

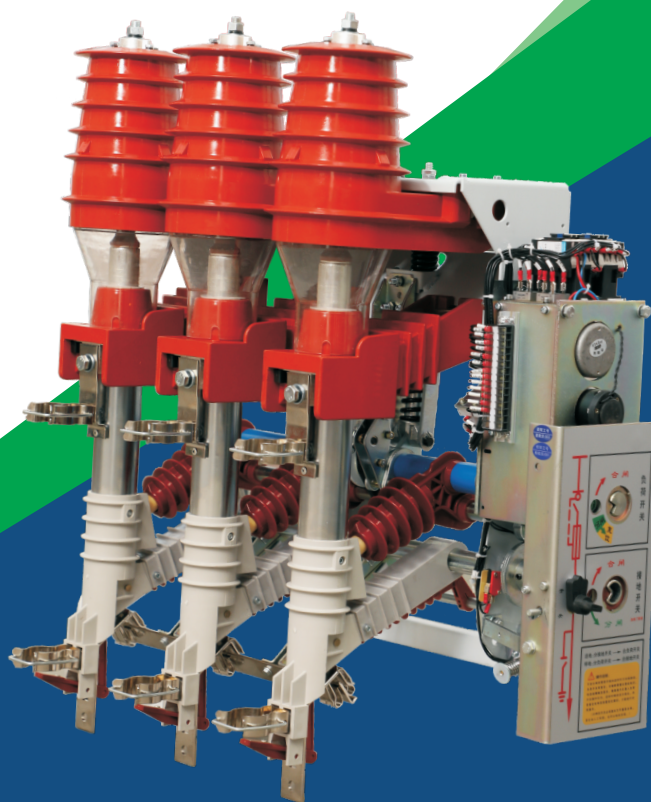




FKN12-12D/630-20 FKRN12-12D/125-31.5

Pneumatic load switch-fuse combination appliance

Product Instruction Manual



ZHEJIANG AAIKAI ELECTRIC CO.,LTD

catalog

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一、Overview

The FKRN12-12D air-operated load switch (hereinafter referred to as the load switch) is a three-phase AC 12kV, 50Hz indoor high-voltage switchgear. Under normal circuit conditions, it can close, carry, and interrupt load current; it can close short-circuit current and has the ability to carry short-circuit current for a specified time. When the load switch is equipped with a current-limiting fuse with an impactor, it becomes a load switch-fuse combination appliance (hereinafter referred to as the combination appliance), which can be used for overload and short-circuit protection of loads (such as power transformers).

This product is suitable for installation in ring network switchgear and other types of switchgear such as prefabricated substations. It is an ideal device for the construction, renovation and upgrading of power distribution networks, substations and switching stations.

1.1.1 Altitude: Not exceeding 1000m;

1.1.2 Ambient temperature: Maximum +40°C, Minimum -25°C;

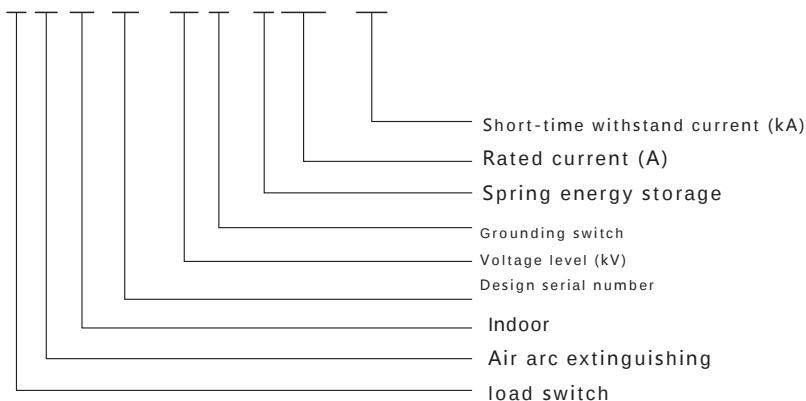
1.1.3 Relative humidity: daily average not exceeding 95%, monthly average not exceeding 90%;

1.1.4 Seismic intensity: below 8 degrees;

1.1.5 This switch shall be installed in a location free from fire, explosion hazards, severe pollution, chemical corrosion, and violent vibration.

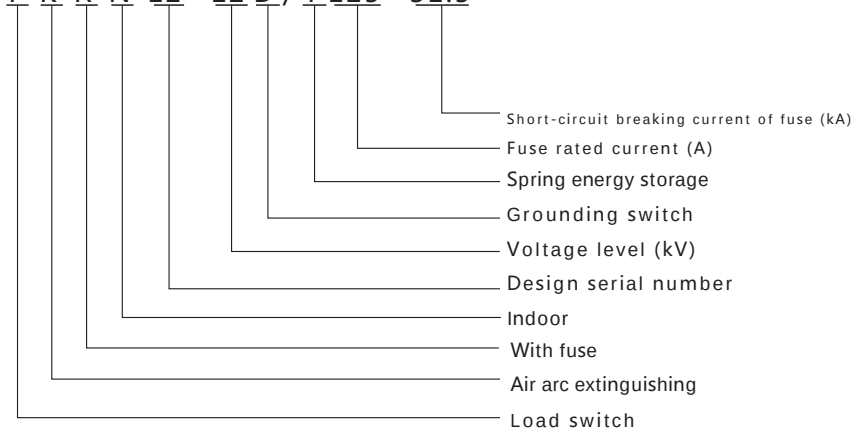
1.2 Model and Meaning

F K N 12 - 12 D / T 630 - 20



1.2.2 Pneumatic load switch - fuse combination appliance:

F K R N 12 - 12 D / T 125 - 31.5



二、Technical parameters

2.1 Specifications and Models

This product comes in two types: load switches and combination electrical appliances. Both types are available with or without grounding switches. The switch has flexible operating positions and can be installed front-facing, left-side, right-side, or upside down. (See Figures 1 and 2)

Technical parameters are shown in Table 1, and mechanical properties are shown in Table

2.2.2.1 Technical Parameter Table 1

2.2.2.1 Technical Parameter Table 1

NO	name		unit	Combined electrical	LBS
1	Rated voltage (maximum voltage)		kV	12	
2	Rated frequency		Hz	50	
3	Rated current		A	Determined by the fuse	630
4	Rated active load breaking current, rated closed-loop breaking current		A	630	
5	Rated short-time withstand current	LBS	kA	20	
			kA	20	
6	Rated short-circuit making current, rated peak withstand current		kA	80	50
7	1-minute power frequency withstand voltage, phase-to-ground/isolation break		kV	42 / 48	
8	Lightning impulse withstand voltage (peak) phase-to-phase and phase-to-ground/isolation break		kV	75 / 85	
9	Rated cable charging breaking current		A	10	
10	Rated short-circuit breaking current		kA	31.5	≤120
11	Rated transfer current		kA	1200	
12	Circuit resistance between stationary contact mounting base and moving contact mounting base		μΩ	≤120	≤320
13	Circuit resistance between incoming and outgoing lines (using copper rods instead of fuses for combined electrical appliances)		μΩ	≤320	
14	Left- or right-mounted external dimensions Height × Width × Depth		mm	880×429×880	880×337×880
15	Formal Clothing Dimensions Height × Width × Depth		mm	880×851×(Y) Y is determined by the customer.	

