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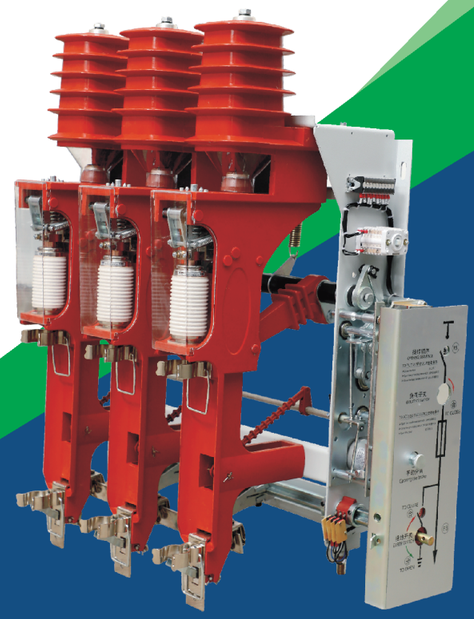
AAIKAI

FZN25-12D/630-20
FZRN25-12D/200-31.5

Vacuum load switch-fuse combination appliance

Product Instruction Manual



ZHEJIANGAAIKAIELECTRICCO., LTD

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I. Overview

The FZN25-12D/T630-20 type indoor AC high-voltage vacuum load switch (hereinafter referred to as the load switch) is suitable for use in three-phase AC 50Hz, 12kV power supply networks for interrupting load current and closing short-circuit current. This product can be equipped with manual and motor-operated mechanisms, and is particularly suitable for harsh conditions, locations with long maintenance cycles, and frequent operation requirements. The vacuum load switch-fuse combination appliance (hereinafter referred to as the combination appliance) FZRN25-12(D)/T200-31.5 can interrupt short-circuit current for short-circuit protection. This product has a tripping mechanism; the fuse has an impactor. When an overload current or short-circuit current passes through, the fuse melts, and the impactor strikes the tripping device, automatically tripping the load switch to prevent single-phase operation.

1.1 Environmental Conditions

1.1.1 Ambient Temperature: -10°C to +40°C;

1.1.2 Altitude: Not exceeding 1000m

1.1.3 Seismic Intensity: Not exceeding 8 degrees;

1.1.4 Relative Humidity: Daily average ≤95%, Monthly average ≤90%;

1.1.5 Location of Use: Free from explosion hazards, chemicals, severe vibrations, and pollution.

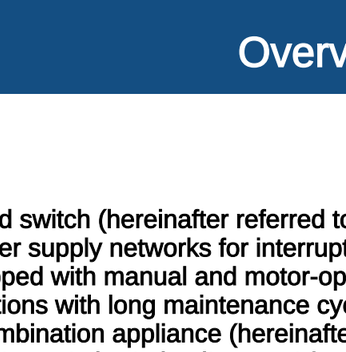
Note: Operating conditions above 1000 meters altitude (At altitudes above 1000 meters, air density decreases, which affects the protection factor of electrical appliances.)

1.2 Model and Meaning

Vacuum load switch

F Z N 25-12 D / T 630-20 / 1250-25

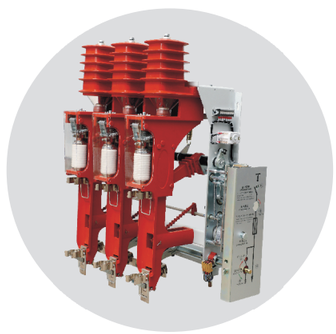
- Short-time withstand current (kA)
- Rated current (A)
- Spring mechanism
- Grounding switch
- Rated voltage (kV)
- Design serial number
- Indoor
- Vacuum arc extinguishing
- Load switch



Vacuum load switch-fuse combination unit

F Z R N 25-12 D / T 200-31.5

- Short-time withstand current (kA)
- Rated current (A)
- Spring mechanism
- Grounding switch
- Rated voltage (kV)
- Design serial number
- Indoor
- Fuse
- Vacuum arc extinguishing
- Load switch



