ZN63A-24 Indoor High-Voltage AC Vacuum Circuit Breaker

1 Overview

ZN63A-24 indoor high voltage AC vacuum circuit breaker (hereinafter referred to as circuit breaker) is used in three-phase AC 50Hz indoor places with rated voltage of 24kV. It is suitable for applications with loads of different nature and frequent operations for the protection and control of electrical facilities used in industrial and mining, enterprises, power plants and substations, especially for metallurgy, chemicals, and coal industries.

The circuit breaker comply with GB/T 1984 "High-voltage alternating-current circuit-breakers", GB/T 11022 "Common specifications for high-voltage switchgear and controlgear standard", DL/T 402 "High-voltage alternating-current circuit-breakers", and IEC standard.

The operating mechanism of circuit breaker is designed as an integrated structure. The operating mechanism and the primary circuit are arranged at front and back. It can be used as a fixed installation unit (fixed cabinet) or form a handcart unit (handcart cabinet) together with the advance mechanism (chassis cart)

2 Type Designation

ZN 63A - □ / T □ - □

- Rated short-circuit breaking current (kA)
- Rated current (A)
- Spring operating mechanism
- Rated voltage (kV)
- Design code
- Indoor vacuum circuit breaker

3 Technical Parameters

3.1 Main technical parameters of circuit breaker

No.	Item	Unit	Value		
1	Rated voltage	kV	24		
2	Rated power frequency withstand voltage (1 min)		Open contacts 79, phase to phase and to earth 65		
3	Rated lightning impulse withstand voltage (peak)		Open contacts 145, phase to phase and to earth 125		
4	Rated frequency	Hz	50		
5	Rated current	A	630 1250	630 1250 1600 2000 2500 3150	1250 1600 2000 2500 3150
6	Rated short-circuit breaking current	kA	20、25	31.5	40
7	Rated short-circuit making current (peak)		50、63	80	100
8	Rated short-time withstand current		20、25	31.5	40
9	Rated peak withstand current		50、63	80	100
10	Rated short circuit duration	s	4		
11	Rated operation sequence		O—0.3s—CO—180s—CO	O—180s—CO—180s—CO	
12	Rated short-circuit breaking current breaking times	Times	50	30	
13	Mechanical life		10,000(Customized)		
14	Rated operating voltage	V	220/110		
15	Allowable cumulative wear thickness of moving and fixed contacts	mm	3		

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3.2 Mechanical property parameters of circuit breaker

No.	Item	Unit	Value
1	Clearance between open contacts	mm	12±1
2	Overtravel		4±1
3	Contact closing bounce time	ms	1600A and below ≤ 2, 2000A and above ≤ 3
4	Three-phase closing and opening synchronization		≤2
5	Average opening speed	m/s	1.4±0.2
6	Average closing speed		0.8±0.2
7	Closing time	ms	30 ～ 70
8	Opening time		20 ～ 50
9	Main circuit resistance	μΩ	630A ≤ 70，1250A ≤ 65 1600A ~ 2000A ≤ 55 2500A and above ≤ 45
10	Contact pressure of closing contact	N	20kA,25kA:2500±1300 31.5kA：3200±300 40kA：4500±300

3.3 Technical data of energy storage motor

This product has a permanent magnet single-phase DC motor equipped with a special reducer. The technical parameters of the motor are listed in table below.

Rated voltage (V)	Rated output power (W)	Normal operating voltage range	Energy storage time at rated voltage (S)
DC220	70	85% to 110% of rated voltage	≤ 15

3.4 Technical data of electromagnet

	Closing electromagnet	Opening electromagnet	Locking electromagnet	Anti-jump relay
Rated operating voltage (V)	DC220	DC220	DC220	DC220
Coil Power (W)	220	220	4	1
Rated current (A)	1	1	18mA	9.1mA
Working voltage range	85% to 110% of rated voltage	65% to 110% of rated voltage	85% to 110% of rated voltage	

4 Operating Conditions

4.1 Ambient temperature: Max. +40℃, Min.-15℃ (storage and transport at -30℃ are allowed);

4.2 Relative humidity: Daily mean ≤95%; monthly mean ≤90%;
Daily mean vapor pressure ≤ 2.2kPa; monthly mean vapor pressure ≤ 1.8kPa;

4.3 Altitude: Not exceed 1,000 meters.

4.4 Seismic intensity does does not exceed 8 magnitude scales.

4.5 There is no obvious pollutions such as dust, smoke, corrosive or flammable gas, steam gas, or salt spray in the ambient air.

