

KYN28A-24(SDK1-24) Metal-Clad AC Withdrawable Switchgear (Installation and Operation Instruction)

Introduction

Overview

KYN28A-24(SDK1 -24) withdrawout metal-enclosed AC Switchgear (hereafter referred to as "switchgear") is used for the three-phase 50/60Hz, rated voltage of 24kV electric power system, such as power plants, electric power substations, industrial & mining enterprises and high-rising buildings, used as the power receiver and distribution as well as circuit control, protection and monitor.

KYN28A-24(SDK1 -24) switchgear is provided with various functions which can avoid faulty operations that include preventing handcart moving with load, circuit breaker closing as earthing switch at closing site, closing earthing switch with power and misentering charged compartment. The switchgear is equipped with good-performance VS1, VN2 series HV AC vacuum circuit breaker and enclosed type vacuum switch. The secondary circuit of switchgear is equipped with high-quality control and protection components; the busbar adopts pyro-condensation insulating material or epoxy coating insulation, it has an optimized electrode shape and compact cabinet structure. The switchgear has advanced technology, stable performance, reasonable structure, and easy utility, which is a reliable power distribution facility.

Applicable standards

1. GB1984 High-voltage alternating-current circuit breaker.

2. GB3906 3~35kV alternating-current metal-enclosed switchgear.

3. GB/T11022 Common specifications for high-voltage switchgear and controlgear standards.

- 4. DL/T404 Ordering technical qualification of indoor AC high-voltage switch cabinet.
- 5. DL/T593 Common ordering qualification guide of high-voltage switchgear.

Working environment

General working environment

1. Environmental temperature:

Highest temperature: +40 $^\circ \rm C$; lowest temperature: -15 $^\circ \rm C$; daily average temperature < 35 $^\circ \rm C$;

2. Environmental humidity:

Daily relative average humidity $\leq 95\%$;

Monthly relative average humidity $\leq 90\%$;

Daily average water vapor pressure ≤ 2.2 kPa;

Monthly average water vapor pressure ≤ 1.8kPa;

Condensation may occur occasionally;

3. Altitude: ≤ 1000m;

4. No pollution such as dust, smoke, corrosive or flammable gas, steam or salt fog;

5. The slight vibration or ground movement outside of the switchgear and control equipment can be neglected.

6. The electromagnetic interference of the secondary system should \leq 1.6kV.

Special working environment

If the working condition cannot meet the general environment requirements of GB/ T11022, the user and manufacturer can reach an agreement by negotiation.

The switchgear is equipped with a heater to avoid condensation. If the switchgear is in the reserve, the heater should be switched on, as well as when the switchgear is on work.

Technical parameters

Main technical parameters of switchgear

No.	Item		Unit	Parameter			
1	Rated voltage		kV	24			
2	Rated frequency		Hz	50/60			
3	Rated insulation ability	1min power frequency withstand voltage(effective value)	kV	Inter-phase relative	65	insulated fracture	79
		Lightening impact withstand voltage(peak value)			125		145
		Auxiliary control loop power frequency withstand voltage	V	2000		0	
4	Rated current		А	630,1250,1600,2000,2500,3150			
5	Rated short circuit breaking current		kA	20		31.5	
6	Rated short circuit closing current (peak value)		kA	50			80
7	Rated short time withstand current (4s)		kA	20		31.5	
8	Rated peak value withstand current		kA	50		80	
9	Auxiliary control loop rated voltage		V	DC or AC 110/220			
10	Protection grade			IP4X(circuit breaker room door open or compartment is IP2X)			
11	Size (width x depth x height)		mm	800x1810x2380		1000x1810x2380	
12	Weight		Kg	840-1440			

Note: The width of the overhead line is 2310 mm.