II. Technical Parameters

2.1 Main Electrical Technical Parameters Table

NO	Name		unit	FZN25-12D/T630-20	FZRN25-12D/T200-31.5
1	Rated voltage		KV	12	
2	Rated frequency		Hz	50	
3	Rated current		A	630	200
4	Rated breaking current	Active load current	A	630	-
		Closed-loop current	A	630	-
		Unloaded transformer	KVA	1600	1600
		Cable charging current	A	10	-
5	Rated transfer current		A	-	3150
6	Rated short-time withstand current (4 seconds)		KA	20	-
7	Rated peak withstand current		KA	50	
8	Rated short-circuit breaking current		KA	-	3.15(Expected value)
9	Rated short-circuit making current		KA	50	-
10	Rated short-time (1 min) power frequency withstand voltage, phase-to-phase and ground/break		KV	42/48	
11	Rated lightning impulse withstand voltage (peak), phase-to-phase and phase-to-ground/break		KV	75/85	
12	Note: The rated short-circuit duration of the grounding switch is 2 seconds.				

2.2 Main Mechanical Characteristic Parameters

NO	Name	unit	numerical values	Remark
1	Vacuum interrupter opening distance	mm	6^{+1}_{0}	
2	Vacuum interrupter contact stroke	mm	-2^{+1}_{0}	Measuring contact spring compression stroke
3	Isolation break spacing	mm	≥130	
5	Interphase center distance	mm	210±1	
6	Vacuum interrupter three-phase closing asynchrony	ms	≤3	
7	Vacuum interrupter allows for contact bounce time during closing.	ms	≤3	
8	Average closing speed of vacuum interrupter	m/s	0.6±0.2	
9	Average opening speed of vacuum interrupter	m/s	0.9±0.2	
10	Resistance of each electrode conductive circuit		≤300	
11	Maximum operating torque required for manual operation	Nm	≤160	
12	Mechanical life	bout	10000	

2.3 Electric Motor Technical Parameter Table

Rated voltage	Rated output power	Normal operating voltage range
~220V	70W	85%-100%Rated voltage

2.4 Shunt Trip Unit Parameter Table

Rated voltage	Normal operating voltage range
DC 220V / DC 110V	65%~120%Rated voltage

2.5 The overcurrent trip unit has a current rating of 5A and an accuracy of ±10%.

III. Structure and Principle

3.1 Basic Structure:

The FZN25-12 load switch adopts an integrated frame assembly structure. In each phase circuit, the moving and stationary contacts are enclosed within a vacuum tube to form a vacuum interrupter, which, along with related conductors, is mounted on an integrated insulating support. The upper end of the vacuum interrupter is connected to the upper and lower direct-acting disconnect switches located at the rear via conductors to form a conductive circuit. The moving and stationary contacts of the disconnect switches and their conductors are also mounted in upper and lower integrated semi-enclosed insulating supports. The entire organically integrated insulating support is securely fastened to the metal frame. The spring-operated operating mechanism effectively incorporates the features of similar products nationwide and is mounted on the side of the metal frame, greatly improving the service life of the spring-operated mechanism. If a detachable fuse device and fuse and its tripping device are installed on the conductor at the lower end of the vacuum interrupter, it constitutes a load switch-fuse combination appliance. The metal frame is equipped with a grounding knife arm, spring operating mechanism, and interlocking. A high-temperature resistant, flame-retardant, transparent plexiglass cover is installed between the moving and stationary contacts of the disconnecting switch to effectively ensure personal safety. A grounding stationary contact is installed at the bottom of the load switch, forming a load switch with a grounding switch and a combined electrical appliance with a grounding switch.

3.2.1 A vacuum interrupter is used, providing strong arc-extinguishing capability, reliable performance, and safety.

3.2.2 The vacuum load switch, direct-acting disconnecting switch, and operating mechanism are integrated, simplifying operation. Opening and isolation are completed in one step, with a clearly visible break. A grounding knife can be added and interlocked with the switch.

3.2.3 Operation is convenient, allowing for both manual and electric operation. Reliable interlocking is provided for each function, facilitating the interlocking design of the switchgear.

3.2.4 Adopting a fully insulated design, all live parts are installed within an SMC insulating support frame. The unique design of the conical insulating base and transparent glass cover isolates the incoming busbar from the switch, facilitating the design of armored switchgear.