4.6 The magnitude of the electromagnetic interference induced in the secondary system does not exceed 1.6kV.

Note: If deviation of normal service conditions occurs, the customer should negotiate with the manufacturer.

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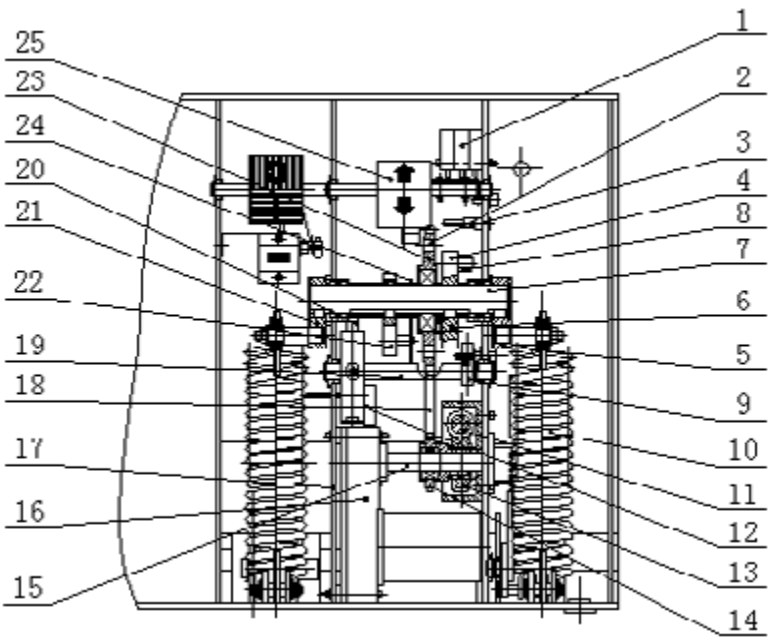
5 Structure and Working Principle

5.1 Body structure

The operating mechanism and primary parts of circuit breaker are arranged at front and back, and the primary part is of the three-phase floor-mounted structure. Arc extinguish chamber and upper and lower outgoing seat are installed in a tubular insulating tube that is made of epoxy resin through the APG pouring process with strong anti-creepage capacity. Such structure can greatly reduce accumulation of dust on the surface of arc extinguish chamber, which not only prevents damage to the arc extinguish chamber from the external factor but also keeps high resistance for voltage effect in the damp-heat and severe dirty environment.

5.2 Operating mechanism

The operating mechanism is a spring operating structure arranged on the plane. The cabinet is divided into five assembly spaces with four middle baffles, and there are energy storage system, opening and closing trip system, buffering system, and aux. switch in those spaces. There are manual closing and opening button, manual energy storage operating hole, spring energy storage state indicator, and closing and opening sign on the operating panel of mechanism.



1	Mircroswitch	6	Energy storage driving wheel	11	Manual storage wheel worm	16	Energy storage motor	21	Crank arm
2	Pin	7	Energy storage shaft	12	Closing electromagnet	17	Interlock driving bend plate	22	Cam
3	Limit rod	8	Roller	13	Manual energy storage worm	18	Drive chain	23	Driving chain wheel
4	Slide block	9	Energy storage holding pawl	14	Motor driving chain wheel	19	Energy storage holding shaft	24	Connecting plate
5	Crank arm	10	Closing spring	15	Motor output shaft	20	Lockout electromagnet	25	Storage wheel sign