Main technical parameters of VS1-24, VN2-24 vacuum circuit breaker

No.	Item		Unit	Parameter			
1	Rated voltage			24			
2	Rated insulation ability	1min power frequency withstanc voltage(RMS)	kV	65			
		Lightening impact withstand voltage(peak value)		125			
3	Rated frequency		Hz	50/60			
4	Rated current		A	630,1250,1600,2000	630,1250,1600,2000, 2500,3150		
5	Rated short circuit breaking current		KA	20	31.5		
6	Rated short circuit closing current (peak value)			50	80		
7	Rated short circuit withstand current (peak value)			20	31.5		
8	Rated peak value withstand current			50	80		
9	Rated single condenser group breaking current		^	630			
10	Rated back-to-back condenser group breaking current		A	400	400		
11	Rated short circuit breaking current breaking times		Timoo	50			
12	Mechanical life		111165	20000			
13	Rated operation sequence			O-0.3s-CO-180s-CO			

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Technical parameters of spring operation mechanism

No.	Item		Unit	Parameter	
1	Poted operation voltage	Closing trip coil	V	AC220,AC110,DC220,DC110	
	Rated operation voltage	Breaking trip coil			
	Operation current	Closing trip coil	•	AC220 D\$C220 1\$1.AC110 D\$C10 3\$1	
2		Breaking trip coil	A		
3	Power of energy storage motor		W	80,100	
4	Rated voltage of energy storage motor		V	AC220,AC110,DC220,DC110	
5	Time of energy storage		S	≤ 10	

Structure and operating principle

Structure introduction

KYN28A-24(SDK1 -24) switchgear is composed by the cabinet and the withdrawable part (so-called handcart). The cabinet body is divided by plated into several functional compartments like bus bar room, circuit breaker room, cable room and relay instrument room. The withdrawable part of the switchgear can be equipped with vacuum circuit breaker handcart, potential transformer handcart, lightning arrester handcart, separated handcart, fuse handcart and etc.



Figure 1. KYN28A-24(SDK1 -24) switchgear structure illustration

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Main structure features

The switchgears can be installed in a back-to-back pair or against wall, which can improve the switchgear's security and flexibility, thus reduce the occupied area.

Shell

The main body enclosure formed by imported zinc steel plate coated with aluminum, which is double-bent by CNC machine in an advance process. It has advantages of higher precision, strong anti corrosion and anti-oxidation. Owing to this advance process, the cabinet gains less weight, higher mechanical strength and more artistic outward appearance compared with other products. The cabinet adopts assembling configuration, which is connected with high intention nuts and bolts. It makes the manufacture time shorten, components highly optimized for general use, less occupied area, easier for organizing manufacture.

Handcart

The framework of handcart is formed by thin steel plate and processed by CNC machine. The handcart and the cabinet are combined with high precision. The mechanical interlock is safe, reliable and flexible. Basis on different applications, there are circuit breaker handcart, voltage transformer handcart, measure handcart, insulation handcart, etc. The same type of handcarts can changeover between each other. There are breaking/testing site and operating site inside the handcart, which are provided with location devices to ensure reliable interlock. All handcarts can be handled with screw rod, which is convenient and flexible to operate. It is easy to draw out the handcart with a special transfer trolley from the switchgear so as to inspect and maintain.

When the handcart is sent into the circuit breaker room by transfer trolley, it can be locked on the breaking/testing site and the body location indication light will show its position. Only when the handcart is completely locked, the screw feed mechanism can be rotated to push the handcart into the operating site. When the handcart reaches the operating site, the strength to push the handle should be increased until stopped, and the corresponding position indication light can show its position. The reliable interlock can assure that the circuit breaker can be closed only when the handcart on operating site or testing site; and only when the circuit breaker is in the state of breaking, the handcart can move.

Compartment

Each main electric unit has a separate room, such as circuit breaker handcart room, busbar room, cable room and relay instrument room. The protection level of all the compartments can achieve IP2X. Except for the relay instrument room, all the other three compartments are equipped with pressure release channel. Owing to the withdrawable type, the increased cable room enables to connect with multi-channel cables.

