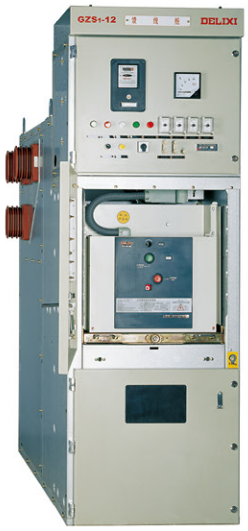
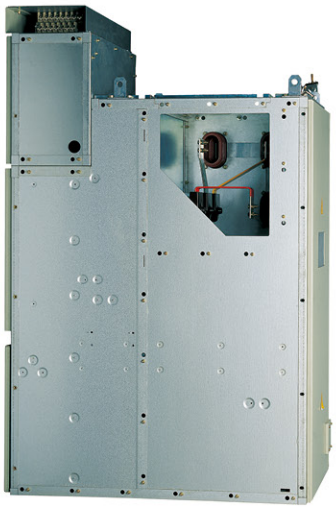
KYN28A–12(GZS1–12)
Indoor AC Metal–clad Withdrawable Switchgear





1. Overview

KYN28A–12(GZS1–12) Indoor AC metal–clad withdrawable switchgear (Hereafter referred to as "switchgear") is an advanced medium–voltage switchgear, developed by Xi'an Senyuan corporation. We had developed the miniaturization withdrawable switchgear cabinet of 650width based on their technologies. It is suitable for the applications in three–phase AC electric power system with rated voltage of 12kv and rated frequency of 50Hz, for the acceptance and distribution of the power, and also provides control, protection, and monitor of the circuit. Technical transferred is also provided by the same corporation.

Applicable Standards:
GB3906–2006: AC metal–clad closed switchgear and control equipment 3.6kV–40.5kv

GB11022–1999: General technical qualification of high–voltage switchgear and control equipment

IEC62271–200/2003: AC metal–clad close switchgear and relevant control equipment with rated voltage between 1kV and 52kv

DL/T404–2007: AC metal closed switchgear and control equipment 3.6kV–40.5kv

2. Type of the Product and Their Indications

K Y N 28A – 12 – □ □

- Environmental feature symbol
  TH–apply for moist and hot area
  TA–apply for dry and hot area
  G–apply for area with high elevation
- Primary circuit scheme
- Rated voltage
- Design number
- Indoor
- Draw–out type (handcart type)
- Metal–clad enclosed switchgear

3. Working environment

a.Environmental temperature: –10℃ ~ 40℃
b.Environmental humidity: the daily average value should be no greater than 95%, the monthly average value should be no greater than 90%. 2
c. Altitude: lower than 1000m.
d.Earthquake proof degree: earthquake intensity no more than 8 degrees.
e. The around atmosphere should not contain distinct pollutions such as corrosive or flammable gas or steam..
f.No severe contamination or frequency severe vibration, and the design of rigid grade under rigid condition should meet the requirements of grade 1.
g.If the working conditions can not meet the environmental requirements of GB3906, please negotiate with the manufacturer.
Notes:
Electric heater should put in operation when relative humidity exceeds 70%.
When working site is beyond the altitude of 1000m, it should conform to national standard.

VS1 indoor vacuum circuit breaker (front and side view)

VS1 indoor vacuum circuit breaker
150mm vs 650mm width

4. Technical parameters

4.1 Technical parameters of switch equipment, refer to Table 1

Table 1

Item		Unit	Parameter		
Rated voltage		kV	3,6,7.2,12		
Rated frequency		Hz	50		
Rated current of the circuit breaker		A	630,1250,1600,2000,2500,3150		
Rated current of the switch cabinet		A	630,1250,1600,2000,2500,3150		
Rated thermal current (4s)		kA	16,20,25,31,5.40,50		
Rated dynamic current (peak value)		kA	40,50,63,80,100,125		
Rated short circuit drop out current		kA	16,20,25,31.5,40,50		
short circuit making current (peak value)		kA	40,50,63,80,100,125		
Rated insulation ability	1min power frequency withstand voltage	kV	24	32	42
	Lightening impact withstand voltage	kV	40	60	75
protection degree		IP4X for shell, and IP2X When breaks room door is open			

4.2 Technical parameters of VD4、VS1–12 vacuum circuit breaker and FP series sulfur hexafluoride circuit breaker

a. Technical parameters of VD4、VS1–12 vacuum circuit breaker and FP series sulfur hexafluoride circuit breaker, refer to Table 2

Table 2

Item		Unit	Parameter
Rated voltage		kV	3,6,7.2,12
Rated frequency		Hz	50
Rated current of the circuit breaker		A	630,1250,1600,2000,2500,3150
Rated thermal current(4s)		kA	16,20,25,31,5.40,50
Rated dynamic current(peak value)		kA	40,50,63,80,100,125
Rated short-circuit drop out current		kA	16,20,25,31.5,40,50
Short-circuit making current (peak value)		kA	40,50,63,80,100,125
Rated insulation ability	1min power frequency withstand voltage	kV	42
	Lightening impact withstand voltage	kV	75
Rated operating sequence		kA	breah-0.3s-close breaking-180s-close breaking
Rated short-circuit current making time		time	50
Mechanical life		time	20000

b. Mechanical feature of VD4、VS1 vacuum circuit breaker and FP series sulfur hexafluoride circuit breaker, refer to Table 3

Table 3

/Item		Unit	Parameter
Switching distance of the contact		mm	11±1
Contact exceed range		mm	4±0.5
Center distance between phases		mm	150±0.5,210±0.5, 250±0.5, 275±0.5
Closing contact bounce time		ms	≤2
Different period of three-phase break brake		ms	≤2
break brake time when voltage	Max	ms	≤50
	Rated	ms	≤50
	Min	ms	≤60
Making time		ms	≤100
Average opening speed		m/s	0.9-1.2
Average opening speed		m/s	0.6-0.8
Circuit direct current resistance of each phase		Ω	≤40
Contact pressure		N	3200±100

When the circuit breaker is applied to control 3–10kv electromotor, AC ≤ 600A, a metal–oxide surge arrester must be installed;clients can consult with manufacturer for the detailed requirements. When the circuit breaker is aplied to cut off the capacitor the group, the rated current of capacitor group should not be the circuit breaker.