2.2.2 Mechanical properties 2

NO	NAME	unit	numerical values	Remark
1	When the circuit is open, the distance between the moving and stationary arc contacts is...	mm	≥ 150	
2	Contact Itinerary	mm	≥ 10	
3	Closing speed	m/s	≥ 2.5	
4	Opening speed	m/s	≥ 1.8	
5	Three-phase closing not synchronized	ms	≤ 10	
6	Three-phase tripping not synchronized	ms	≤ 5	
7	Grounding switch moving and stationary contact spacing	mm	≥ 150	
8	Mechanical life	Second-rate	≥ 2000	

三、Basic structure and arc extinguishing principle

3.1 Basic Product Structure and Dimensions: See Figures 1, 2, and 3.

3.1.1 This product features a frame structure. The three-phase circuit components are fixed to the frame by six insulating supports made of SMC insulating material. The conductive cylinder in the moving contact is empty and also functions as a cylinder. Driven by spring force, it moves vertically up and down to achieve closing and opening. Inside the conductive cylinder is a stationary "piston" with piston rings, fixed within the cylinder by a piston rod. When the switch is opened, the air in the conductive cylinder is compressed and ejected from the arc-resistant plastic nozzle at the top, extinguishing the arc. Although the amount of gas in the cylinder is limited, the special design of the nozzle reliably extinguishes the arc. The high-speed airflow quickly restores the dielectric insulation strength between the breaks, effectively preventing arc reignition.

3.1.2 The opening process is shown in Figure 4.

3.1.3 To improve the reliability of the switch, the conductive and arc-extinguishing elements are separate. The conductive elements are made of copper, consisting of a plum blossom-shaped contact finger and a conductive cylinder. The arc-ignition element is made of an arc-resistant copper-tungsten alloy, consisting of an arc-starting rod and an arc-starting ring.

3.1.4 The arc-starting rod is located in the center of the plum blossom-shaped contact finger on the upper insulating support, while the arc-starting ring is located inside the conductive cylinder, below the nozzle. When the circuit is opened, the outer surface of the conductive cylinder separates from the stationary contact finger, and only then does the arc-starting ring separate from the arc-starting rod. The arc burns only between the arc-starting rod and the arc-starting ring without burning the stationary contact finger and the conductive cylinder.

3.2 Operating Mechanism

3.2.1 It can be operated manually or electrically.

3.2.2 The load switch uses one operating shaft (can be operated electrically or manually), and the grounding switch uses another operating shaft (manual only). The two operating shafts must be operated separately (they share one operating handle when operating manually). The two operating shafts are mechanically interlocked to prevent misoperation. The load switch can only be closed or opened after the grounding switch is open. When the load switch is in the closed position, the grounding switch cannot be closed.

3.2.3 Load Switch Spring Energy Storage Mechanism (taking the right-hand mounting as an example) (as shown in Figure 1) The operating mechanism uses spring energy storage for closing and opening. It consists of two identical closing and opening springs and a crank arm. When closing, rotating the handle clockwise drives the two springs to store energy simultaneously. After compressing the springs past their dead point, the switch closes. When opening, rotating the handle counterclockwise opens the switch.

3.2.4 Combined Electrical Appliance Spring Energy Storage Mechanism The operating mechanism uses spring energy storage for closing and opening. It consists of one closing spring, one opening spring, and a half-shaft tripping mechanism. When closing, turning the handle clockwise stores energy in both springs simultaneously. The compressed spring closes the switch when it passes the dead point, while the stretched spring retains its energy through the half-shaft. When opening, turning the handle counterclockwise opens the switch.

When one or more fuses blow, their strikers act on the circuit breaker, and through a series of linkages, the half-shaft mechanism is released, causing the tripping spring to release energy and automatically tripping the load switch. After tripping, the load switch shaft must be reset before the next closing action can be performed.

3.3 Safety Devices

The cabinet is equipped with a door lock [installation dimensions are shown in Figure 4 (Type A door lock) and Figure 5 (Type B door lock)]. The door lock works in conjunction with the door pin on the switch. The door pin is locked to the locking sleeve in the grounding shaft operating hole. The motor power supply is also locked to the grounding switch. When the door lock is not properly locked (i.e., the cabinet door is not closed), the door pin is still inserted in the locking sleeve of the grounding shaft operating hole. Therefore, the operating handle cannot be inserted into the grounding shaft operating hole, and manual operation is not possible. At the same time, the motor operating power is not connected, and electric operation is not possible. Only after the door lock is properly locked (i.e., the cabinet door is closed) can the operating handle be inserted into the grounding shaft operating hole. Turning the handle opens the grounding switch for manual operation, and the power supply is also connected, allowing for electric operation.

After the door lock is engaged, if the grounding switch is not in the closed position, the door pin cannot return to the lock sleeve, the door lock cannot be turned, the cabinet door cannot be opened, and the operator and maintenance personnel cannot put their hands into the cabinet, thus ensuring safety.

The grounding switch and safety partition share a single manual operating shaft, opening and closing simultaneously. When the load switch is opened, the grounding switch is closed simultaneously, and the grounded safety partition automatically seals the energized stationary contacts. Only then can the door lock be turned to open the cabinet door without touching any energized parts, ensuring personnel safety.

IV. Switch Operation

Normally, before use, the load switch is in the open position, while the grounding switch is in the closed position, with "open" and "close" indicators. The following explanation uses the right-side mounting as an example.

4.1 Manual Operation

4.1.1 Pulling Out the Door Pin There is a door pin in the operating hole of the grounding switch that is interlocked with the switchgear door (see Figure 1, Figure 2). If the switchgear door is not locked, the door pin remains in the operating hole, and the operating handle cannot be inserted, making operation impossible. Only after the switchgear door is fully locked will the door pin disengage from the operating hole, allowing the handle to be inserted for operation. After the grounding switch is open, the locking sleeve blocks the pin hole, preventing the door pin from returning to the operating hole and the switchgear door from opening, ensuring safety. When operating the load switch alone without a switchgear, the door pin must be pulled out before the handle can be inserted into the operating hole for operation.

4.1.2 Manual Closing and Opening of the Load Switch

After pulling out the door pin as per 5.1.1, insert the handle into the grounding switch operating hole and rotate it clockwise to open the grounding switch. The grounding switch indicator will change from "closed" to "open". Pull out the handle and insert it into the load switch operating hole. Rotate the handle clockwise to close the load switch.

The load switch indicator will change from "open" to "close". Pull out the handle to complete the closing operation.

Insert the handle into the load switch operating hole and rotate it counterclockwise to open the load switch. The load switch indicator will change from "Closed" to "Open". Pull the handle out and insert it into the grounding switch operating hole, rotating it counterclockwise to close the grounding switch. The grounding switch indicator will change from "Open" to "Closed". Pull the handle out to complete the opening operation.