1. Busbar compartment A: the main busbar is connected with the separate ones, fixed by branch busbar (static contact box) and main bus bar bushing. The main busbar and connection busbar are copper rows with rectangle cross sections. Two main busbar rows can be put together in the case of large current load. For special requirements, the main busbar can be coated with pyro-condensation bushing and specified insulation cover box. The busbars in the adjacent cabinets are fitted with insulation bushings when failure happens since the inner faulty arc occurs.

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2. Circuit breaker compartment B: the both sides of the compartment are equipped with tracks which enable the handcart in the cabinet to move from breaking/testing site to operating site. The plate (valve) of static contact box is installed on the back of handcart compartment. When the handcart moves from breaking/testing site to operating site, both top and bottom valves of the static contact box and the handcart open in a linkage automatically; when the handcart moves in opposite direction, the valves close automatically till the handcart moves back to a position and forms an available separation by completely covering the static contact box. As the valves can be operated separately, the current-carrying valve can be locked, so the maintenance staff can carry out overhaul without touching any current-carrying objects. The handcart can be operated when the door of the circuit breaker compartment is closed. The inside handcart positions, breaking or closing indications and the energy storage status can be inspected through the inspection windows.



3. Cable compartment C: the space of the cable compartment is enlarged owing to the withdrawable structure. The current transformer and earthing switch are installed on the rear wall of the compartment (the earthing switch can also be installed in the middle of the switchgear if customer needs); and the lightning arrester is fixed on the rear-bottom compartment. By moving the handcart and the withdrawable horizontal baffle plate away, the construction staff can enter the switchgear from the front to install and maintain. The cable connection conductor can be connected with 1-3 cables of every phase, 6 cables if necessary. The removable metal blanking plate or unmagnetic-conductive metal plate fixed on the bottom of the cable compartment can ensure the convenience of construction.

4. Relay instrument compartment D: the relay instrument compartment can be equipped with relay protection components, instruments, current-carrying indicator and the secondary equipments with special requirements. The control circuit is laid down in the slot which is fitted with metal plate to separate the secondary wires from HV components. The left-front slot is reserved for the control cables inlet and outlet; the secondary cable hole also exists on the corresponding bottom area. The bus bar hole is also opened on the top of this compartment. The cover board of this compartment can be overturned to install the small bus bar when connecting.

Pressure release device

There are pressure release devices installed on the tops of handcart compartment, busbar compartment and cable compartment. When the faulty arc occurs, pressure inside the switchgear increases, the special sealing ring on the front door encloses the cabinet door. The pressure release metal board can open automatically to release the pressure and high temperature air, so as to protect the operator and the switchgear.

Connection between secondary plug and handcart

The secondary circuit connection of the switchgear and handcart is connected by the secondary plug which is associated with handcart by a nylon retractable corrugated tube. The secondary plug is fixed on the right-up of the handcart. It can be plugged in or pulled out only when the handcart is on testing/breaking site. When the handcart is on the operating site, the secondary plug is locked. The closing mechanism of the circuit breaker handcart fitted with electromagnet can only break out before the secondary plug in operation.

Current-carrying display device

The switchgear can be equipped with the current-carrying indicator device which can inspect the primaey circuit. This device is composed by HV sensor and an indicator. It can show the HV circuit current-carrying status and cooperate with the electromagnetic lock to force lock the handlebar, cabinet door and adjacent cabinet. This can avoid moving handcart with load, closing earthing switch with current and accidentally accessing the current-carrying separate zones, and improve the anti-faulty performance.

Condensation prevention

In order to prevent condensation in atmosphere with high humidity or fluctuation temperature, heating devices are installed in the circuit breaker compartment and cable compartment to prevent failure in such working condition.



Earthing device

The cable compartment has 5 x 40mm copper rows which run through switchgear cabinets and connect with cabinet body for the direct earthing components. As the main body is formed by zinc steel plate coated with aluminium, so the whole cabinet is in a well-earthing situation and the safety of the operator can be assured.

Faulty operation preventing Interlock and its working principle

The switchgear is equipped with safe and reliable interlock device which fully meets the requirements of "5 preventions".