3.2.5 Flexible installation and convenient maintenance; can be installed upright or side-mounted, making fuse replacement easier.
3.3 Working Principle

3.3.1 The load switch closes by rotating the main shaft. During a clockwise rotation angle not exceeding 130°, the mechanism spring stores energy. Beyond 130°, the spring energy is released, driving the vacuum load switch drive section to move, causing the moving contact of the vacuum interrupter to move vertically upwards, thus closing the switch. At this time, the opening spring stores energy. When the panel tripping device or tripping coil is activated, the tripping half-shaft in the mechanism acts, and the opening spring is quickly released.

3.3.2 The grounding switch completes the energy storage and release action of the grounding switch spring by rotating the grounding main shaft, driving the grounding knife to rotate, thus realizing the closing and opening of the grounding switch.

3.3.3 The combined electrical appliance operates by striking the tripping device in the load switch after any phase fuse blows, triggering the pre-stored energy-carrying load switch spring mechanism to simultaneously open all three phases of the load switch. The load switch cannot be closed unless the fuse is replaced. 3.3.4 Arc Extinguishing Principle: The vacuum interrupter chamber used in the FZN25-12D vacuum load switch and FZRN25-12D combined electrical appliance has a high vacuum level. When the moving and stationary contacts of the interrupter chamber are energized and open under the action of the mechanism, a vacuum arc is generated between the contacts. Since there are very few free electrons in the vacuum, it is insufficient to sustain the arc. When the current naturally crosses zero, the arc extinguishes, and the dielectric insulation strength between the contacts quickly recovers, achieving the breaking purpose. 3.3.5 Operating Principle: During closing, the closing spring is manually or electrically energized. When the spring passes through the center, it drives the cam to rotate the switch main shaft through the linkage mechanism, keeping the switch in the closed state. When the switch spindle rotates, the first half of the rotation involves the operating lever closing the conductive cylinder, connecting the stationary contact and the intermediate contact seat, thus closing the isolation break. At this point, there is no current. In the second half of the rotation, the conductive cylinder stops moving, and the operating lever closes the vacuum interrupter. The pre-breakdown arc in the interrupter disappears as the moving and stationary contacts close. When opening, the closing holding mechanism (tripping half-shaft) is manually or electrically disengaged, and the switch spindle returns to its original position under the action of the opening spring. At this time, the operating lever separates the moving and stationary contacts of the vacuum interrupter in the first half of the rotation, interrupting the current, while the conductive cylinder remains stationary in the closed position.

3.3.6 Interlocking: The interlocking between the load switch, grounding switch, and cabinet door all adopt a mandatory mechanical interlocking method to ensure the "five-proof" function. A reliable mechanical interlock is installed between the load switch and the grounding switch. A secondary control circuit is formed by microswitches. When the grounding switch closes, the electric closing power supply to the load switch is disconnected, preventing the load switch from closing. The secondary control circuit, consisting of a microswitch linked by a trip shaft, requires replacement of the fuse after it trips the load switch in order to reclose it. (Configured according to user requirements)

IV. Structural Diagram

1. Upper contact seat of disconnecting switch
2. Insulating support frame
3. Transparent glass cover
4. Metal frame
5. Conductive cylinder of disconnecting switch
6. Lower contact seat of disconnecting switch
7. Vacuum interrupter chamber
8. Lower outlet seat of vacuum interrupter chamber
9. Vacuum load switch drive section
10. Fuse
11. Tripping mechanism
12. Grounding switch
13. Live indicator
14. Grounding switch operating port
15. Cabinet door lock pin
16. Manual trip button
17. Energy storage and closing operating port

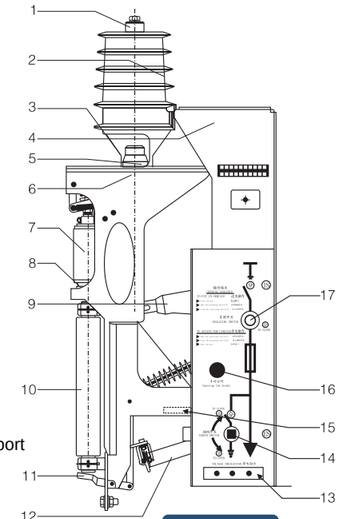


Figure 1

V. Routine Matters

5.1 Lifting, Installation, and Commissioning
Lifting should be carried out according to the lifting markings. Handle with care during lifting, prevent shock, and avoid inverting.