4.3 Technical parameters of operation mechanism, refer to Table 4

Table 4

Item		Unit	Value
Rated operation voltage	Closing coil	V	DC220,110 AC220,110
	Opening coil	V	AC220,110 DC220,110
Coil power	Closing coil	W	245
	Opening coil	W	245
Power of energy storage motor		W	50
Rated voltage of energy storage motor		V	DC220,110, AC220,110
Time of energy storage		s	≤10

5. Structure

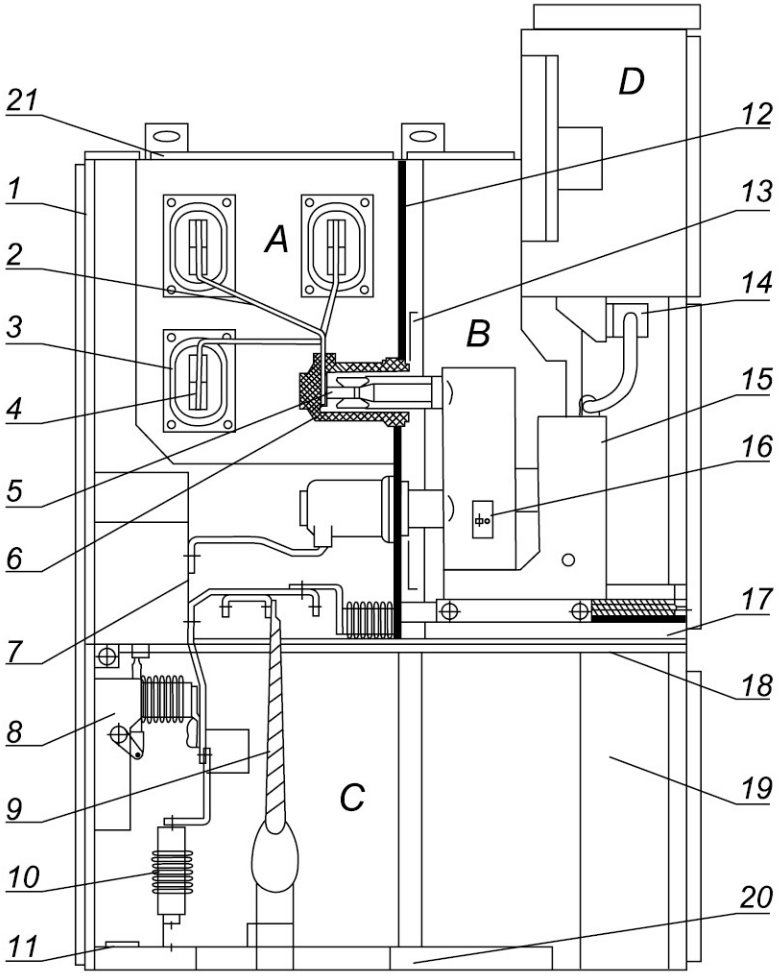


Figure 1. Switchgear inner structure

A–Busbar room
B–Circuit breaker handcart room
C–Cable room
D–Relay instrument room
1–Shell
2–Branch busbar
3–Busbar bushing
4–Main busbar
5–Static contact box
6–Static contact
7–Current transformer
8–Earthing switch
9–Cable
10–Arrester
11–Earthing main busbar
12– Removable clapboard
13–Separator (Valve)
14–Secondary plug
15–Circuit breaker handcart
16–Heating device
17–Withdrawable horizontal baffle plate
18–Operation device of earthing switch
19–Secondary trunking
20–Soleplate
21–Pressure release device

Figure 2. After the draw–out circuit breaker is moved, the static contact in the separate room will be shielded by the metal valve, the circuit breaker will be protected.

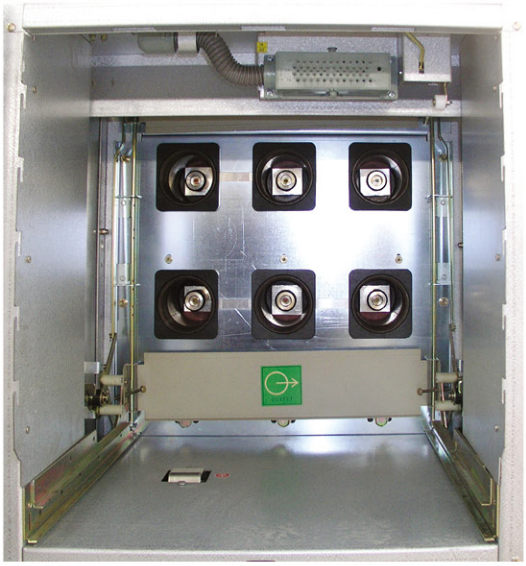


Figure 3. In the separate room of the circuit breaker, open the metal valve to check the static contact.

Streucture overview

The switchgear is designed according to GB3906 metal–clad closed switchgear. It composes of a main body enclosure and a withdrawable component (called handcart). The enclosure is divided into four separate rooms. The protection lever of the shell will be IP4X, and if the door of separate room or breaker room is open, then the protection lever should be IP2X. There are several functional schemes such as overhead inlet and outlet overhead line, inlet and outlet cable, forming a whole electric power distribution system device. This switchgear can be installed, commissioned and maintained from the front, which makes it possible to be arranged as back–to–back, side–to–side, or against the wall.

5.1 Shell and auxiliary

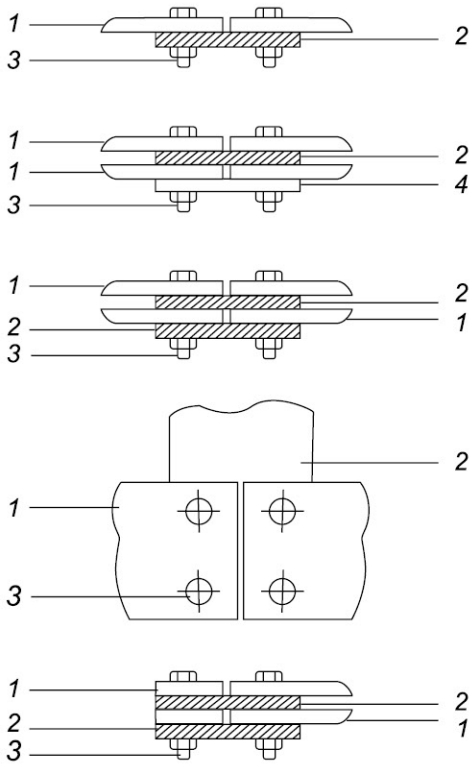
The main body enclosure formed by import zinc steel plate coated with aluminum, double–bented by CNC machine. Owning to this advance process, the cabinet gains less weight, higher mechanical strength and more artistic outward appearance compared with other products, as well as the advantage of higher precision, strong anti–corrosion and anti–oxidation capacity. The cabinet adopts assembling configuration. It is connected with high intention nuts and bolts, thus the process manufacture period is shortened, while occupying less area, the components are highly optimized for general use, so it is easier for organization.