5.1.3 Manual Closing and Opening of Combined Electrical Appliances: After pulling out the door pin as described in 5.1.1, insert the handle into the grounding switch operating hole and rotate it clockwise approximately 720 degrees to open the grounding switch. The grounding switch indicator will change from "Closed" to "Open". Pull the handle out and insert it into the load switch operating hole, rotating the handle clockwise to charge the spring and close the switch. The load switch indicator will change from "Open" to "Closed". Pull the handle out to complete the closing operation. (Note: When closing the switch of a combined electrical appliance, if the operating force is minimal when the handle is rotated clockwise and the spring cannot store energy, it indicates that the stop mechanism has not reset. In this case, the handle must first be rotated counterclockwise to its dead center to reset the stop mechanism, and then the handle can be rotated clockwise to store energy and close the switch.)

Insert the handle into the operating hole of the load switch and rotate it counterclockwise to open the load switch. Then rotate the handle counterclockwise to the dead point to reset the stop mechanism, and the load switch indicator will change from "on" to "off".

5.1.4 If the load switch is tripped due to a fuse striker, the operating handle must first be inserted into the load switch operating hole and rotated counterclockwise to the dead center to reset the stop mechanism. Then, the ground switch must be closed, the switch cabinet door opened, the fuse replaced with a special tool, and the operation repeated as described above.

For left-mounted switches, the opening and closing operations are exactly the opposite; for upright switches, the opening and closing operations of the grounding switch are exactly the opposite. **4.2 Electric Operation:** When closing, the motor drives the load switch shaft to rotate clockwise. After the load switch completes the closing action, the motor automatically stops. When opening, the motor drives the load switch shaft to rotate counterclockwise. After the load switch opens, the motor continues to rotate until the load switch is fully open, at which point the motor automatically stops. When the fuse blows or the shunt trip trips, causing the load switch to open, the motor also automatically drives the load switch shaft to rotate counterclockwise, and the switch energy storage mechanism automatically resets.

All methods of tripping can ensure that the load switch is fully tripped and that there is a clearly visible break.

V. Routine Matters

5.1 Accompanying Documents and Attachments

The following documents and attachments are provided with the load switch:

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

5.2 Transportation

5.2.1 The load switch, packaged in its intact box, can be loaded and unloaded by forklift, crane, or manually. It is suitable for transport by car, train, ship, and plane.

5.2.2 During handling, it must not be tipped over, placed on its side, or subjected to severe vibration.

5.3 Storage

5.3.1 The load switch should be stored in a dry place.

5.3.2 It should be protected from rain to prevent moisture damage.

5.3.3 When the load switch is not used for a long time, apply neutral petroleum jelly to the metal surface, wrap the insulating parts with clean oil paper, store it in a well-ventilated, dry room free of corrosive gases, place it horizontally, and cover it with plastic film to prevent dust accumulation.

5.4 Acceptance

5.4.1 Check for packaging damage.

5.4.2 Unpack the box, retrieve the packing list, and check that all packing documents and provided accessories are complete.

5.4.3 Check that the nameplate data of the load switch matches the order.

6 Switch Installation

The load switch is shipped in the open position. Installation should proceed as follows:

6.1 Clean all surfaces thoroughly.

6.2 If the switch is electrically operated, check the secondary wiring for completeness and ensure all connections are secure before installation. Use a multimeter to test the secondary wiring. The secondary wiring diagram is provided with the circuit.

6.3 Check that the predetermined installation dimensions of the switch cabinet (or transformer substation, etc.) match the product's installation dimensions. Product installation dimensions are shown in Figures 6 and 7.

6.4 The mounting surface of the switch cabinet (or transformer substation, etc.) must fit snugly against the product's mounting surface. If a gap exists, shims must be added. Never use fasteners to force a tight fit, as this may deform the switch.

6.5 Perform closing and opening operations to check for flexibility and reliability.

7. Preparations Before Operation

7.1 Before operation, the user does not need to make any adjustments to the load switch. Only check for loose fasteners in all parts; if any are found, tighten them.

If the moving contact fixing bolts are loose, tighten them and then check the coaxiality of the moving and stationary contacts and the phase-to-phase spacing.

7.2 Clean the surfaces of the insulating components.

7.3 Conduct a trial operation. Only after no abnormalities are observed and the insulation test and circuit resistance check are passed can the switch be put into operation.

8. Use and Maintenance

8.1 Every year after operation, wipe the surfaces, check and tighten all fasteners, and check the springs for damage. Apply a thin layer of wide-temperature grease to the moving parts of the load switch and spring mechanism. Apply petroleum jelly to the operating mechanism of the motor drive.

8.2 When the combined electrical equipment encounters a fault, one or more phase fuses may trip. In this case, all three-phase fuses of the same model must be replaced.

8.3 During handling, installation, and use, the moving and stationary contacts of the load switch must not be subjected to force or impact to avoid changing their relative positions and affecting normal closing and opening.

8.4 The fixing bolts of the moving and stationary contacts must not be loosened, and the tensioning screws of the trip spring must not be loosened.

9 Ordering Instructions

9.1 The product model, name, and quantity should be specified.

FKN12-12D/T630-20 Pneumatic Load Switch ; FKRN12-12D/T125-31.5 Pneumatic Load Switch with Fuse Combination Appliance;

9.2 All products are shipped with a grounding switch and dust cover. If the user does not require a grounding switch or requires a safety barrier, please specify when ordering.

9.3 If the user requires spare parts and lubricating grease, please specify when ordering.

9.4 If the user requires fuses, please specify the quantity, model, and specifications, and select according to Table 3.

9.5 All models do not include an electric mechanism. If the user requires electric operation, please specify when ordering.