1. Suggestive button or KK type switchover is installed on the door of the instrument compartment to prevent closing/breaking the circuit breaker by fault.

2. Only when circuit breaker handcart is at testing or operating site, the breaking/closing of the circuit breaker can be carried out; and once the breaker is closed, the handcart cannot be moved to prevent accidentally pushing or pulling the handcart with load.

3. Only when the earthing switch is at breaking site, the circuit breaker handcart can move from testing/breaking site to operating site; only when the circuit breaker handcart in testing/breaking site, the earthing switch can be closed (the earthing switch can be fitted with currentcarrying indicator device). This design is able to prevent handling circuit breaker when the earthing switch is closed and accidental closing the earthing switch with current.

4. If the earthing switch is at breaking site, the bottom door and rear door are locked to prevent accidental entering currentcarrying separate zones.

5. The circuit breaker handcart which is fitted with closing lock electromagnet as customer requires can stop manual or electrical closing operation when the lock device is not unlocked.

6. When the circuit breaker handcart is at the operating site, the secondary plug is locked and cannot be pulled out.

7. The electrical interlocks can be applied to each cabinet

The switchgear can be added with electromagnetic lock device on the earthing switch mechanism to improve the reliability, and provide with the reverse interlock device for rear door and earthing switch as customer requires. Customers can choose when ordering.

Switchgear electrical circuit control connection principle

The electrical control principle of VS1-24, VN2-24 vacuum circuit breaker can be referred to Figure4 and Figures. The vacuum circuit breaker secondary control is composed by energy store circuit, closing circuit, breaking circuit, lock circuit and auxiliary switch circuit, while the lock electromagnet is optional. When the circuit breaker handcart is at testing or operating site, lock electromagnet Y1 with current pick-up with operating power, and close limit switch SP5 connection point 13-14. The closing coil HQ can close normally and after the locking electromagnet Y1 picked up, the closing bent board can be unlocked and manual closing is available. Therefore, the lock electromagnet can stop manual or electrical closing if the secondary control power is off.

KYN28A-24(SDK1) switchgear vacuum circuit breakers typical control loop diagram is shown in Figure7.

Transportation, installation and test

Transformation and storage cautions

1. The product cannot be tilted, reversed and vibrated during loading and transportation. The strings should be located on the package box or the indicated parts of switchgear.

2. Avoid from the rain:

3. After delivering, the receiver should check the product package. Any damage or loss, inform the supplier to check in site if necessary.

4. The products should be placed stable. The components and parts cannot be removed freely.

Switchgear installation

1. The basic framework should be stable and 2-4mm above the ground level. The allowable tolerance of the framework flatness and straightness is 1mm/m.

2. Adjust the switchgear position on the framework and their verticality should not be more than 2mm. It is better to assemble from the middle when the number of switchgears is more than 10 sets. The switchgear and the framework can be connected with bolts or welded.

3. In order to install busbar, the switchgear assembles and busbar installation can be performed alternatively.

4. Use the preset earthing busbar row to connect the main earthing busbar of the switchgear. Connect the switchgear main earthing busbar with the earth pole of power distribution room

5. After the installation of the primary and the secondary cables, seal the gap around the cable holes and fix the sealing board and separate board.

Switchgear test

1. Check the plugging depth and connection of the isolating contact.

2. Apply the test after the switchgear installation, for example, manually handle the circuit breaker, handcart and earthing switch, and check all the operating procedures of the mechanical interlock.

3. Check the closing/breaking mechanism features of the circuit breaker and test it with indicated highest or lowest operation voltages.

4. Powered on the secondary loop and make sure there is no fault with the protection, control and signal circuits.

5. Measure the main circuit resistance. The circuit resistance of the circuit breaker should not be larger than the standard value.

6. According to the handover standards, test the power frequency withstand voltages of the phase-to-phase and phase-to- earth of the main circuit.