5.2 Handcart

The framework of handcart, alike the cabinet, is formed by steel plate, and processed by CNC machine. The handcart is insuloted from the cabinet when combined. The mechanical interlock is safety, reliable and flexible. Based on the different usage, there are circuit breaker handcart, potential transformer handcart, measure handcart and separate handcart. All kinds of handcart canbe organized on basis of modulus. The same type of handcart can be replaced. In cabinet, handcart may be at break position, testing position, or working position, each one has its own locating device to ensure reliable interlock followed by the operation procedure to prevent interlock disoperation. All handcarts are fixed by nut or spindle, so the operation is convenient and flexible for all operators. The handcart can be easily drawn out from the cabinet for inspection and maintenance. Due to the withdrawable adoption, it saves space and is easily to be inspected and repaired.

5.3 Separate room

Each main electric unit has a separate room, that is, circuit breaker handcart room, busbar room, cable room and relay control room.All the rooms can achieve IP2X protection level. Except for the relay control room, the other three separate rooms are equipped with a release pathway. Owning to the withdrawable type, the increased cable room enable the multiple cable are connected.



1--main busbar 3–bolt
2–branch busbar 4–block

Figure 4. Connection type of busbar and branch busbar

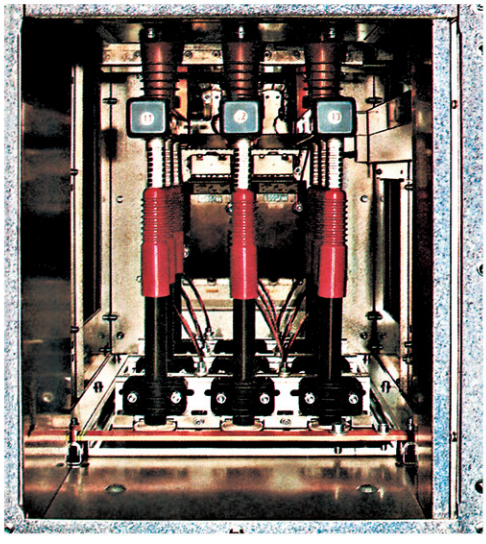


Figure 5. The terminal cabinet separate room with three cabinets

5.3.1 Circuit breaker room

There is one slide guide at each side of the circuit breaker room for the handcart [15] to move from breaking position or testing position to operation position. The separator (Valve) [13] of the static contact [6] is installed on the back of the handcart room. When the handcart [15] is moving from the breaking or testing position to the operation position, the up and down valves of the static contact connecting with the handcart would be open automatically. On the contrary, when moving opposite to cover the static contact, the valves would close automatically. Since the up and down valves could be operated separately, the operator would not touch the live parts during the maintenance while the live parts are separated. When the circuit breaker room is closed, the handcart can be handled as well. Moreover, the handcart status and the energy storage can be monitored through the middle inspection window.

5.3.2 Busbar room

The main busbar [4] in Figure 4, is consist of single busbar and fastened by branch busbar [2] and static contact box [6]. The main busbar [4] and interbus are rectangular cross section copper busbar which are used for large current load by double busbars. The branch busbar is connected to the static contact box [6] and main busbar [4] through bolt. For special requirement, the busbar can be wrapped with heat–shrinkable bushing, link bolt insulation sleeve and end cap. Adjacent busbars are fixed with bushing [3]. If there is an internal fault arc, the space between the busbar can be used as air buffer to prevent from melting. Thus the bushing [3] is quite necessary to ensure the safety and stops the accident spreading to other parts.

5.3.3 Cable room

The cable room has a large space since the switchgear employs mid–set switch type. The current transformer [7] and earthing switch [8] are installed on the back of the room, and arrester [10] is on the bottom back of the room. The workers could access the inner cabinet for installation and maintenance by moving away the handcart [15] and withdrawable horizontal plate [17]. Cables in the Cable room are connected to the conductor. Each phase can be linked with 1 to 3 single cores cable, or 6 single cores when necessary. The removable non–metal panel or non–conductive metal plate is equipped to ensure the construction conveniently.

5.3.4 Relay Control room

The relay control room is equipped with relay protection device, instrument, powered monitoring indicator and specialized secondary equipment. All the control lines are placed in the trunking with enough space and covered by metal plate, isolating the secondary line from HV chamber. The left side trunking is used for reserved circuit lines incoming or outgoing. Lines internal from the switchgear itself are placed in the right trunking. On the top of the relay control room plate, there is a reserved little hole for busbar installation. Moreover, the top plate can be turned over for busbar installation.

5.4 Interlocking device to prevent fault operation

Switchgear is equipped with reliable interlocking device, satisfying the "Five Standards".

a. There is an obvious button or KK type alternation switch to prevent fault operation.

b. Only when the circuit breaker handcart is under test or operation site, the circuit breaker can be used to switch on or switch off. In addition, the handcart is not able to move while the circuit breaker is switched on. It helps to stop on–load wrong operation.

c. Only when the earthing switch is on the breaking site, the circuit breaker handcart is able to be moved from the breaking or test site to operation site. Only when the circuit breaker handcart is on the test or breaking site, the earthing switch can be switch off (the earthing switch can be fitted with voltage indicator). Thus it helps to avoid switching off the earthing switch when under hot line, as well as switching on the circuit breaker when earthing switch is on closed site.

d. In order to prevent the staff access to the area, the bottom door and back door cannot be open when the earthing switch is on breaking site.

e. When the circuit breaker handcart is located on the test or operation site without control voltage, it can only be operated by manual mode, not automatic mode.

f. When the circuit breaker handcart is on the operation site, secondary plug is locked and not able to be pulled out.

g. Electric interlock is applied for each cabinet.

The switchgear can be equipped with electromagnet locking device on the earthing switch to improve reliability. Customers choose whether they need it or not.

5.5 Pressure relief device

There are pressure relief devices installed in the circuit breaker room, busbar room and cable room. When the inner fault occurs with arc, pressure inside the cabinet will increase. Then the special preassemble gasket on the door seals the cabinet in the front. Finally the pressure relief device on the top open automatically to release the pressure, ensure the safety of operator and switchgear itself.

5.6 Secondary plug and handcart interlock

The secondary circuit of switchgear and handcart are interlocked through manual secondary aviation plug. Moving–contact from secondary plug is connected with circuit breaker handcart by nylon corrugated expansion pipe. The secondary static contact base is fixed on the top right of the handcart. Only when the handcart is set on the test or breaking site, the secondary plug can be plugged in or pulled out. When the circuit breaker handcart is on the operation site, the secondary is locked and cannot be pulled out since the function of mechanical interlock works. As the closing mechanism of circuit breaker handcart is locked by the electromagnet, the handcart is only able to be switched off when the secondary plug is disconnected.