Refer to Figure 3 for the opening dimensions of the switchgear busbar compartment and switch compartment sealing plate; refer to Figure 4 for product installation.

5.2 Installation and Commissioning

5.2.1 Pre-installation Inspection: After unpacking, check the product for damage and rust, verify that the product nameplate and certificate of conformity match the order, and confirm that the packing list matches the actual items. Clean surface dust and dirt only after confirming everything is in order.

5.2.2 Installation: During installation, ensure the flatness and strength of the cabinet frame mounting beams to prevent stress on the product after installation, thus avoiding affecting operational performance and increasing operational vibration. The product should not be damaged during installation.

5.2.3 Commissioning: The product has undergone rigorous commissioning before leaving the factory. Users can check according to the product's mechanical characteristic parameters. If any non-conformities are found, contact the manufacturer for joint commissioning by both the manufacturer and the user. The vacuum level of the vacuum interrupter is checked using the power frequency withstand voltage method while the opening torque of the interrupter remains unchanged.

5.3 Load Switch Maintenance and Repair Procedures Maintenance Cycle and Engineering

1. Maintenance Cycle

1.1 After the switch is put into operation, it should be maintained 1-2 times per year. A comprehensive maintenance should be carried out after interrupting 20 load currents, with a focus on the arc-extinguishing tube.

1.2 Maintenance Procedures

1.2.1 Clean dust and dirt from all components of the load switch.

1.2.2 Inspect the ceramic parts.

1.2.3 Inspect the contact parts.

1.2.4 Rust removal and corrosion protection for the metal structure.

1.2.5 Adjustment and testing after maintenance.

Maintenance and Inspection Standards

1.1 The insulation components of the load switch should be clean and free from damage, cracks, and discharge marks.
1.2 The operating mechanism, transmission device, shaft, and other pins of the load switch should be complete and not loose.
1.3 All electrical connections, including moving and stationary contacts, should have tight contact, without overheating or discoloration.
1.4 The interlocking device should be in good working order and operate accurately.
1.5 The opening and closing indications of the display switch should be correct.
1.6 The grounding wire of the load switch should be free from looseness, broken strands, and corrosion.
To prevent damage to the switch due to third-party causes during operation, annual maintenance is required.
5.4 Transportation and Storage
5.4.1 Vacuum load switches and combined electrical appliances must be sealed in special packaging boxes during transportation.
5.4.2 During packaging, the load switch should be in the open position, and the grounding switch should be in the closed position.
5.4.3 During transportation, the load switch must not be tilted or inverted to prevent violent impacts.
5.4.4 During transportation, the product must be protected from rain to prevent moisture damage.
5.4.5 During storage, it should be placed in a dry, well-ventilated, moisture-proof indoor environment free from harmful gas corrosion. For long-term storage, lubricant should be applied to metal surfaces and rotating parts, and the environmental conditions should be checked regularly to ensure they meet requirements.
5.4.6 The permissible storage period for vacuum interrupters is 20 years.
5.5 Factory Documents and Attachments

1. Product Instruction Manual/1 copy 2. Product Certificate of Conformity/1 copy
3. Factory Inspection Report/1 copy 4. Packing List/1 copy
6. Door Lock or Lock Plate (Door Interlock Angle Steel/1 each) 6. Emergency Unlocking Plate/1 piece
5. Operating Handle/1 piece