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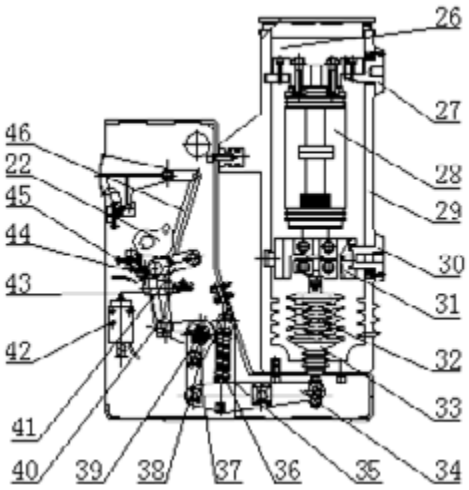
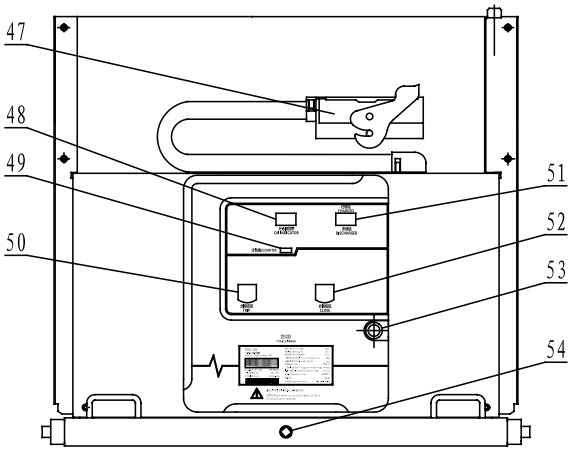


26 Uppper bracket	31 Lower bracket	36 Opening spring	41 Connecting plate
27 Upper outgoing seat	32 Contact spring	37 Drive connecting plate	42 Opening electromagnet
28 Vacuum interrupter	33 Insulating pull rod	38 Sprindle driving crank arm	43 Closing holding pawl
29 Insulating tube	34 Driving crank arm	39 Spindle	44 Half shaft
30 Lower outgoing seat	35 Buffer	40 Drive connecting plate	45 Manual closing top rod
46 Opening and closing sign connecting plate			



47 Secondary plug	49 Counter sightglass	51 Energy storage indicaiton sightglass	53 Manual energy storage operating hole
48 Opening and closing indication sightglass	50 Opening button	52 Closing button	54 Chassis cart operating hole

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5.3 Working principle

5.3.1 Arc extinguishing principle

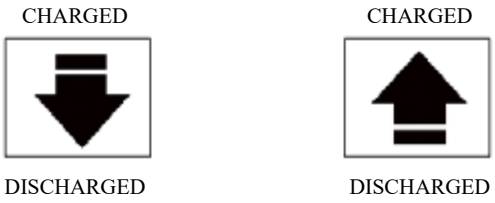
Circuit breaker adopts an arc extinguishing chamber with vacuum as arc extinguishing and breaking insulating medium, with very high arc extinguishing and insulating performance. When the live moving and fixed contacts are open under the action of the operating mechanism to generate very strong electric arc between contacts. Meanwhile, as the contact has special structure, an appropriate longitudinal magnetic field will also be generated in the contact clearance, making the electric arc is kept diffusion and distributed on the contact surface evenly to maintain a low arc voltage. When the current crosses zero naturally, residual ions, electrons and metal steam will be recombined or coagulated on the contact surface and shield within the microsecond time, and the insulation strength of medium at the interrupter break is restored quickly to extinguish the electric arc for realizing breaking purpose. As the longitudinal magnetic field is used to control electric arc, this circuit breaker has strong and stable breaking capacity.

5.3.2 Action principle

5.3.2.1 Energy storage

Energy required to close the circuit breaker is supplied by the closing energy storage spring. For energy storage, the energy storage motor (16) works, or the energy storage handle is inserted into the manual energy storage operating hole (53) for clockwise rotation. For electric energy storage, the chain wheel drive system (14, 18, 23) is driven by the motor output shaft (15); for manual energy storage, the chain wheel drive system (14, 18, 23) is driven by the worm gear, and worm (11, 13). When the chain (23) is rotating, the pin (2) will push the slide block (4) of the energy storage drive wheel (6) to make the energy storage shaft (7) rotate, and pull the closing spring (10) through the crank arms (5) and (21); when the energy storage position reaches, the limit rod (3) on the frame will press the slide block (4) down to separate the chain wheel drive system, and the energy storage holding pawl (9) will support the roller (8) in the energy storage position; meanwhile, the connecting plate (24) on the energy storage shaft will drive the energy storage wheel sign (25) turn to display “charged”, and the auxiliary switch works to cut off the power supply of energy storage motor; at this time, the circuit breaker is at the closing ready state.