5.7 Charged display device

There is a charged display device for testing the primary circuit if customer requires. This device consists of high pressure sensor and portable display. They are connected together with wires as a whole. It not only shows the high pressure circuit status, but also can be cooperated with electromagnetic lock to force earthing switch handle and net door locked. This manner helps to prevent switching off earthing switch with live and accessing into the live zone, to avoid faulty operation.

5.8 Condensation and corrosion prevention

In order to avoid danger when operating in the high humidity and large fluctuations temperature, heater is installed in the circuit breaker room and cable room separately, to prevent corrosion in above environment.

5.9 Earthing device

There is an individual earth copper busbar with a dimension of 5X40mm2 in the cable room which is going through adjacent switchgear, and has a good contact with the switchgear body. This busbar is used for components that are earthing directly. Meanwhile, since the whole switchgear body is made up of aluminum zinc plate, it makes a good earthing status to protect the operator and switchgear.

5.10 Switchgear overall dimension (refer to Figure 6 and Figure 7)

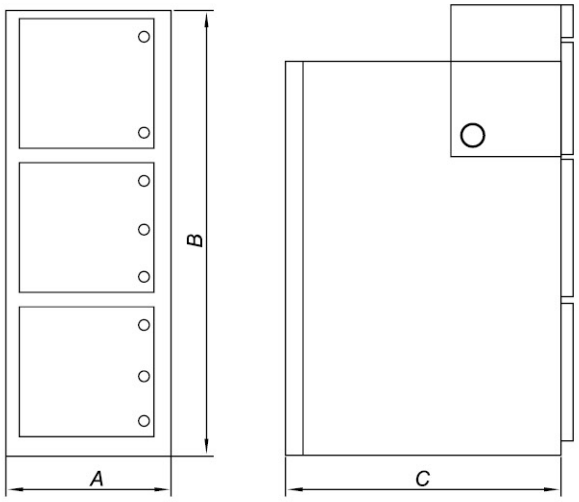


Figure 6. Switchgear dimension

Switchgear dimension (mm)

Table 5

Height B		2370
Width A	Rated current of the branch busbar reaches 1250A	650 or 800
	Rated current of the branch busbar reaches 1600A and above	1000
Depth C	Cable inlet and outlet	1500
	Overhead inlet and outlet	1660

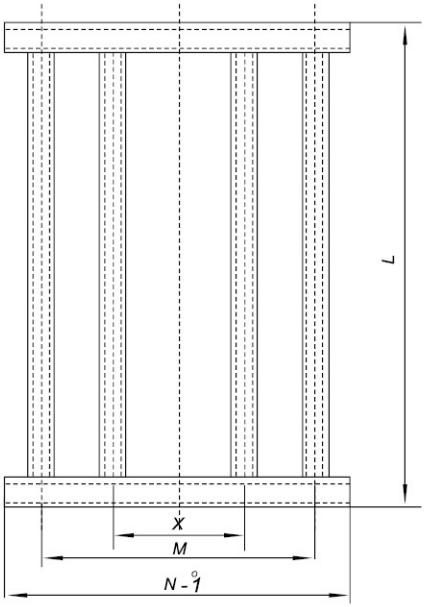


Figure 7. Switchgear foundation installation diagram

6. Switchgear installation and commissioning

6.1 Switchgear foundation installation diagram refers to Table 6 and Figure 7. The black star "★" means that the foundation diagram is applying the switchgear with black star.

6.2 Switchgear installation

6.2.1 Foundation dimension and installation dimension of switchgear refer to Figure 8, Figure 9, Table 7 and Table 8. (Pay attention to the dimension of switchgear with black star installation)

6.2.2 If the switchgears stand in a single line, the corridor distance is at least 2.5m. If they stand in double row, the corridor distance is at least 3m.

6.2.3 In terms of project requirement and drawing specification, switchgears need to be places in specific position. If there are more than ten switchgears, they should be positioned from the middle.

6.2.4 During transportation, special tools such as crane or forklift are applied, roller and crowbar are forbidden. Circuit breaker handcart cannot be placed in the switchgear during transportation. It would be pushed in only after the switchgear is installed.

6.2.5 Remove the cover plate by loosening the top cover bolt of the busbar room.
6.2.6 Loosen the fixed bolt in the front of busbar room, and then take the removable clapboard away [12].
6.2.7 Loosen the fixed bolt of withdrawable horizontal plate [17] which is under the circuit breaker handcart, and remove it.
6.2.8 Loosen and remove the cable top cover [20]
6.2.9 Take the plate away from the left side control trough of the switchgear, as well as the plate at right side trough.
6.2.10 Dismantle the lifting board and fastener
6.2.11 Based on the above instruction, install the switchgear one by one. The difference for the installation fluctuation should not exceed 2mm, including both horizontal direction and vertical direction.
6.2.12 After installation, use M2 foundation bolt to connect the switchgear to groundwork frame or use electric welding to join them together.

6.3 Busbar installation

Busbar in the switchgear is rectangular and subsection type. When differnet currents are applied, the difference between busbar is only about quantity and specification. During installation, follow the below steps,
6.3.1 Wipe up the busbar with dry clean soft cloth. Examine the bushing, ensure there is no damage on it, and then put conductive paste or neutral Vaseline on the connection part.
6.3.2 Install the busbar one by one cabinet. Join the main busbar and corresponding branch busabrs with appropriate gasket, and screw it up.
The main busbar and branch busbar joint type can be found in Figure 9.

6.4 Switchgear earthing device

6.4.1 Use the prepared junction plate to connect the earthing busbar [11] of each cabinet together.
6.4.2 Join all the earthing lines together inside the switchgear.
6.4.3 Connect the basic frame to the earthing busbar. If there are more than ten cabinets, at least more than two earthing busbars are required.
6.4.4 Connect the earthing line of the earthing switch with the earthing main busbar of switchgear together.

6.5 Examination after installation

When the installation is completed, clean the surface, check the fastening bolt and connection state. Push the circuit breaker handcart in and out, break and close the switch, make sure there is no problem with them. Reset instrument pointer to zero. Inspect the secondary circuit in terms of circuit diagram. Finally, adjust the relay and check the interlock.

