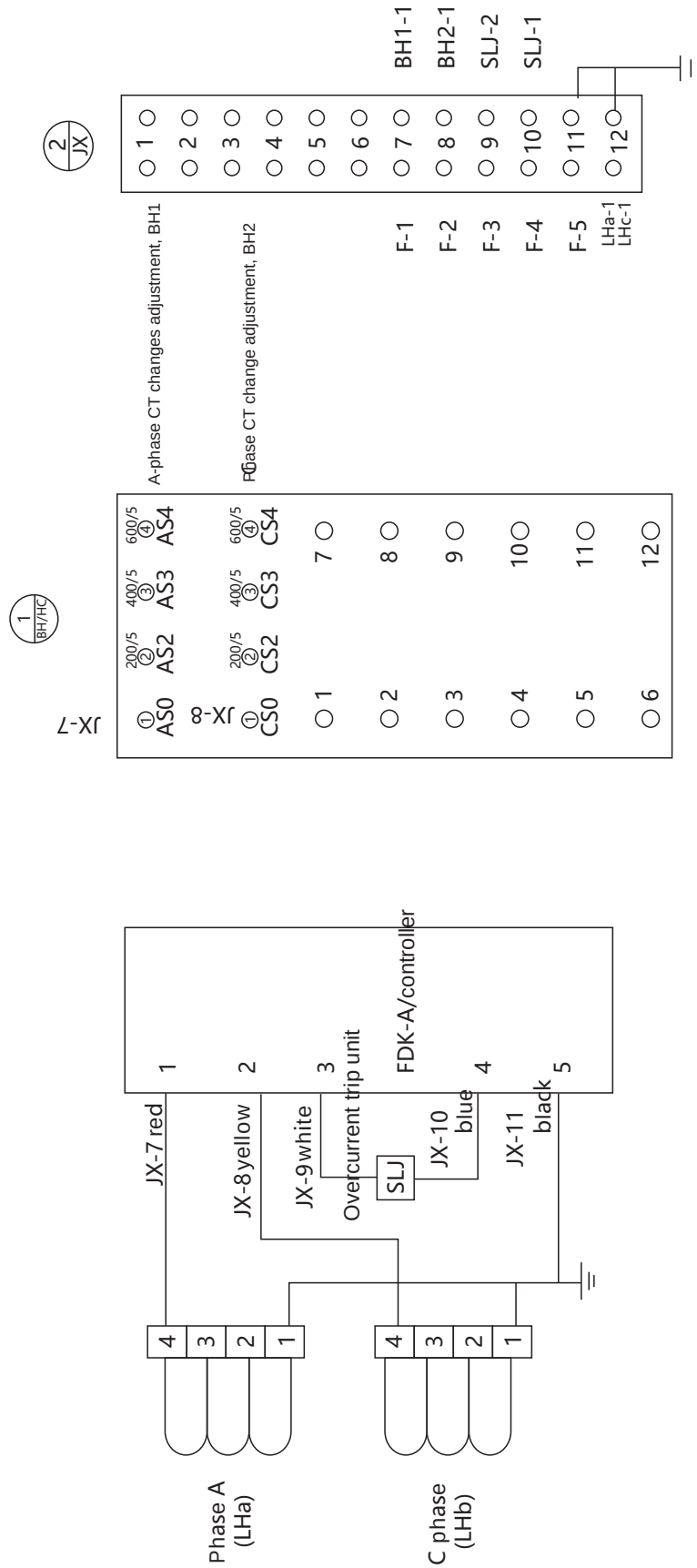
6.9 Ordering Instructions

6.9.1 When ordering, please specify the product model and rating, operating method, voltage level, and quantity.

6.9.2 Users can select appropriate functional configurations according to their usage requirements. These include current transformer ratio, accuracy class, capacity, electronic PT, remote control, surge suppressor, distribution controller, disconnect switch, etc.