7. Test the secondary circuit insulation intensity for 1min when applied with 2000V without flashover or breakdown. The electronic components and test voltage for the secondary circuit should be agreed by the user and the manufacturer.

Switchgear operation procedures

While the switchgear design can guarantee the correct operating with the interlock device, the operators should operate this switchgear strictly according to the operating procedure and this technical document; otherwise, the equipment would be damaged or even accident occurs.

Operation of circuit breaker cabinet without earthing switch

1. Place the movable parts of circuit breaker into the switchgear: before pushing the circuit breaker handcart into the switchgear, carefully check whether the circuit breaker is in good condition, no lack of components, no other tools in the mechanism case or in the switch. If there is no problem, place the handcart on the transfer trolley and lock it. Push the transfer trolley close to the switchgear and lift the handcart to a proper position, and then insert the front positioning lock plate of the transfer trolley to the cabinet partition socket and lock them together. Open the lock-hook of the circuit breaker handcart, push the handcart into the switchgear and lock it at the same time. After the handcart is placed and locked well inside the switchgear, unlock the transfer trolley from switchgear and move it away.

2. Operating the handcart inside the switchgear: After the handcart is pushed into the switchgear, the handcart is at breaking site inside the switchgear. When put the handcart into use. Firstly set the handcart at test site and insert the plug of auxiliary circuit. If power on, the indicator light of the test site on the meter room plate will light up. Electrical operation test can be taken when the main circuit is not connected. If further operation needs to be continued, firstly close all the doors of the switchgear, insert the key to the lock hole and lock the door, make sure that the circuit breaker is at breaking site (see d section). Secondarily, insert the handcart handle to the middle plate operation hole, then rotate the handle clockwise in circle until auxiliary switch changes to operating site light turning on, finally take the handle away. At this moment, main circuit is connected, circuit breaker is at operating site, and closing/breaking operation can be taken by the control circuit. If the handcart needs to be excited from the operating site, then make sure the circuit breaker is at breaking site (see d section), insert the handcart handle to the middle plate operation hole, then rotate the handcart needs to be excited from the operating site, then make sure the circuit breaker is at breaking site (see d section), insert the handcart handle to the middle plate operation hole, then rotate the handcart handle to the middle plate operation hole, then rotate the handcart is at breaking site (see d section). Secondarily and closing/breaking operation can be taken by the control circuit. If the handcart needs to be excited from the operating site, then make sure the circuit breaker is at breaking site (see d section), insert the handcart handle to the middle plate operation hole, then rotate the handle anticlockwise in circle until auxiliary switch changes. The handcart is back to the test site, main circuit is totally disconnected and the metal valve is turned off.

3. Pull the handcart out of switchgear: If the operator wants to pull the handcart out of switchgear. Firstly, make sure that the handcart is at test site, and then unplug the auxiliary circuit, fasten the plug on the handcart frame, push the transfer trolley to the front of the switchgear and lock it (the same procedure with pushing the handcart into the switchgear), unlock the handcart and pull it out. When the handcart is totally moved to the locked transfer trolley, unlock the transfer trolley with switchgear, finally move and lay the transfer trolley down. If the handcart needs to be transported by the trolley for a long distance, be very careful when pushing the trolley, so as to avoid accidents during the transportation.

4. Closing/breaking status confirmation of circuit breaker inside switchgear: Closing/breaking status of circuit breaker can be determined by the handcart ON/OFF indicator sign and the ON/OFF indicator light on the meter room panel. If you observe the handcart indicator panel through the middle glass window, green means the circuit breaker is at breaking status, in such condition, if the auxiliary circuit is plugged, the ON status of indicator light will light on.

Operation of circuit breaker cabinet with earthing switch

The operating procedures for pushing the handcart into and get the handcart out of the cabinet with earhting switch are completely same to above without earhting switch. Only when the handcart is operated inside the switchgear or the earthing switch is under operation, pay attention to the following points,

1. Operating the handcart inside the switchgear

Before pushing the handcart to the operation site, except for the requirements of b in 5.1, it is still important to confirm that the earthing switch is at breaking status. Otherwise next step cannot be processed.