Switchgear dimension (mm)

Table 6

Width A	Depth B	MNLX			
650	1500 cable	480	650	1450	
650	1660 overhead	480	650	1610	
800	1500 cable	630	800	1450	
800	1660 overhead	630	800	1610	
1000	1500 cable	830	1000	1450	
1000	1660 overhead	830	1000	1610	
★800	1500,1660	630	800		400
★1000	1500,1660	830	1000		400
★1200	1500,1660	830	1200		550

Switchgear dimension (mm)

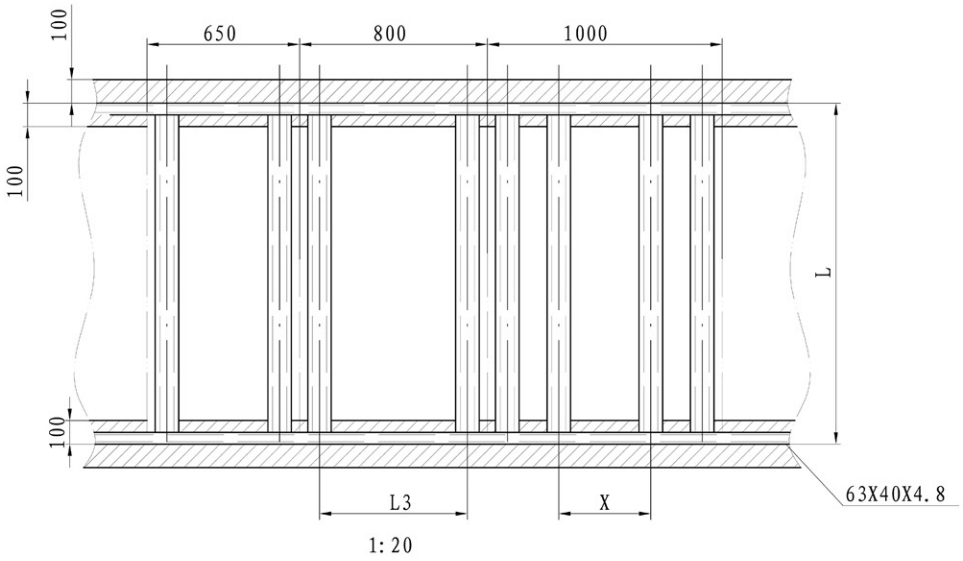
Table 7

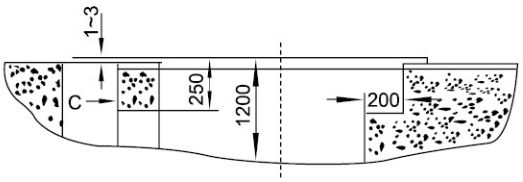
Depth	L
1500	1450
1660	1610

Switchgear dimension (mm)

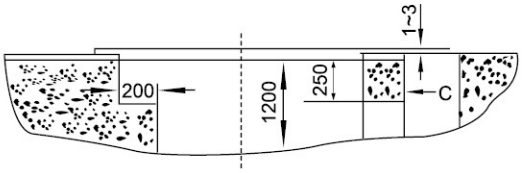
Table 8

Width A	Depth B	L1	L2	L3
650	1500 cable	380	480	470
650	1660 overhead	380	480	630
800	1500 cable	530	630	470
800	1660 overhead	530	630	630
1000	1500 cable	730	830	470
1000	1660 overhead	730	830	630

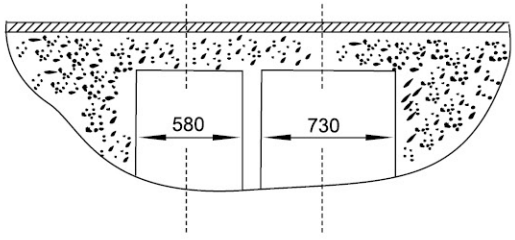




A–A Rotating, equipment without mounting against wall



A–A Rotating, equipment with mounting against wall



C Auxiliary view

Figure 8. Base Illustration for Switchgear Mounting

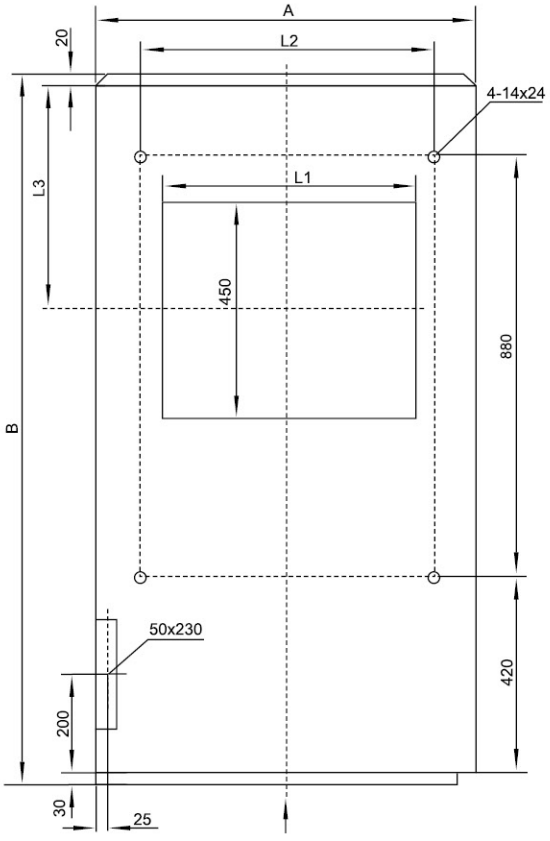


Figure 9. Illustration for Switchgear Mounting

7. Use and maintenance

During operation, except for relative regulations, the operator should follow the steps below as well,

7.1 Operation procedure

Although the switchgear is designed with interlock to ensure the correct procedure of operating each part of the switchgear, operators shall still follow the operating procedures and technical requirements strictly when operating each part of the switchgear. Forced operation may cause switchgear damage and even accidents.

7.1.1 Operation of circuit breaker cabinet without earthing switch

a. 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.

b. 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 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.

c. 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.

d. 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.

7.1.2 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,

a. Operating the handcart inside the switchgear

Before pushing the handcart to the operation site, except for the requirements of b in 7.1.1, it is still important to confirm that the earthing switch is at breaking status. Otherwise next step cannot be processed.

b. 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.

Figure 10. Movable component of circuit breaker in the testing/isolation position

Figure 11. Circuit breaker isolation room (with door open), movable component of circuit breaker in the running position

7.1.3 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 7.1.1), 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.

Cautions when using interlock is stated as below,

a. The interlock function of this product is mainly based on mechanical interlock, supplemented with electrical interlock. It supports switch "five defend" locking function, but operators shall not ignore the operation rules, because the security effect of interlock device can only be achieved by integrating operation procedures and technical means, so as to avoid accidents caused by faulty operation.

b. The using and releasing of interlock for this product, is mostly achieved in the process of normal operation, so extra operation is not necessary. If operation is resisted (for example, operation resistance increases), firstly check whether the operation is faulty, it is not allowed to force operation which may damage the equipment and even cause accidents arising from faulty operation.

c. Some interlocks (such as the interlock between the switchgear bottom panel and earthing switch) can be peremptorily released upon special needs. Emergency unlock must be applied cautiously and shall not be used frequently. When emergency unlock is applied, necessary protection shall be taken, and once emergency is removed, recover interlock immediately.