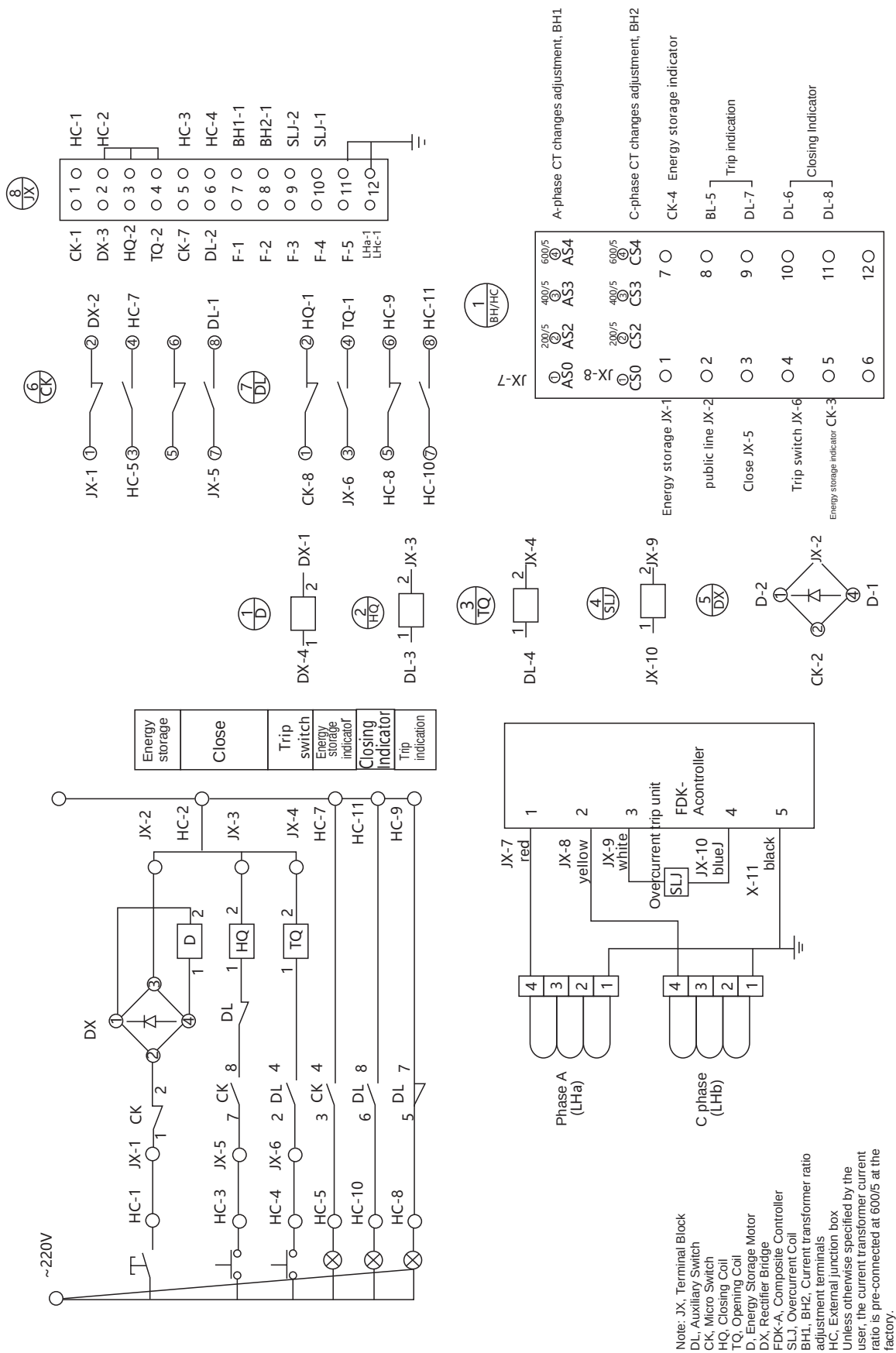
VII. Product Wiring Diagram

ZW32-12 control circuit schematic diagram and wiring diagram (manual).