Energy storage indicator is shown in figure below: Left figure shows discharged, and right figure shows charged.



5.3.2.2 Closing operation

When closing operation, press the “Closing” button (52) by hands or make the closing electromagnet (12) act through the external power supply to drive the energy storage shaft (7) and the cam (22) on this shaft rotate; the cam will drive the secondary four-link drive mechanisms (41, 40, 38, 37, 34) to push the insulating pull rod (33) making the moving contact of the arc extinguishing chamber (28) enter the closing position, and compress the contact spring (32) to keep the contact pressure required by the contact.

After closing operation, the closed holding pawl (43) and half shaft (44) are used to keep the closing state, meanwhile, the energy storage sign will display “discharged”; the energy storage microswitch resets, and the energy storage operating circuit is turned on again. If the external power supply is connected, energy storage will be made again. The connecting plate (46) will pull the closing/opening sign while closing to display the “Closing” mark, and the drive connecting rod will pull the auxiliary switch for activation. The closing indicator sees figure below:

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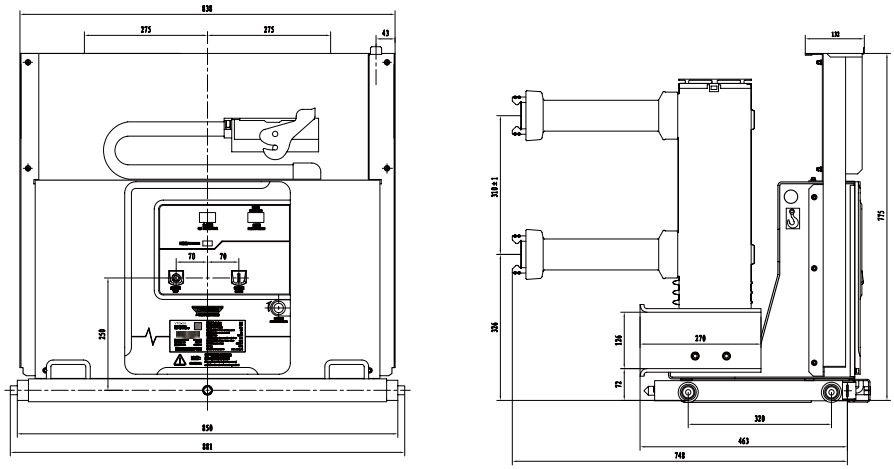
6 Outline and Installation Dimensions

6.1 Outline drawings of handcart type circuit breaker



Note: The handcart stroke is 300mm.

Rated current (A)	630	1250	1600
Rated short-circuit breaking current (kA)	20、25	25/31.5/40	31.5/40
Size of matching fixed contact (mm)	φ35	φ49	φ55

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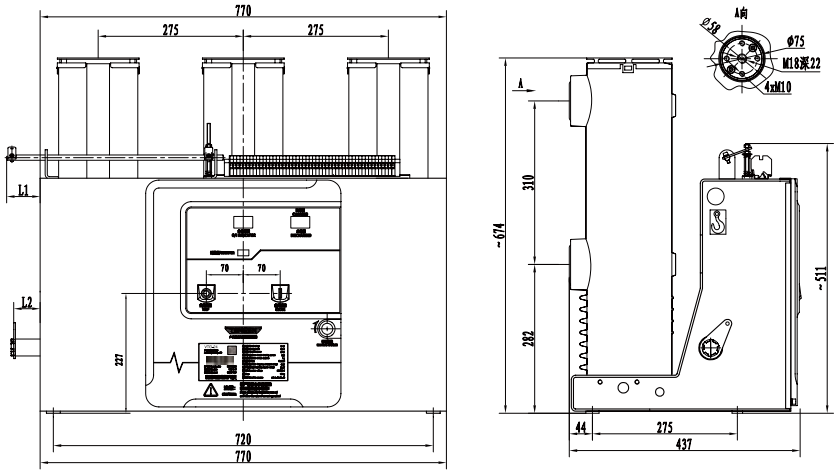
6.2 Outline drawings of handcart type circuit breaker



Note: The handcart stroke is 300mm.