Dimensions

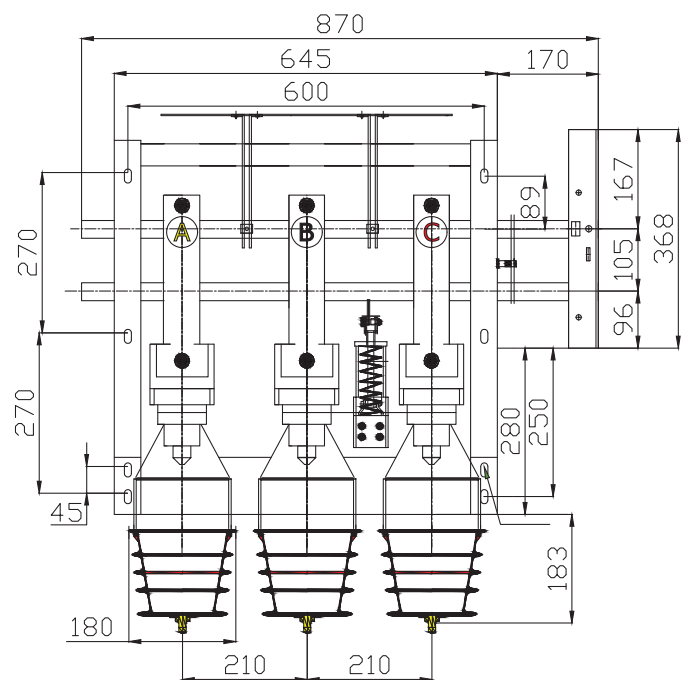
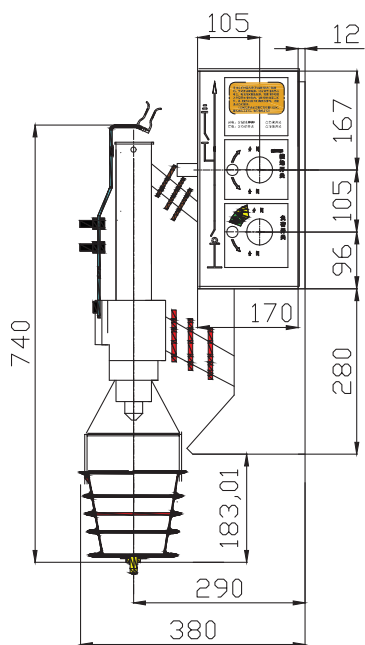
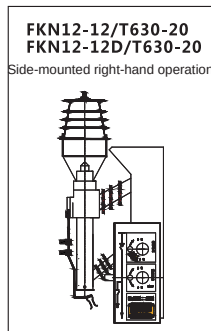
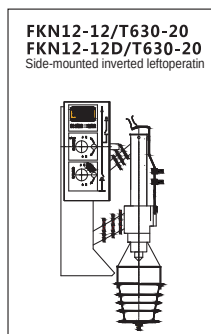
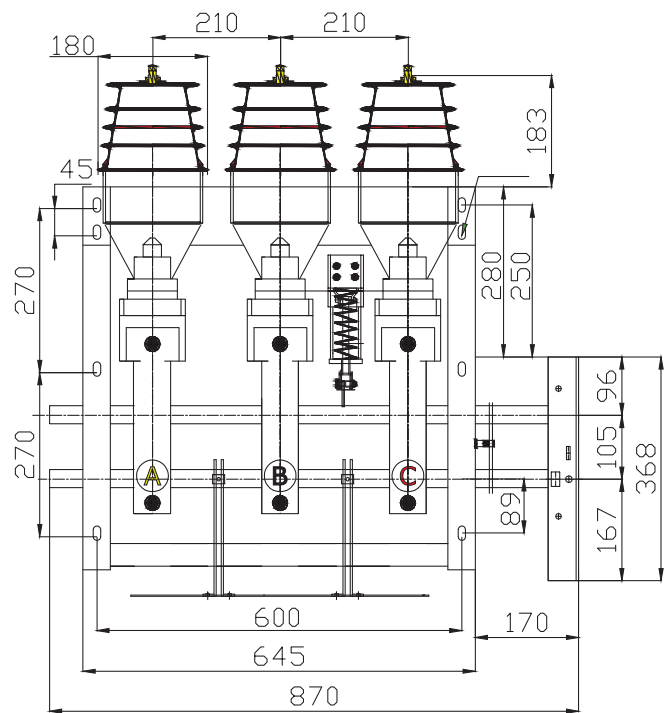
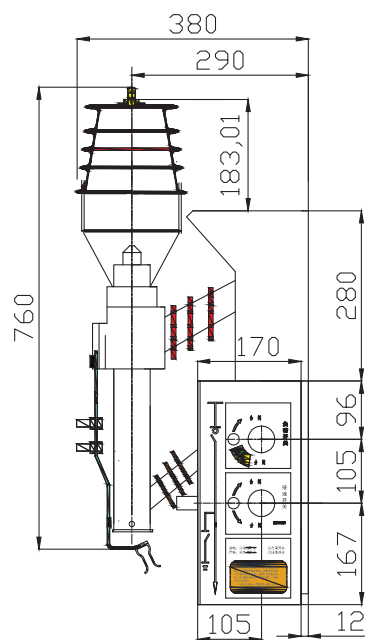
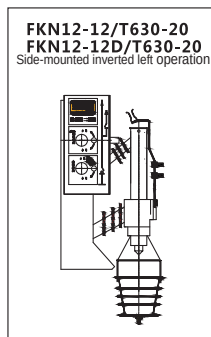
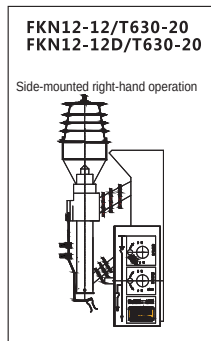