2. Closing or breaking the earthing switch

Before closing the earthing switch, firstly make sure that the handcart is back to the test/breaking site. Secondarily, take off the crank handle and press down interlock bent plate at the earthing switch operation hole. Thirdly, insert the earthing switch operation handle to the hole, rotate 90 degree clockwise, the earthing switch will be ON. If rotate 90 degree anticlockwise, the earthing switch will be OFF.

Operation of isolation handcart

Isolation handcart is not able to connect and cut off load current, so the handcart cannot be moved with load. When operating the isolation handcart inside the switchgear, firstly make the matching circuit breaker off (see section b in 5.1), then the auxiliary contact switch over and disconnect the electrical interlock with the isolation handcart. Finally, the isolation handcart can be operated. The operating procedure is the same as the operating procedure of circuit breaker handcart.

The interlock function of KYN28A-24(SDK1) is based on mechanical interlock to achieve "five defends" function. If the required operating strength is increasing, please check the interlock mechanical first, and then continue operation.



Maintenance and service

The maintenance period of the equipment/component (like the easily damaged parts) depends on the running time, operation frequency and failure breaking time. Based on the working condition and local environment, examine and maintain the switchgear every 3-5 years.

1. Check the circuit breaker and operation mechanism based on the vacuum circuit breaker instruction and carry out the necessary adjustment and lubrication.

2. Check the handcart in-out process and carry out the necessary adjustment and lubrication.

3. Check the interlock device and carry out the necessary adjustment and lubrication.

4. Check the dynamic and static separate probes contact surface, plug-in depth, spring tension and surface coating and replace the old conductive paste on the separate probe.

5. Check the connection of the bus bar and various conductive parts and tighten the connection. If the contact surface is warm, deal with it timely.

6. Check the earthing loop, like earthing probe, main earthing wire and cross-door earthing wire to ensure the conductive reliability.

7. Clean the vacuum interrupter room and insulator with soft cloth. If the electricity discharge occurs partially due to the condensation, apply silicone grease on the surface as a temporary remedy.

Attached documents

- 1. Product quality certificate
- 2. Factory inspection report
- 3. Installation and utility instruction
- 4. Secondary circuit connection diagram
- 5. Packing list
- 6. Special tools
- 7. Technical documents and attached files of switchgear main component utility instruction

Order information

- 1. Primary circuit connection scheme
- 2. Switchgear arrangement and power distribution room layout diagram
- 3. Model, specification and quantity of the main
- equipments inside switchgear
- 4. Secondary circuit diagram
- 5. If the switchgear is used in special environment,
- please note the manufacturer when ordering
- 6. Other special requirements

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Primary connection schemes

Scheme No.		001	002	003	004	005
Primary connection scheme						
Rated current (A)		630 ~ 3150				
Primary Main Equipment Units	VN2-24、VS1-24 Vacuum circuit breaker	1	1	1	1	1
	LZZB9-24 Current transformer	2	2	2	3	3
	JDZ11-20/JDZX11-20 Current transformer					
	XRNP-24 0.5A HV fuse					
	N15-24 Earthing switch		1	1		1
	HY5WZ-32/84 Lightning arrester			3		
Utility		Power receiving Power feeding	Power feeding	Power feeding	Power receiving Power feeding	Power feeding

Scheme No.		006	007	008	009	010
Primary connection scheme						
Rated current (A)		630 ~ 3150				
Primary Main Equipment Units	VN2-24、VS1-24 Vacuum circuit breaker	1	1	1	1	1
	LZZB9-24 Current transformer	3	2	2	2	2
	JDZ11-20/JDZX11-20 Current transformer					
	XRNP-24 0.5A HV fuse					
	JN15-24 Earthing switch	1		1		1
	HY5WZ-32/84 Lightning arrester	3				
Utility		Power feeding	Connection (right)	Connection (right)	Connection (left)	Connection (left)