5.6 Ordering Instructions When ordering, please specify:

5.6.1 Model, Name, Quantity, and Operating Direction

5.6.2 Rated Voltage and Rated Current

5.6.3 Rated Voltage of Operating Mechanism

5.6.4 With or without Panel

5.6.5 With or without Grounding Switch

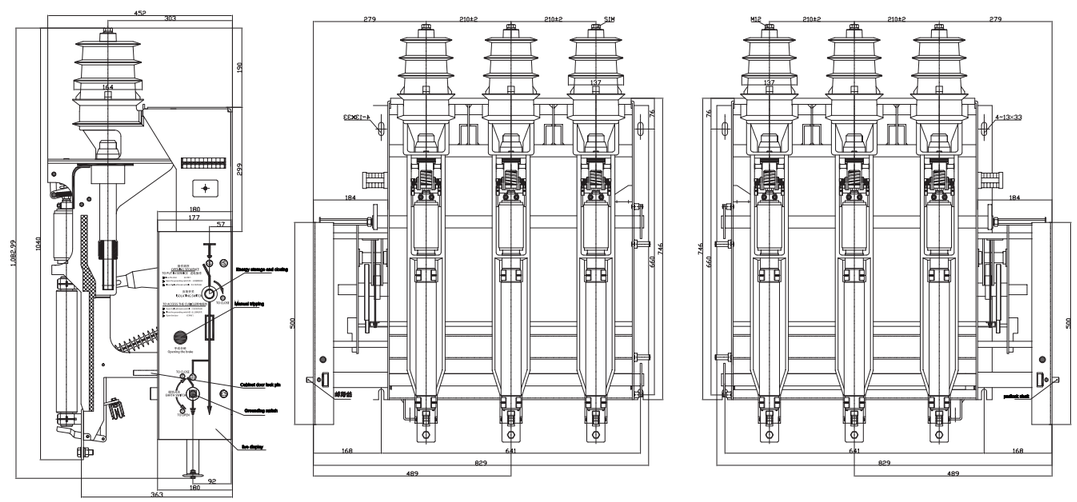
5.6.6 If fuses are required to be supplied with the combined electrical appliances, the rated current value and quantity of the fuses should be provided.

5.6.7 Name and quantity of Spare Parts/Components

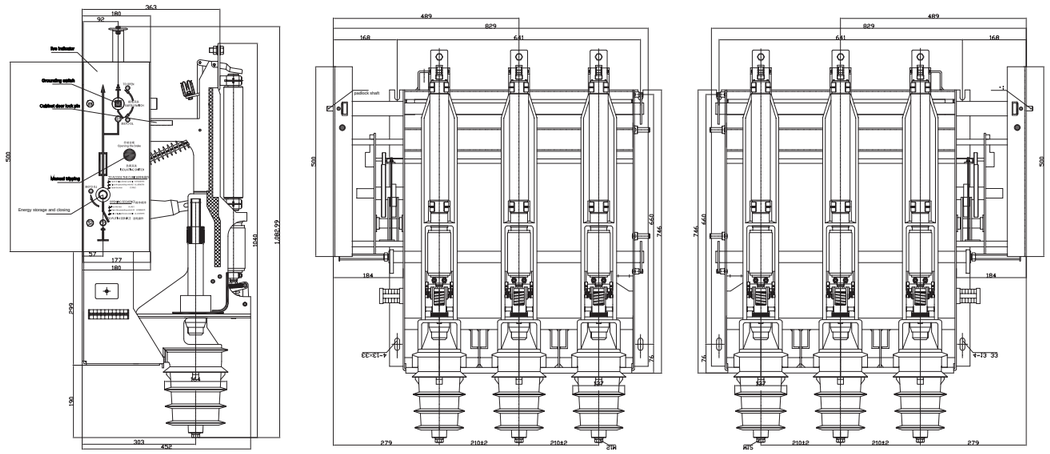
Fault phenomenon	reason	Troubleshooting steps:
Cannot store energy or close	The grounding switch is in the closed state.	Open the grounding switch
	Damaged auxiliary switch or loose grounding in the energy storagemotor bridge full-wave rectifier	Inspect and replace damaged components one by one
	Fuse striker extension	Replace the fuse
Not closed properly	Insufficient output of closing spring	Tighten the closing spring
	Transmission component lag	Reset
Rejection	Damaged trip coil	Replace the opening coil
	The trip spring is loose.	Tighten the opening spring
	Transmission component jamming	Lubricate relevant parts