Figure 1

Dimensions

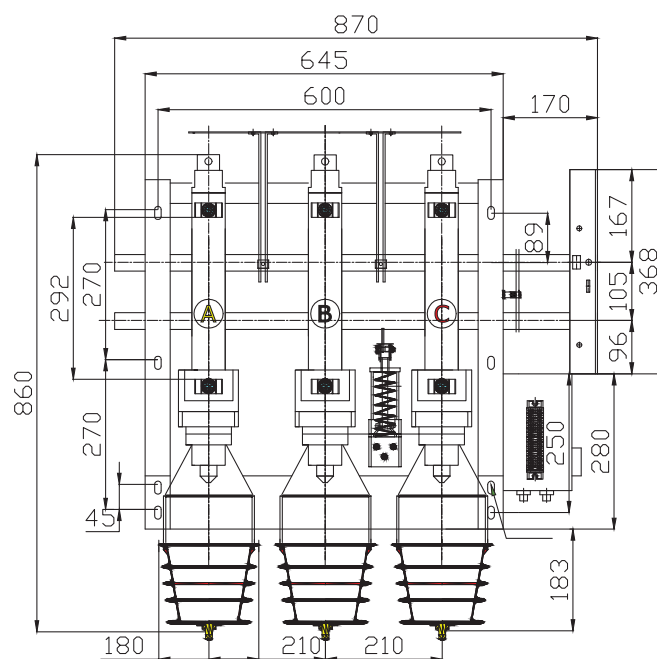
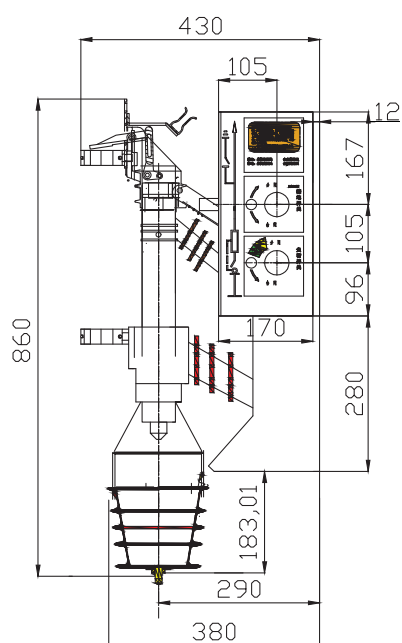
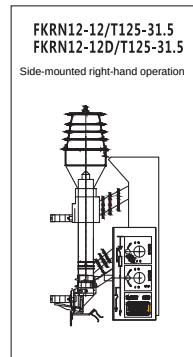
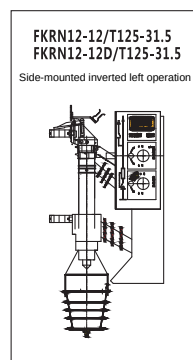
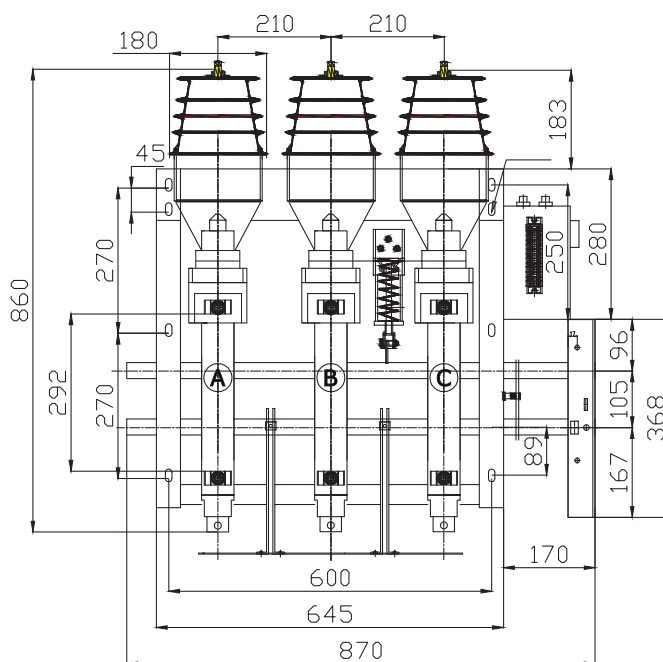
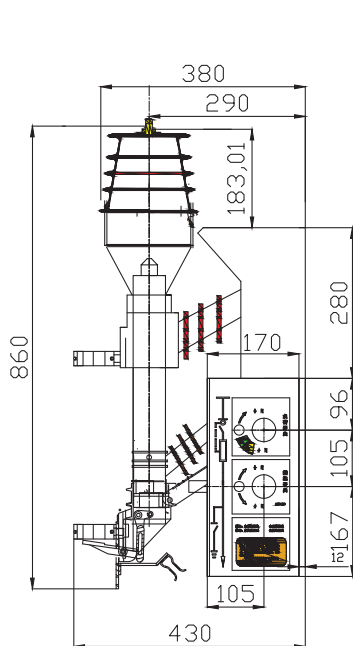
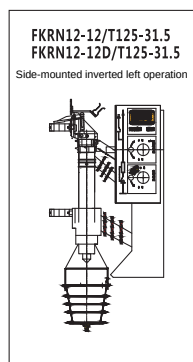
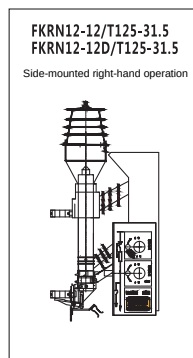