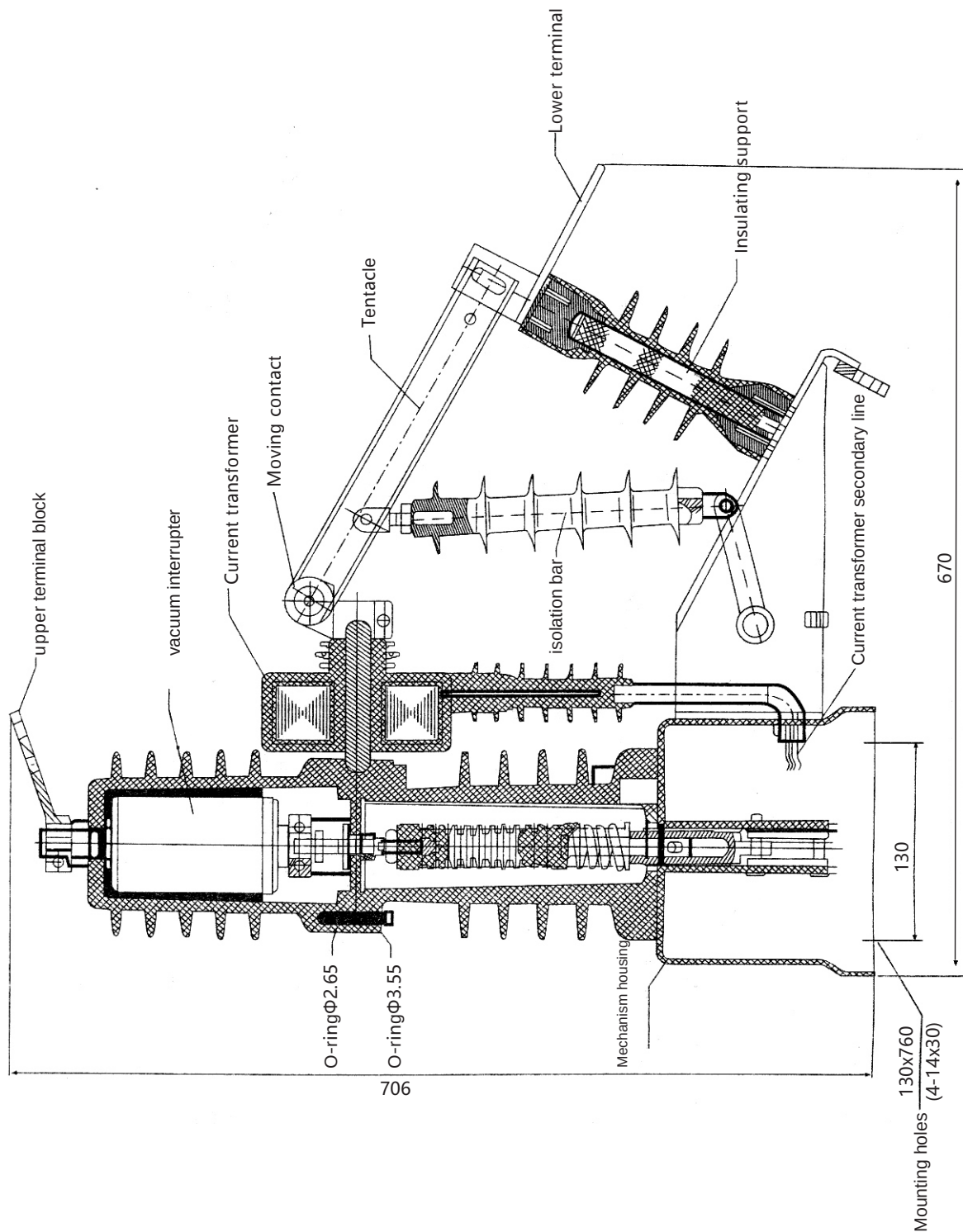


Note: JX, terminal block
 FDK-A, composite controller
 SLJ, overcurrent coil
 BH1, BH2, current transformer
 regulating terminal HC, external junction box
 Unless otherwise specified by the user, the current ratio of the current transformer is already connected at 600/5 at the time of manufacture.