7.2 Switchgear examination & repair shall be conducted as per relevant regulations and requirements, customers need to pay attention to the following points,

a. Check and modulate the condition of the circuit breaker as per the requirements of the installation instructions of vacuum circuit breaker.

b. Check the condition of the handcart feed mechanism and interlock, and make them achieve relevant requirements of these instructions.

c. Check the contacts condition of main circuit. Clean off the oil and grease accumulated on the movable contact and fixed contact. Check the abrasion of contact, the strength of the spring, whether there is abnormal oxidation of plating layer arising from over–high temperature. If any problems are found, measurements shall be taken timely.

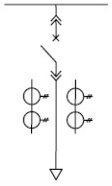
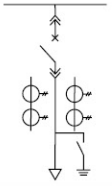
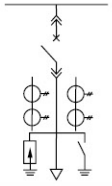
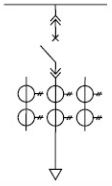
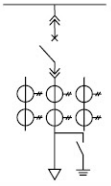
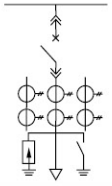
d. Check the contact of auxiliary circuit whether it is in good condition. If not, fix it.

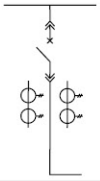
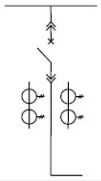
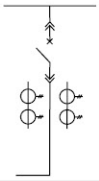
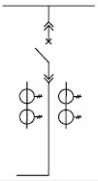
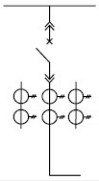
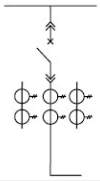
e. Check the condition of each part of the earthing circuit, such as earthing contact, main earthing wire and through–door earthing wire, ensure their continuous conductivity.

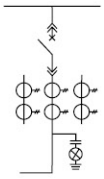
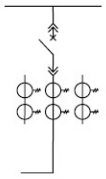
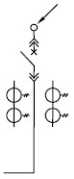
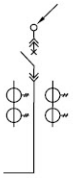
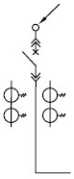
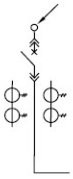
f. Check the fasteners of each part. If it is loose, and timely fasten it.

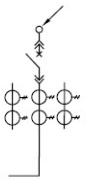
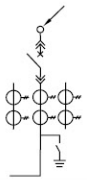
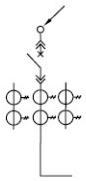
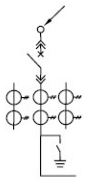
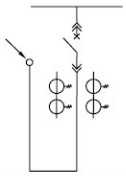
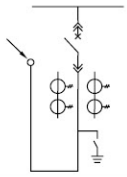
8. Connection Scheme

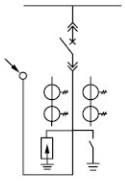
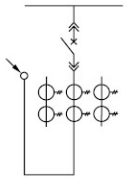
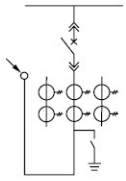
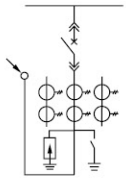
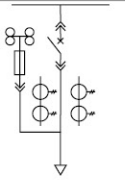
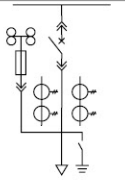
Table 9

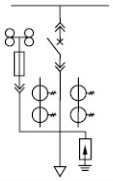
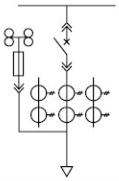
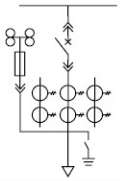
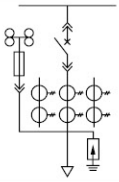
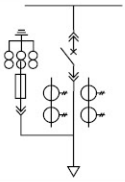
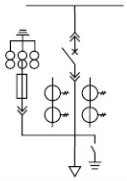
Scheme Number		001	002	003	004	005	006
Primary connection scheme							
Switchgear dimensions (mm) (Width x Depth x Height)		800 1000 ×1500×2370	800 1000 ×1500×2370	800 1000 ×1500×2370	800 1000 ×1500×2370	800 1000 ×1500×2370	800 1000 ×1500×2370
Rated current (A)		630~3150	630~3150	630~3150	630~3150	630~3150	630~3150
Primary Main Equipment Units	Vacuum circuit breaker (VS1or VD4)	1	1	1	1	1	1
	Current transformer LZZBJ9-12/150b/2 LZZBJ9-12/150b/4	2	2	2	3	3	3
	Voltage transformer						
	High Voltage Fuse RN2-10						
	Earthing switch JN15		1	1		1	1
	Arrester HY5WS-17/50			3			3
Loop Name		Incoming, feeding	Feeding	Feeding	Incoming, feeding	Feeding	Feeding
Note		If rated current >=1600A, the width is 1000mm					

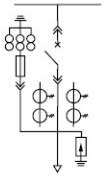
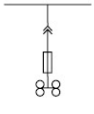
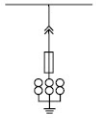
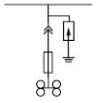
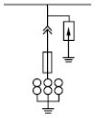
Scheme Number	007	008	009	010	011	012
Primary connection scheme						
Switchgear dimensions (mm) (Width x Depth x Height)	800 1000 × 1500 × 2370	800 1000 × 1500 × 2370	800 1000 × 1500 × 2370	800 1000 × 1500 × 2370	800 1000 × 1500 × 2370	800 1000 × 1500 × 2370
Rated current (A)	630~3150	630~3150	630~3150	630~3150	630~3150	630~3150
Primary Main Equipment Units: Vacuum circuit breaker (VS1or VD4)	1	1	1	1	1	1
Primary Main Equipment Units: Current transformer LZZBJ9-12/150b/2 LZZBJ9-12/150b/4	2	2	2	2	3	3
Primary Main Equipment Units: Voltage transformer						
Primary Main Equipment Units: High Voltage Fuse RN2-10						
Primary Main Equipment Units: Earthing switch JN15						
Primary Main Equipment Units: Arrester HY5WS-17/50						
Loop Name	Connection (Right)	Connection (Right)	Connection (Left)	Connection (Left)	Connection (Right)	Connection (Right)
Note	If rated current >=1600A, the width is 1000mm					