Figure 2

Dimensions

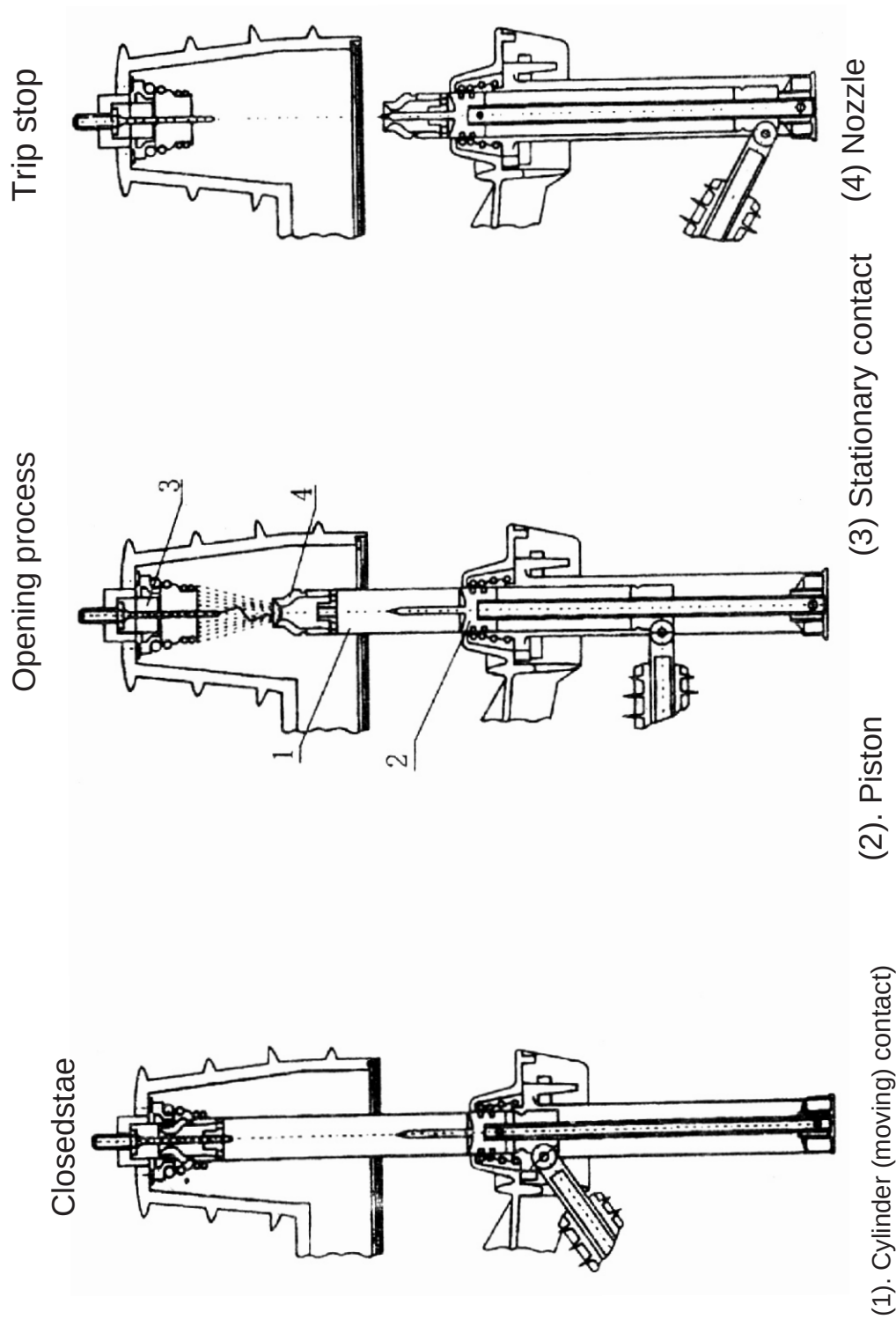


Figure 4 Schematic diagram of load switch tripping process

Dimensions

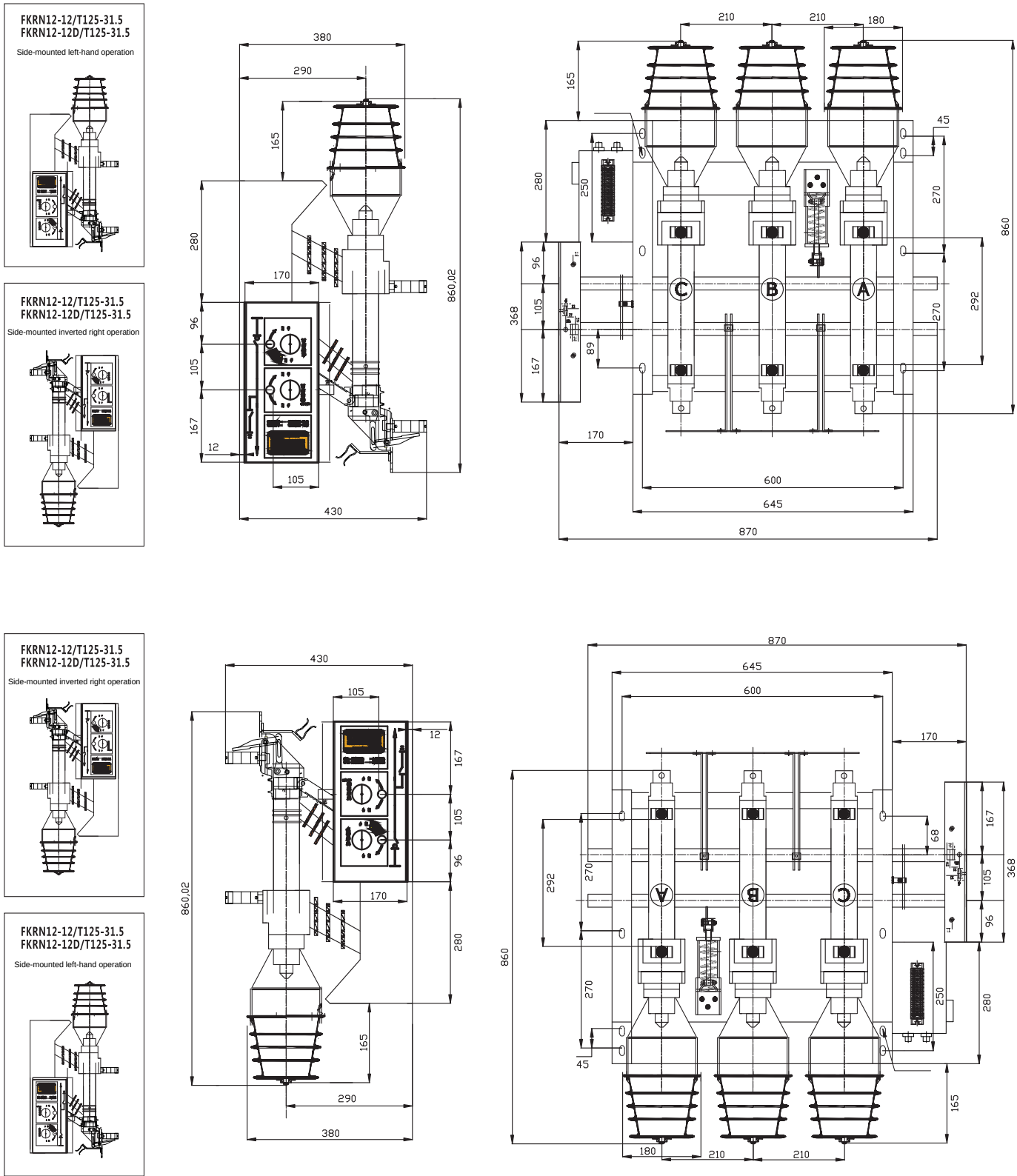
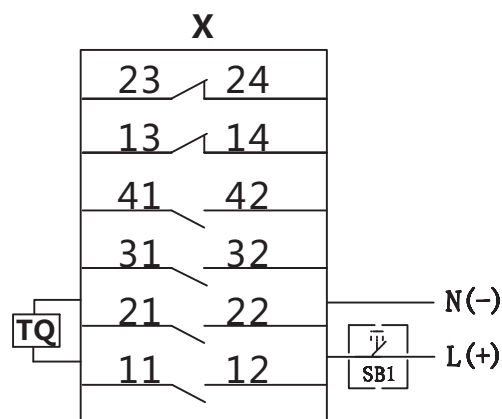