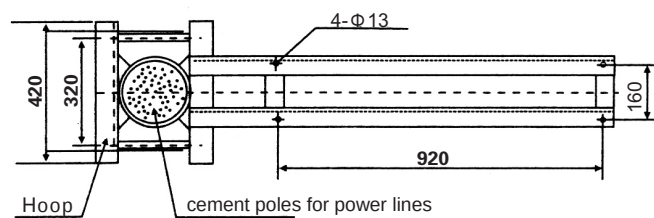
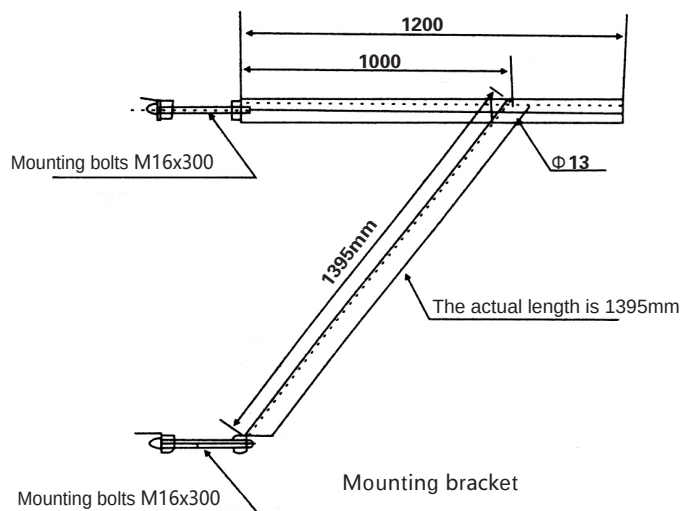
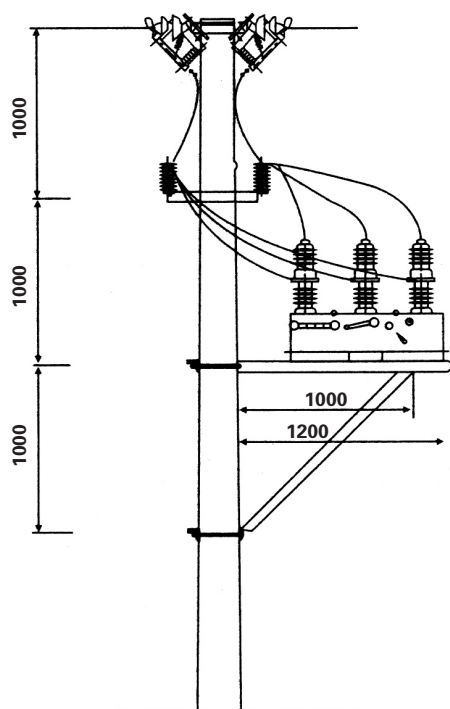
ZW32 control circuit schematic and wiring diagram (electric)



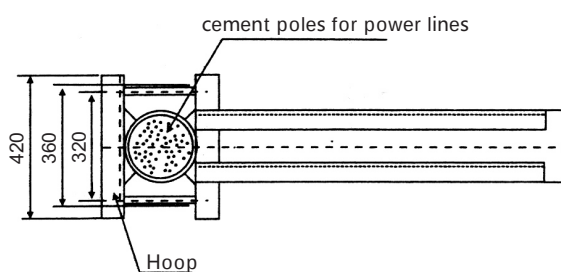
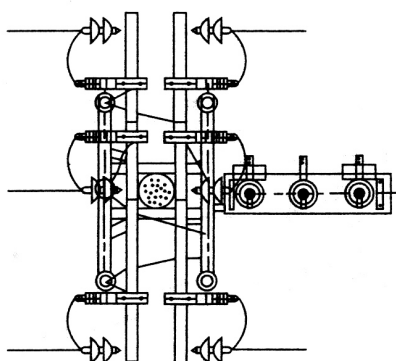
VIII. Structural Diagram