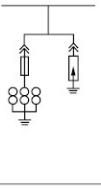
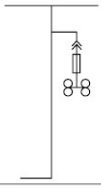
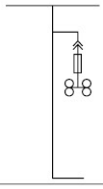
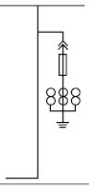
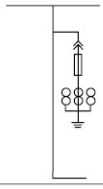
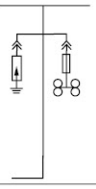
Scheme Number	013	014	015	016	017	018
Primary connection scheme						
Switchgear dimensions (mm) (Width x Depth x Height)	800 1000 × 1500 × 2370	800 1000 × 1500 × 2370	800 1000 × 1500 × 2370	800 1000 × 1500 × 2370	800 1000 × 1500 × 2370	800 1000 × 1500 × 2370
Rated current (A)	630~3150	630~3150	630~3150	630~3150	630~3150	630~3150
Primary Main Equipment Units: Vacuum circuit breaker (VS1or VD4)	1	1	1	1	1	1
Primary Main Equipment Units: Current transformer LZZBJ9-12/150b/2 LZZBJ9-12/150b/4 Voltage transformer	3	3	2	2	2	2
Primary Main Equipment Units: High Voltage Fuse RN2-10						
Primary Main Equipment Units: Earthing switch JN15						
Primary Main Equipment Units: Arrester HY5WS-17/50						
Loop Name	Connection (Right)	Connection (Right)	Overhead-line in (Left Connection)	Overhead-line in (Left Connection)	Overhead-line in (RightConnection)	Overhead-line in (RightConnection)
Note	If rated current≥1600A, the width is1000mm					

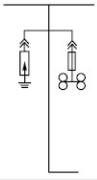
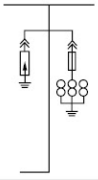
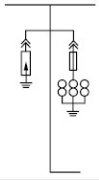
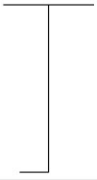
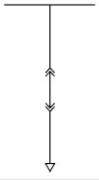
Scheme Number		019	020	021	022	023	024
Primary connection scheme							
Switchgear dimensions (mm) (Width x Depth x Height)		800 1000 ×1500×2370	800 1000 ×1500×2370	800 1000 ×1500×2370	800 1000 ×1500×2370	800 1000 ×1660×2370	800 1000 ×1660×2370
Rated current (A)		630~3150	630~3150	630~3150	630~3150	630~3150	630~3150
Primary Main Equipment Units	Vacuum circuit breaker (VS1or VD4)	1	1	1	1	1	1
	Current transformer LZZBJ9-12/150b/2 LZZBJ9-12/150b/4	3	3	3	3	2	2
	Voltage transformer						
	High Voltage Fuse RN2-10						
	Earthing switch JN15		1		1		1
	Arrester HY5WS-17/50						
Loop Name		Overhead-line in (Left Connection)	Overhead-line in (Left Connection)	Overhead-line in (RightConnection)	Overhead-line in (RightConnection)	Overhead line in & out	Overhead line out
Note		If rated current >=1600A, the width is 1000mm					

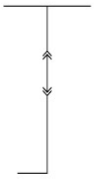
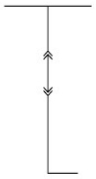
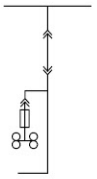
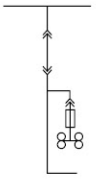
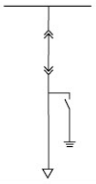
Scheme Number		025	026	027	028	029	030
Primary connection scheme							
Switchgear dimensions (mm) (Width x Depth x Height)		800 1000 ×1660×2370	800 1000 ×1660×2370	800 1000 ×1660×2370	800 1000 ×1660×2370	800 1000 ×1500×2370	800 1000 ×1500×2370
Rated current (A)		630~3150	630~3150	630~3150	630~3150	630~3150	630~3150
Primary Main Equipment Units	Vacuum circuit breaker (VS1or VD4)	1	1	1	1	1	1
	Current transformer LZZBJ9-12/150b/2 LZZBJ9-12/150b/4	2	3	3	3	2	2
	Voltage transformer					RZL-10 2	RZL-10 2
	High Voltage Fuse RN2-10					3	3
	Earthing switch JN15	1		1	1		1
	Arrester HY5WS-17/50	3			3		
Loop Name		Overhead line out	Overhead line in & out	Overhead line out	Overhead line out	Cable line in +PT	Cable line out +PT
Note		If rated current≥1600A, the width is1000mm					

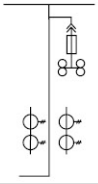
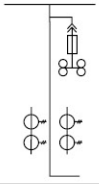
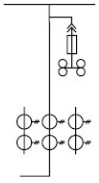
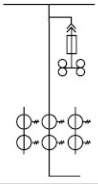
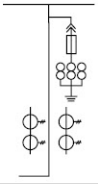
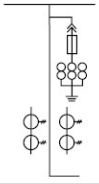
Scheme Number		031	032	033	034	035	036
Primary connection scheme							
Switchgear dimensions (mm) (Width x Depth x Height)		800 / 1000 × 1500 × 2370	800 / 1000 × 1500 × 2370	800 / 1000 × 1500 × 2370	800 / 1000 × 1500 × 2370	800 / 1000 × 1500 × 2370	800 / 1000 × 1500 × 2370
Rated current (A)		630~3150	630~3150	630~3150	630~3150	630~3150	630~3150
Primary Main Equipment Units	Vacuum circuit breaker (VS1or VD4)	1	1	1	1	1	1
	Current transformer LZZBJ9-12/150b/2 LZZBJ9-12/150b/4	2	3	3	3	2	2
	Voltage transformer	RZL-10 2	RZL-10 2	RZL-10 2	RZL-10 2	RZL-10 3	RZL-10 3
	High Voltage Fuse RN2-10	3	3	3	3	3	3
	Earthing switch JN15			1			1
	Arrester HY5WS-17/50	3			3		
Loop Name		Cable line in +PT	Cable line in +PT	Cable line out+PT	Cable line in +PT	Cable line in +PT	Cable line out+PT
Note		If rated current >=1600A, the width is 1000mm					