Rated current (A)	1600、2000	2500、3150	4000
Rated short-circuit breaking current (kA)	31.5/40		40
Size of matching fixed contact (mm)	φ79	φ109	

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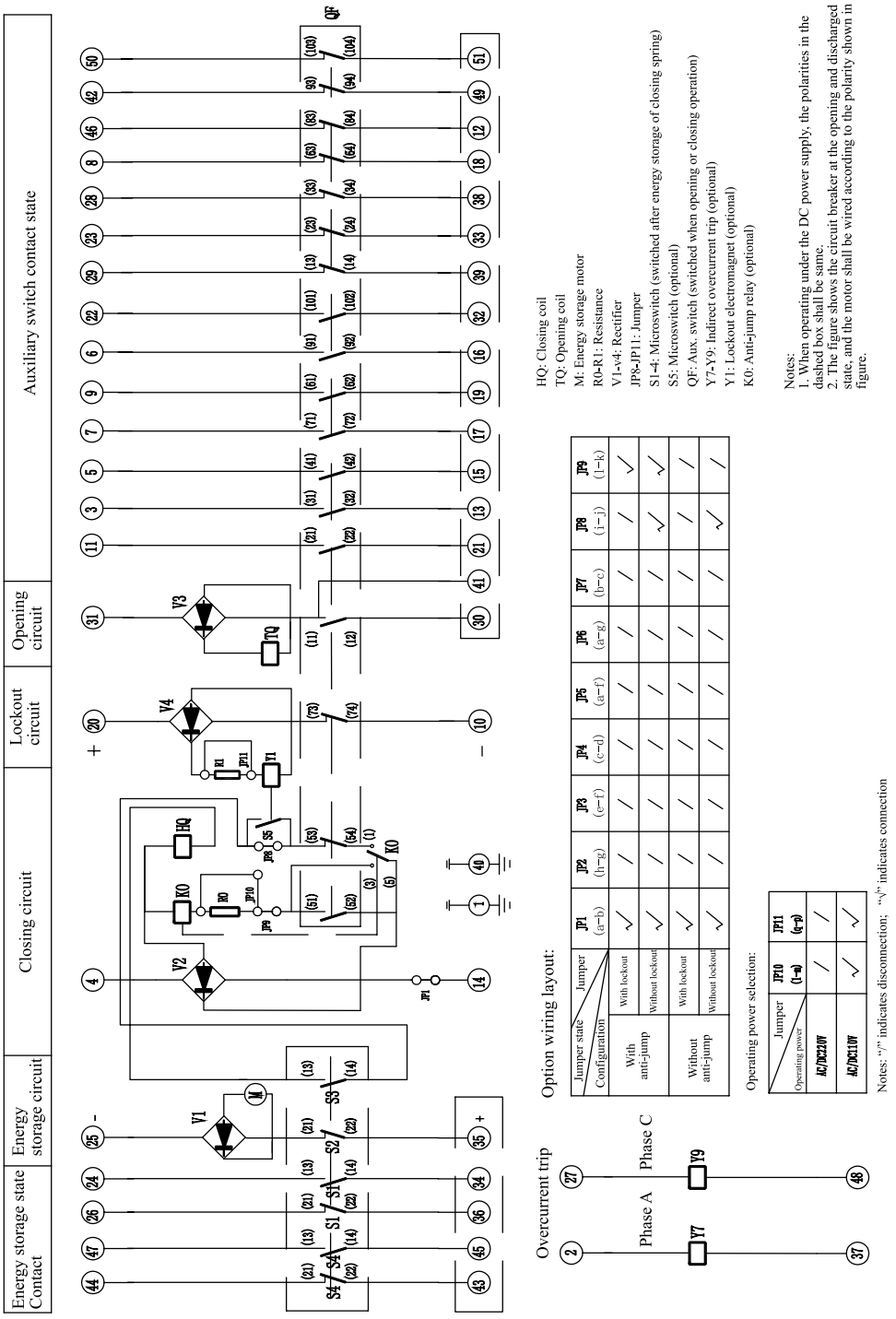
7 Electrical Schematic Diagram