IX. Installation Diagram



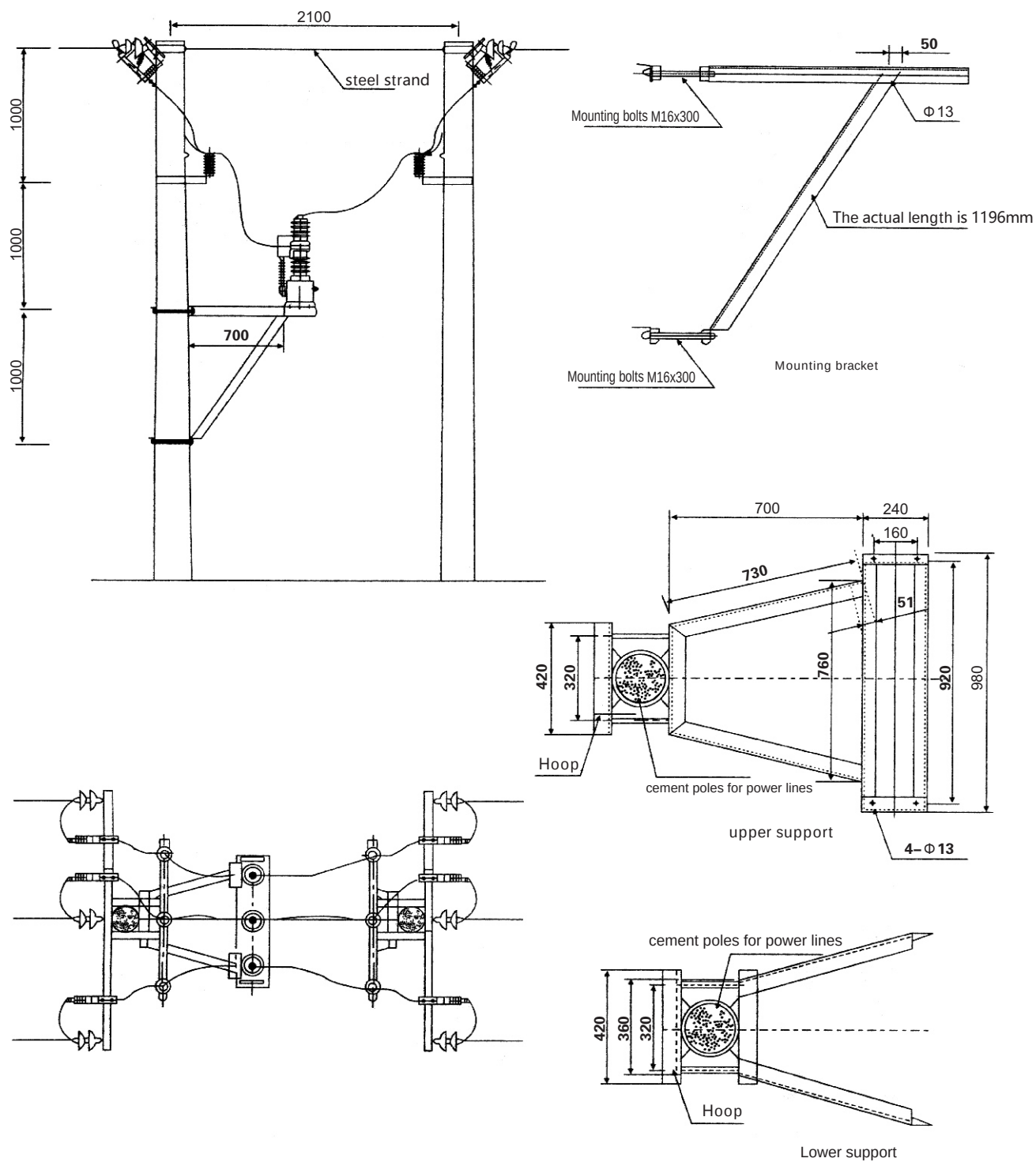
upper support



Lower support

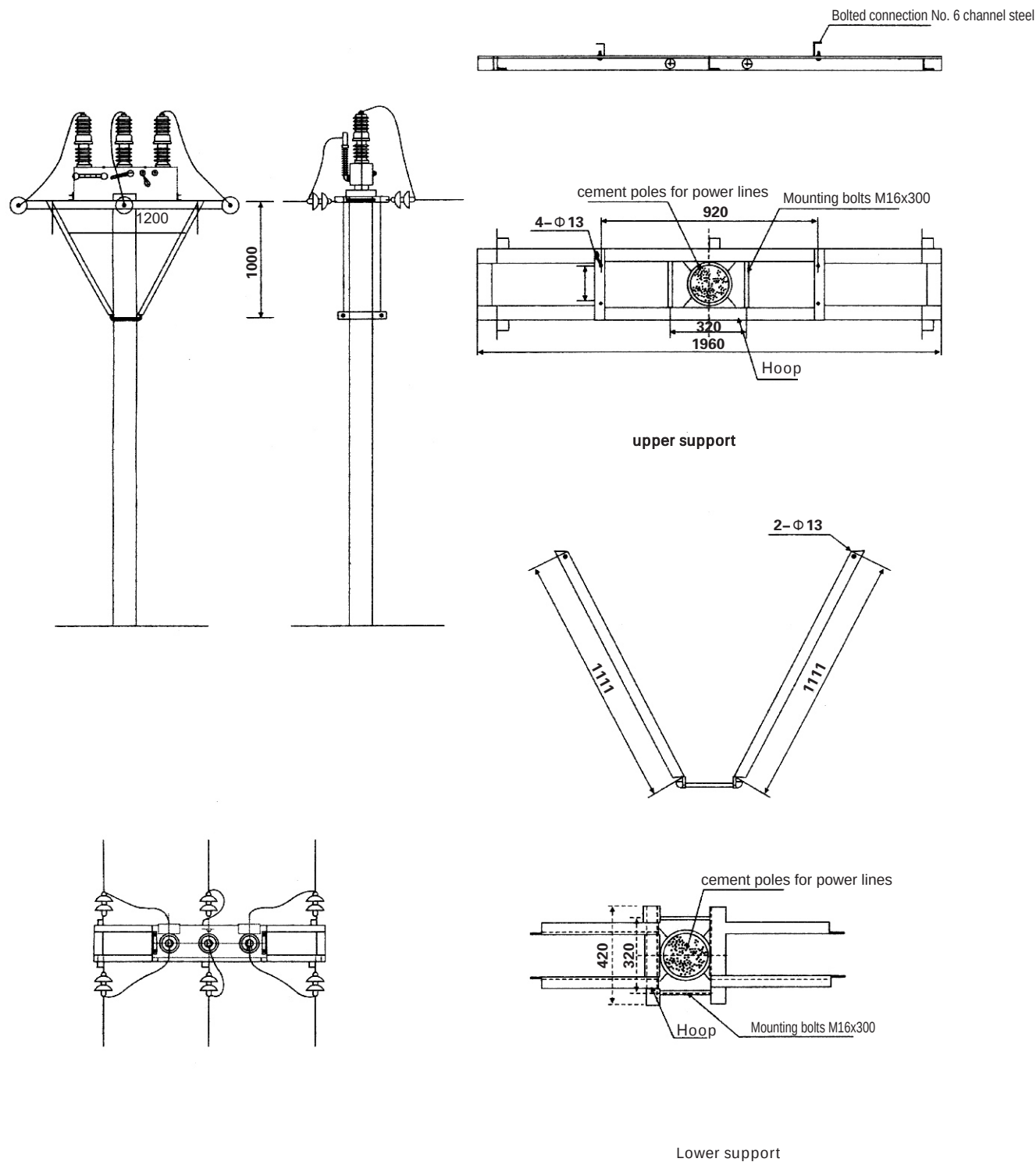
Note: The size of the clamp should be determined according to the actual size of the utility pole.