VI. Dimensioning Drawing

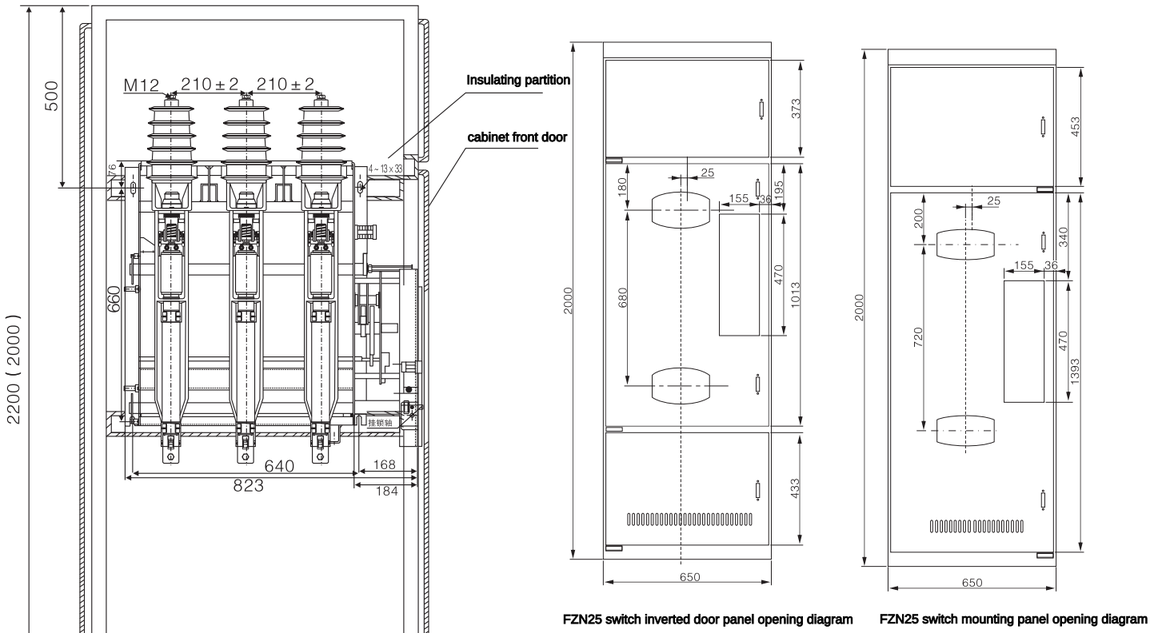
FZRN25-12D/T200-31.5 Front mounting, right-hand operation



FZRN25-12D/T200-31.5 Front-mounted, inverted, left-hand operation



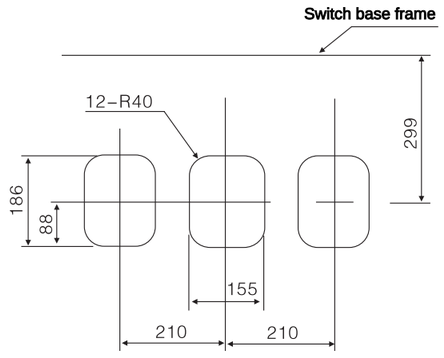
VII. Cabinet Reference Drawing



FZN25 switch inverted door panel opening diagram

FZN25 switch mounting panel opening diagram

Figure 3. Installation diagram of FZN25 switch and cabinet.



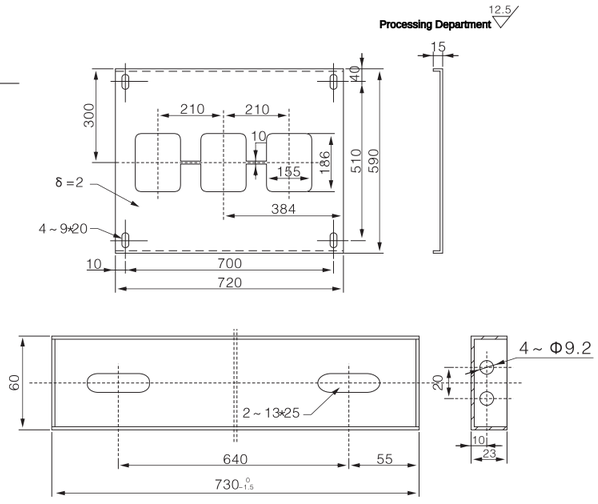
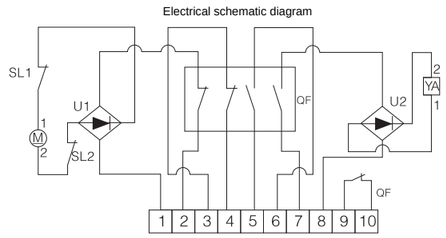