7.1 Secondary Schematic Diagram for Fixed Type



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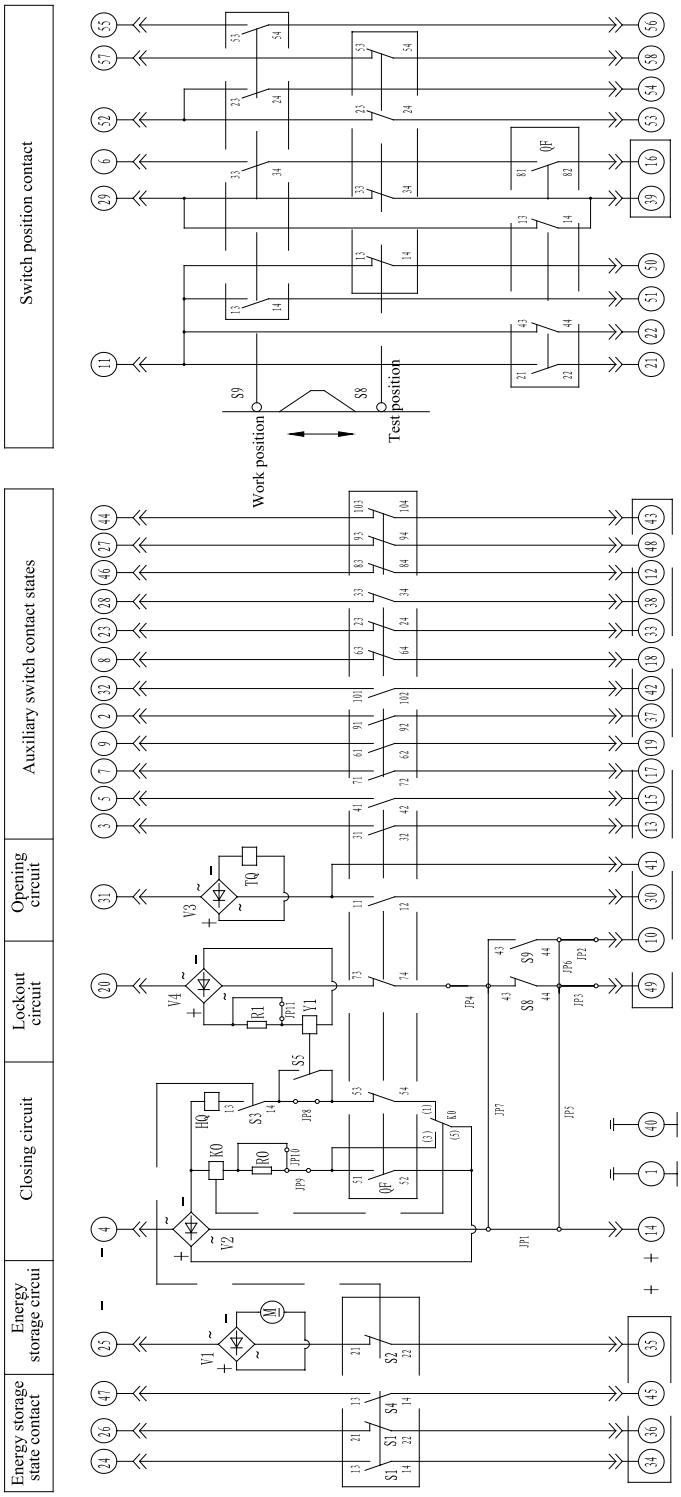
7.2 Secondary Schematic Diagram for Handcart Type