Installation diagram, Figure 7

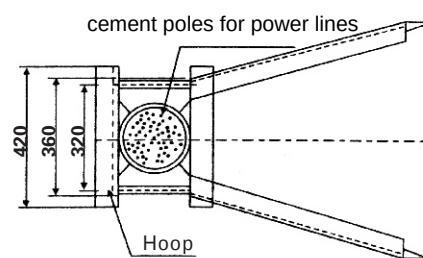
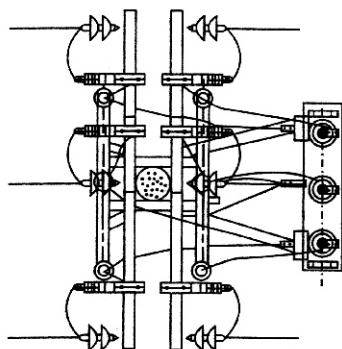
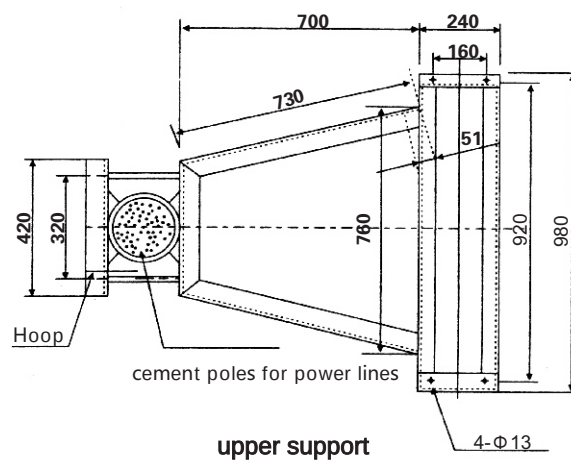
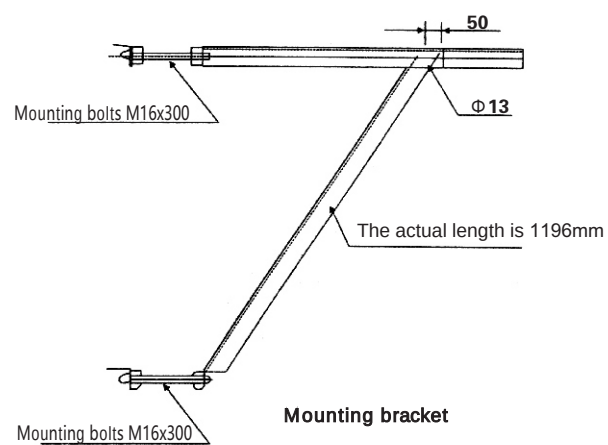
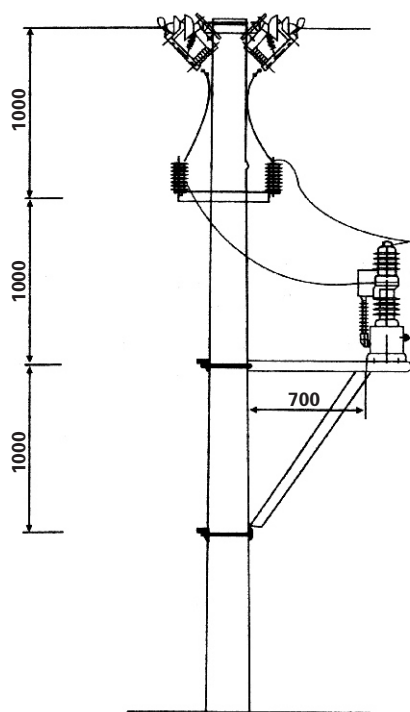