Figure 4

8. Electrical Schematic Diagram

● **Electric operating mechanism selection**



NO	code name	Name	quantity	Remark
7	S	Auxiliary switch	1	F10-10
5.6	U1 U2	Single-phase rectifier bridge	2	KBPC25-10
4	SL1 SL2	micro switch	2	LX**-62与地刀轴联动
3	TQ	Disconnect the electromagnet	1	ЬWX16170016
2	M	Energy storage motor	1	59ZY-CJ02
XT	XT	Terminal blocks	1	TD 660V-15A

● **Secondary wiring diagram**

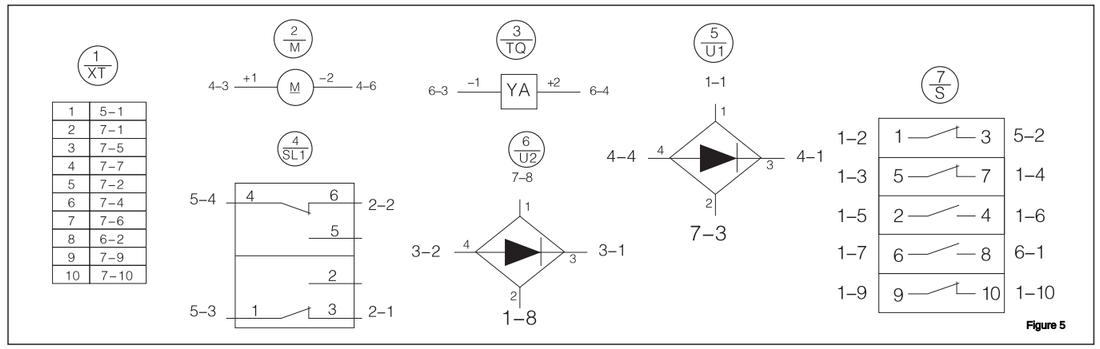
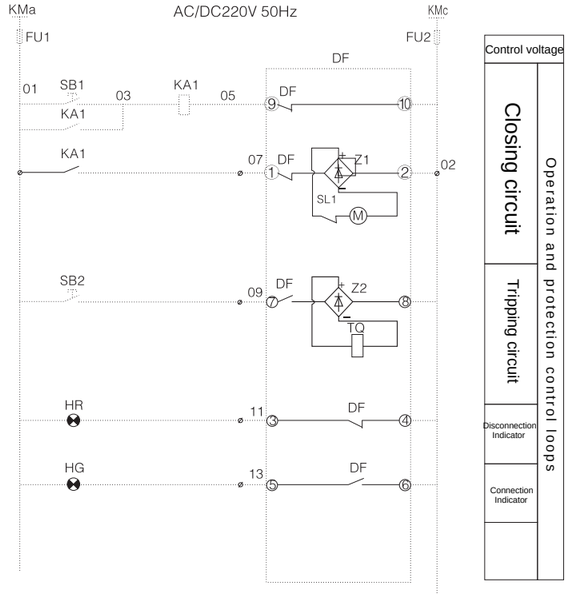
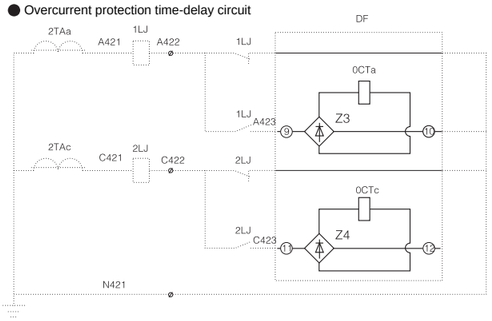


Figure 5

● Cabinet installation reference diagram with direct protection points

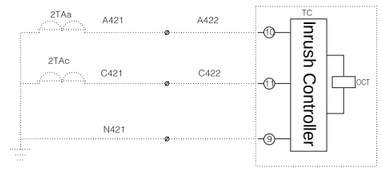


● Overcurrent protection time-delay circuit



NO	code name	Name	quantity	Remark
1	0CT	Overflow de-taper	1	JD5A
2	2TAa 2TAc	Current transformer	2	LZZJB9-10
3	Z3 Z4	Single-phase rectifier bridge	2	QL50A
4	LJ	Overcurrent relay	2	GL-15

● Overcurrent protection time limit circuit



NO	code name	Name	quantity	Remark
1	TC	Inrush Controller	1	TC-42
2	0CT	Overcurrent trip unit	1	JD5A
3	2TAa 2TAc	Current transformer	2	LZZJB9-10