Figure 3

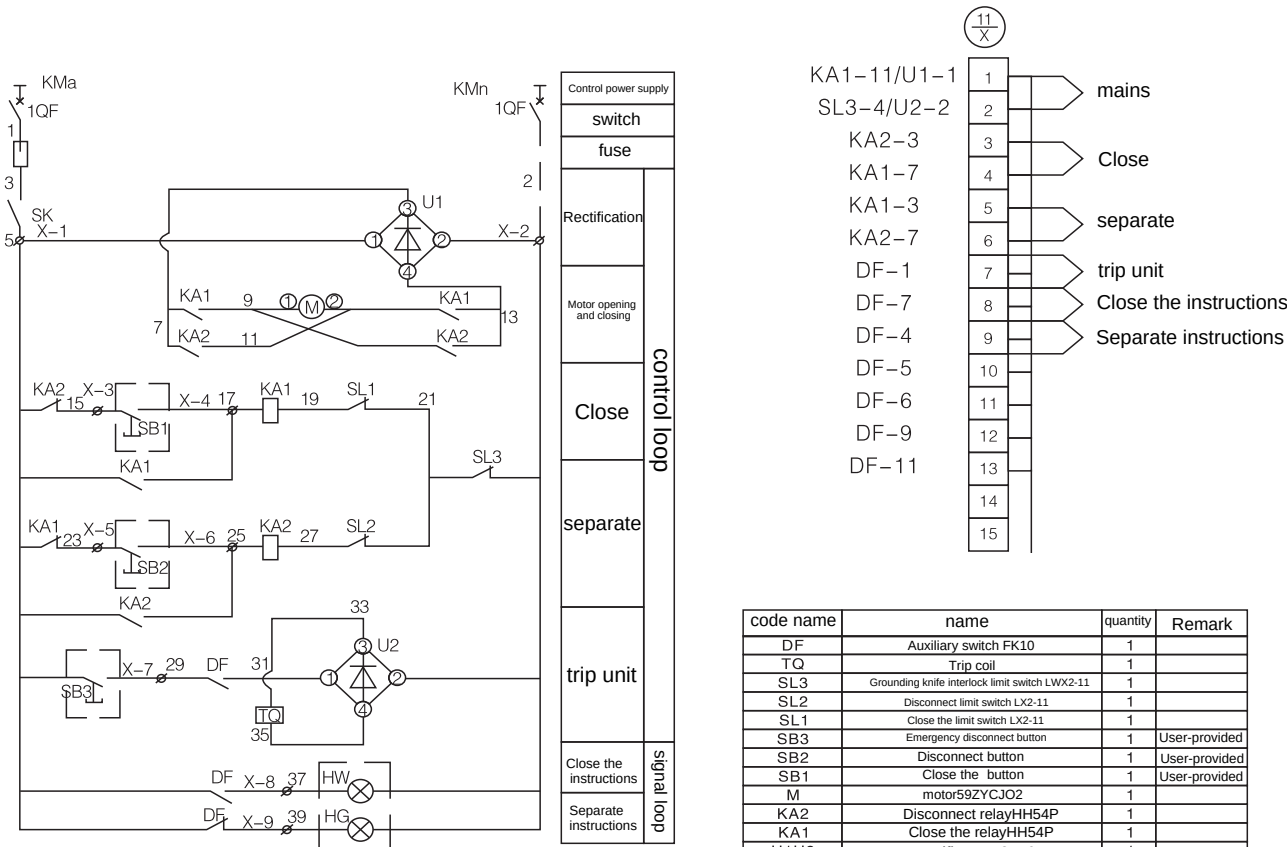
Schematic diagram



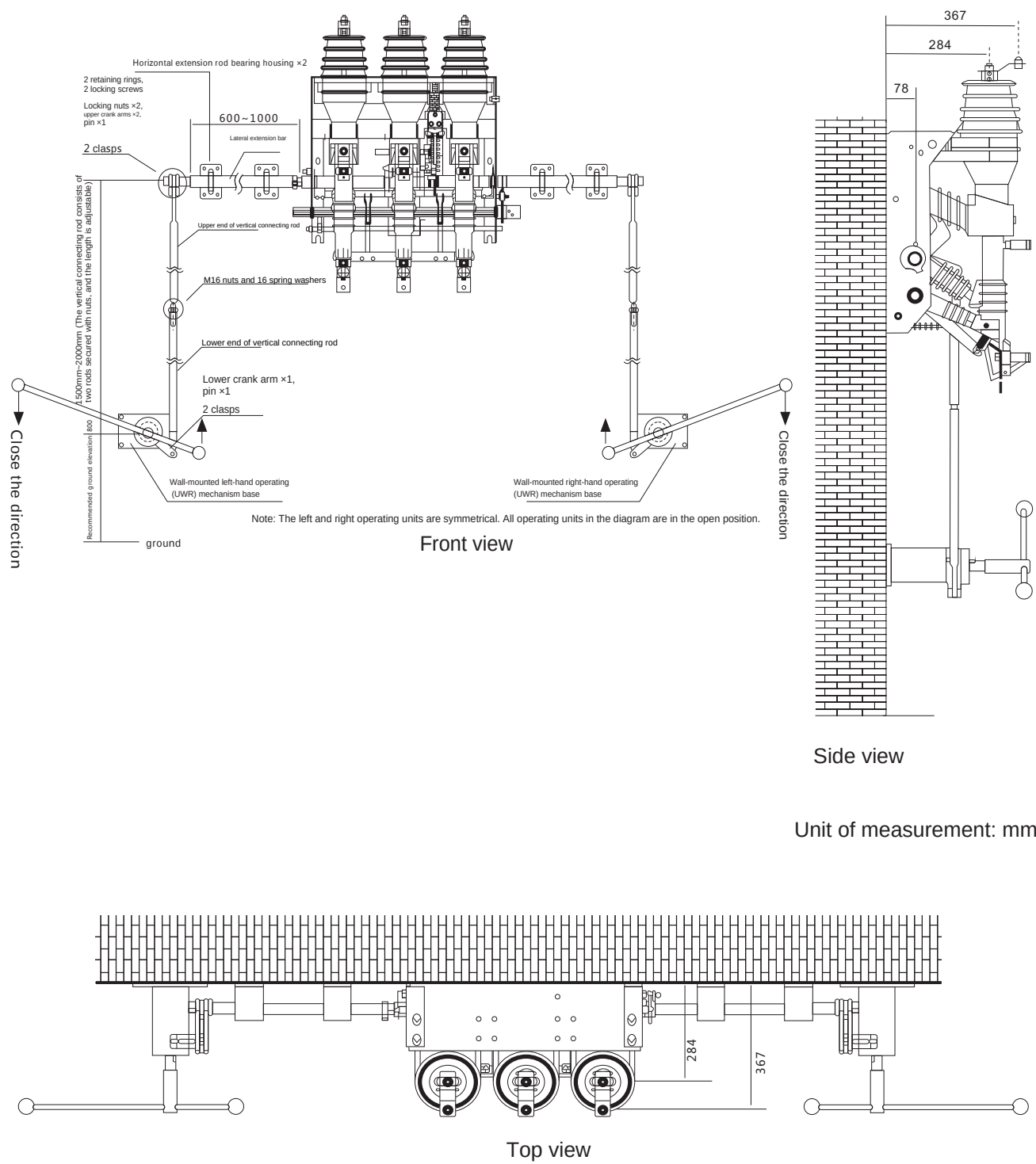
NO	mark	name	Remark	unxi t	amount
1	TQ	Trip coil (AC220V)	SWXJ.617.00.G	pair	1
2	X	Auxiliary switches/terminals	F10-10/W	pair	1
3	SB1	Trip button	For personal use	pair	1
4			/		
5			/		
6			/		

Note: The switch in this diagram is in the open position; the user's external connection is within the dashed line.