Note: The size of the clamp should be determined according to the actual size of the utility pole.

Installation diagram, Figure 8



Note: The size of the clamp should be determined according to the actual size of the utility pole.
Installation diagram, Figure 9



Note: The size of the clamp should be determined according to the actual size of the utility pole.

Installation diagram, Figure 10

1. After the switch is put into use, it should be inspected 1-2 times annually, and a major overhaul should be carried out every three years.
2. Vacuum degree test of the arc-extinguishing chamber: December.
3. Inspection of the vacuum arc-extinguishing chamber: Check whether the porcelain insulator of the vacuum arc-extinguishing chamber is intact, without cracks or leaks; check that the copper shielding cylinder is pure in color, bright, without oxidation, discoloration due to heating, or discharge marks; check the wear of the contacts, the cumulative amount should not exceed 3mm. Measure the reduction of overtravel and the wear of the contacts. Each adjustment of overtravel must be recorded. When the cumulative wear of the contacts exceeds 3mm, the arc-extinguishing chamber should be replaced.
4. Inspection of the insulating cylinder: Clean and inspect the three insulating cylinders. The surface should be clean and intact, without burns, discoloration, cracks, or other abnormalities. Check that the fixing screws of the three insulating cylinders on the base are tight, the insulating cylinders are reliably fixed, and the relative dimensions are qualified.
5. Operating Mechanism Inspection: Manually operate the switch to open and close the circuit breaker, checking all transmission parts. They should be flexible and reliable, without jamming. During the slow manual opening and closing of the switch, check that the turns of the trip spring are evenly spaced and free of breaks. Its characteristics should meet the switching speed requirements.
6. Surge Arrester Inspection: Clean the surge arrester, ensuring it is intact and undamaged.
7. Switching and Locking Mechanism Inspection: Inspect the connecting rod bevel protrusions on the mechanical locking device. There should be no severe wear or deformation, and the springs should be in good elasticity. Any abnormalities should be addressed.
8. Primary Isolating Contact Inspection: Clean and inspect the contact fingers. There should be no overheating, melting, discoloration, or other abnormalities. If burns or overheating are found, treat with a file and gauze, and apply a layer of petroleum jelly.
9. Auxiliary switch inspection: Inspect the moving and stationary contacts of the secondary plug-in components for burns, deformation, etc., and check for insulation cracks and damage. If any abnormalities are found, investigate the cause and replace the missing parts. Inspect the auxiliary switch and terminal blocks, ensuring the wiring is tight. The auxiliary contacts and linkages should operate flexibly and correctly, with good contact at the joints.
10. Acceptance after switch maintenance: After the major components have been inspected or replaced during switch maintenance, the person in charge should conduct a comprehensive inspection to ensure the quality of the maintenance. Switch maintenance must be carried out annually according to the maintenance procedures, 1-2 times per year, to ensure that the switch is not damaged or destroyed by third parties when outdoors.