Operating power selection: 1-m

Jumper state / Operating power	JP110
AC/DC220V	/
AC/DC110V	√

T (1-58)	58-core aviation plug	TQ	Opening trip coil
K0	Internal anti-jump relay (optional)	S9	Aux. switch (switched at the work position)
V1-V4	Rectifier	S8	Aux. switch (switched at the test position)
Y1	Locking electromagnet coil (optional)	JP1-JP11	Jumper
M	Energy storage motor	S5	Locking electromagnet microswitch (optional)
R0-R1	Resistance	S1-S4	Travel switch (switched after energy storage of closing spring)
HQ	Closing trip coil	QF	Aux. switch 1#-ON and 1#-OFF (switched when opening or closing)

Option wiring layout:

Configuration \ Jumper state		JP1 (a-b)	JP2 (h-g)	JP3 (e-f)	JP4 (c-d)	JP5 (a-f)	JP6 (a-g)	JP7 (b-c)	JP8 (i-j)	JP9 (l-k)
With anti-jump	With lockout	√	√	√	√	/	/	/	/	√
	Without lockout	/	/	/	/	√	√	√	√	√
Without anti-jump	With lockout	√	√	√	√	/	/	/	/	/
	Without lockout	/	/	/	/	√	√	√	√	/

Notes: "/" indicates disconnection; "√" indicates connection

Notes:
1. The circuit breaker is in the test position at the opening and discharged state.
2. When operating under the DC power supply, the polarities in the dashed box shall be same, and the motor shall be wired according to the polarity shown in figure.

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8 Ordering Technical Confirmation Form

Technical Confirmation Form for Ordering ZN63A-24 Indoor High-Voltage AC Vacuum Circuit Breaker

Please determine your requirements according to the items listed in table below:

Product model	☐ Handcart type ☐ Fixed type		
Order Qty. (unit)		Primary structure	Insulated tube type air insulation
Rated current (A)	☐ 630 ☐ 1250 ☐ Others_____		
Rated short-circuit breaking current (kA)	☐ 20 ☐ 25 ☐ 31.5 ☐ 40		
Phase spacing (mm)	☐ 275 (Standard configuration) ☐ Others_____		
Clearance between poles (mm)	☐ 310 (Standard configuration)		
Operating voltage (V)	☐ AC/DC220 (Standard configuration) ☐ Others_____		
Anti-jump device	☐ Without anti-jump (Standard configuration) ☐ With anti-jump		
Lockout device (no handcart lockout for fixed type)	Closing lockout: ☐ No lockout (standard configuration) ☐ With lockout, operating voltage _____V		
	Handcart lockout (lock chassis cart): ☐ Without lockout (standard configuration) ☐ With lockout, operating voltage _____V		
Overcurrent device	☐ Without overcurrent (Standard configuration) ☐ Overcurrent of phases A and C ☐ Overcurrent of phases A, B, and C Note: The action current is 5A for overcurrent coil as standard configuration		
Undervoltage trip device	☐ No (standard configuration) ☐ Yes		
Handcart option (this option is not selected for fixed type)	Earthing: ☐ Bottom friction earthing (Standard configuration) ☐ Others Program lock (mechanical lock): ☐ No (standard configuration) ☐ Lock chassis cart ☐ Lock circuit breaker baffle		
Fixed circuit breaker interlock output (mm) (this optioin is not selected for handcart type)	Top opening interlock extension: ☐ Left (standard configuration 50)___ ☐ Right____ ☐ No		
	Spindle extension: ☐ No (standard configuration 50) ☐ Left____ ☐ Right		
Secondary wiring scheme	☐ Tengen standard scheme (see Catalogue) ☐ Non-standard scheme (please attach the Figure)		
Dimensions	☐ Tengen standard scheme (see Catalogue) ☐ Non-standard scheme (please attach the Figure)		
Standard accessories	Handcart type: One energy storage handle, one handcart handle (length 40mm), one aviation socket port (58-core, with 50 pins (1.5 mm^2)) , one coiled pipe (about 300mm); for 1250A and below, the contact surface of Al contact arm is ordinarily plated with silver as standard configuration; for 1600A and above, the copper contact arm is ordinarily plated with silver as standard configuration Fixed type: One energy storage handle		
Other special requirements		Ordering unit (seal) Signature:_____ Confirmation date:_____ Tel:_____	

Note: Options not checked are produced according to the TENGEN's standard configuration