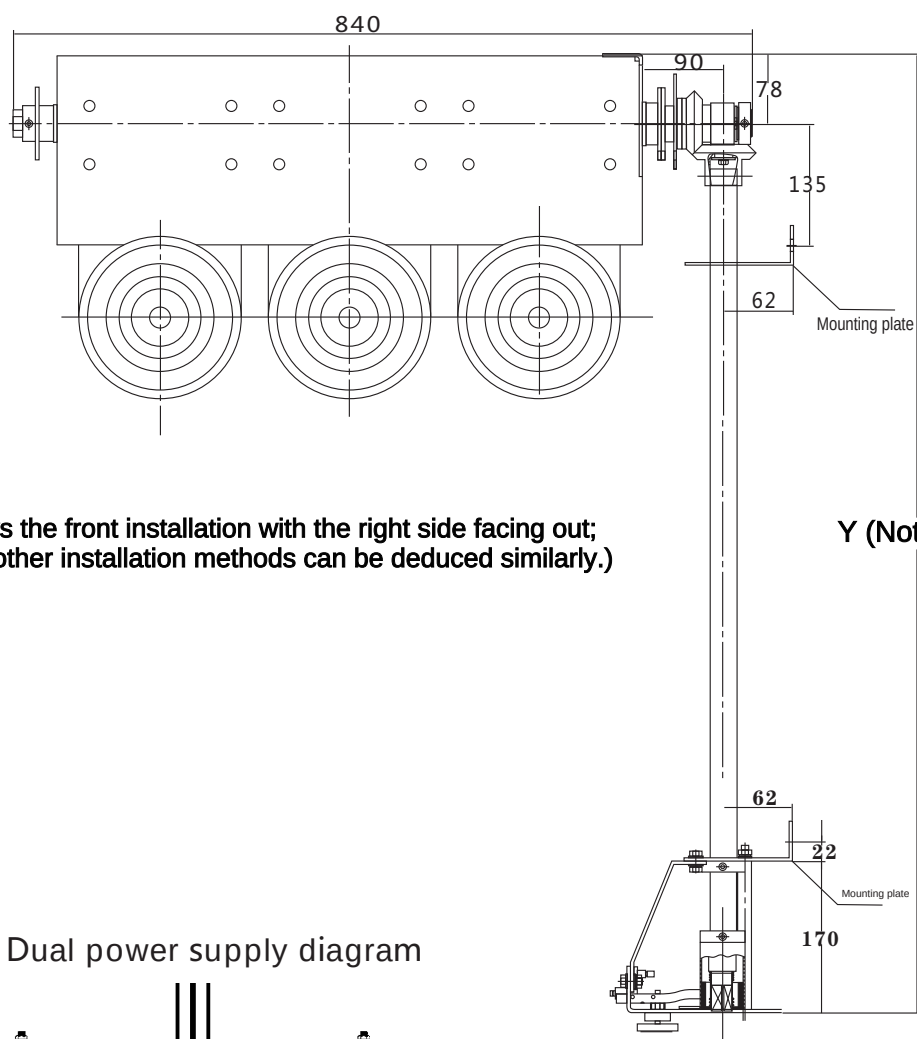
Schematic diagram



Wall mounting diagram



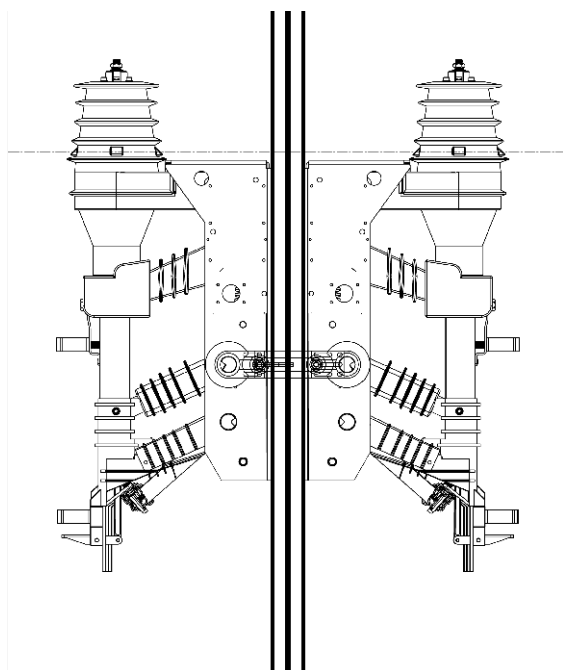
Front view of the installation top view



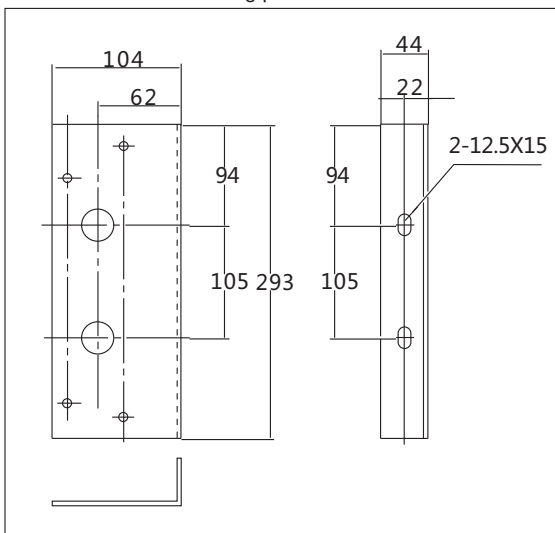
(This diagram shows the front installation with the right side facing out; the dimensions for other installation methods can be deduced similarly.)

Y (Note: Y is determined by the client)

Dual power supply diagram



Mounting plate dimensions



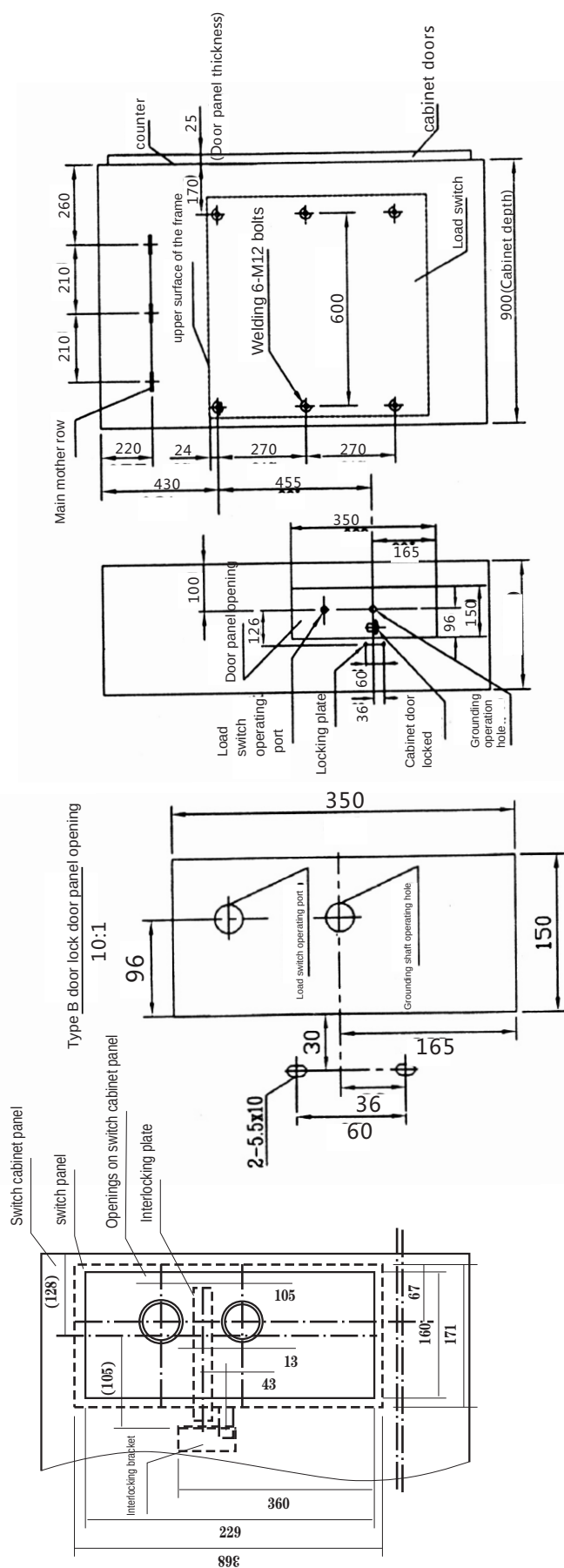


Figure 5. Reference for the installation dimensions of the pneumatic load switch in the ring main unit and the opening diagram of the B-type door panel

Table 3 Reference Table for Fuse Selection

NO	Transformer capacity kVA	Transformer primary voltage 10kV (maximum voltage 12kV)	
		Fuse Model	Fuse rated current A
1	100	12kV SDLAJ	16
2	125	12kV SDLAJ	16
3	160	12kV SDLAJ	16
4	200	12kV SDLAJ	20
5	250	12kV SDLAJ	25
6	300 , 315	12kV SDLAJ	31.5
7	400	12kV SDLAJ	40
8	500	12kV SDLAJ	50
9	630	12kV SDLAJ	63
10	750,800	12kV SDLAJ	80
11	1000	12kV SDLAJ	100
12	1250	12kV SDLAJ	125

I. 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.

II. Maintenance and Inspection Engineering and 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, shafts, 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 inspection and maintenance are required.