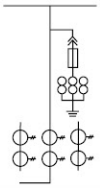
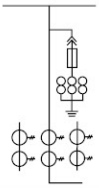
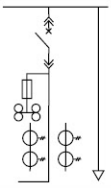
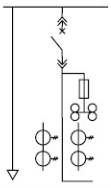
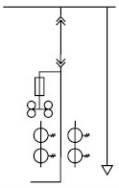
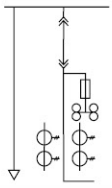
Scheme Number		037	038	039	040	041	042
Primary connection scheme							
Switchgear dimensions (mm) (Width x Depth x Height)		800 × 1500 × 2370	800 × 1500 × 2370	800 × 1500 × 2370	800 × 1500 × 2370	800 × 1500 × 2370	800 × 1500 × 2370
Rated current (A)		630~3150	630~3150	630~3150	630~3150	630~3150	630~3150
Primary Main Equipment Units	Vacuum circuit breaker (VS1or VD4)	1					
	Current transformer LZZBJ9-12/150b/2 LZZBJ9-12/150b/4	2					
	Voltage transformer	RZL-10 3	RZL-10 2	RZL-10 3	RZL-10 2	RZL-10 3	RZL-10 2
	High Voltage Fuse RN2-10	3	3	3	3	3	3
	Earthing switch JN15						
	Arrester HY5WS-17/50	3			3	3	3
Loop Name		Cable line out +PT	Voltage measurement	Voltage measurement	Voltage measurement	Voltage measurement + Arrester	Voltage measurement + Arrester
Note		If rated current≥1600A, the width is1000mm					

Scheme Number	043	044	045	046	047	048
Primary connection scheme						
Switchgear dimensions (mm) (Width x Depth x Height)	800 × 1500 × 2370	800/1000 × 1500 × 2370	800/1000 × 1500 × 2370	800/1000 × 1500 × 2370	800/1000 × 1500 × 2370	800/1000 × 1500 × 2370
Rated current (A)	630~3150	630~3150	630~3150	630~3150	630~3150	630~3150
Primary Main Equipment Units: Vacuum circuit breaker (VS1or VD4)						
Primary Main Equipment Units: Current transformer LZZBJ9-12/150b/2 LZZBJ9-12/150b/4						
Primary Main Equipment Units: Voltage transformer	RZL-10 3	RZL-10 2	RZL-10 2	RZL-10 3	RZL-10 3	RZL-10 2
Primary Main Equipment Units: High Voltage Fuse RN2-10	3	3	3	3	3	3
Primary Main Equipment Units: Earthing switch JN15						
Primary Main Equipment Units: Arrester HY5WS-17/50	3					3
Loop Name	Voltage measurement + Arrester	Voltage measurement + Busbar	Voltage measurement + Busbar	Voltage measurement + Busbar	Voltage measurement + Busbar	Voltage measurement + Arrester+ Busbar
Note	If rated current >=1600A, the width is 1000mm					

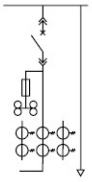
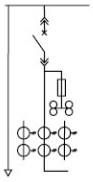
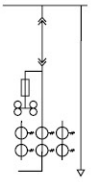
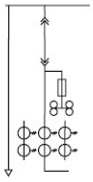
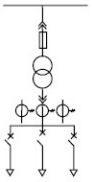
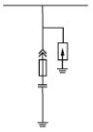
Scheme Number	049	050	051	052	053	054
Primary connection scheme						
Switchgear dimensions (mm) (Width x Depth x Height)	800/1000 × 1500 × 2370	800/1000 × 1500 × 2370	800/1000 × 1500 × 2370	800/1000 × 1500 × 2370	800/1000 × 1500 × 2370	800/1000 × 1500 × 2370
Rated current (A)	630~3150	630~3150	630~3150	630~3150	630~3150	630~3150
Primary Main Equipment Units: Vacuum circuit breaker (VS1or VD4)						1(Isolation cart)
Primary Main Equipment Units: Current transformer LZZBJ9-12/150b/2 LZZBJ9-12/150b/4						
Primary Main Equipment Units: Voltage transformer	RZL-10 2	RZL-10 3	RZL-10 3			
Primary Main Equipment Units: High Voltage Fuse RN2-10	3	3	3			
Primary Main Equipment Units: Earthing switch JN15						
Primary Main Equipment Units: Arrester HY5WS-17/50	3					
Loop Name	Voltage measurement + Arrester+ Busbar	Voltage measurement + Busbar	Voltage measurement + Busbar	Transit Busbar	Transit Busbar	Busbar Exaltation
Note	If rated current≥1600A, the width is1000mm					

Scheme Number	055	056	057	058	059	060
Primary connection scheme						
Switchgear dimensions (mm) (Width x Depth x Height)	800/1000 × 1500 × 2370	800/1000 × 1500 × 2370	800/1000 × 1500 × 2370	800/1000 × 1500 × 2370	800/1000 × 1500 × 2370	800/1000 × 1500 × 2370
Rated current (A)	630~3150	630~3150	630~3150	630~3150	630~3150	630~3150
Primary Main Equipment Units: Vacuum circuit breaker (VS1or VD4)	1	1	1	1		1
Primary Main Equipment Units: Current transformer LZZBJ9-12/150b/2 LZZBJ9-12/150b/4						
Primary Main Equipment Units: Voltage transformer			RZL-10 2	RZL-10 2		
Primary Main Equipment Units: High Voltage Fuse RN2-10			3	3		
Primary Main Equipment Units: Earthing switch JN15						1
Primary Main Equipment Units: Arrester HY5WS-17/50						
Loop Name	Isolation + Connection(Left)	Isolation + Connection(Right)	Isolation+Connection(Left) +Voltage measurement	Isolation+Connection(Right) +Voltage measurement	line out phase change	line out phase change
Note	If rated current >=1600A, the width is 1000mm					

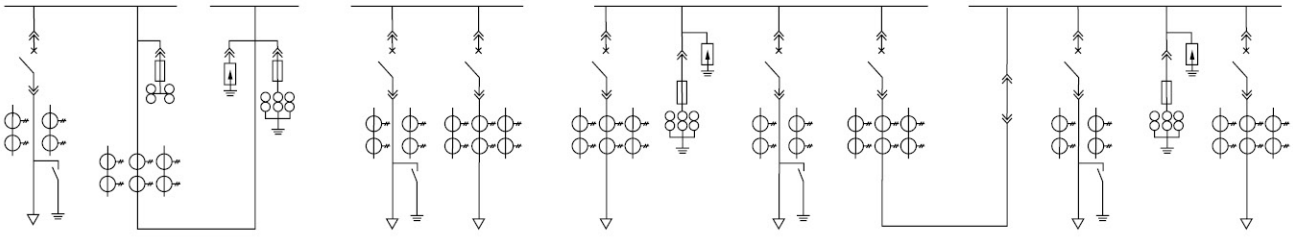
Scheme Number	061	062	063	064	065	066
Primary connection scheme						
Switchgear dimensions (mm) (Width x Depth x Height)	800/1000 × 1600 × 2370	800/1000 × 1600 × 2370	800/1000 × 1600 × 2370	800/1000 × 1600 × 2370	800/1000 × 2500 × 2370	800/1000 × 1500 × 2370
Rated current (A)	630~3150	630~3150	630~3150	630~3150	630~3150	630~3150
Primary Main Equipment Units: Vacuum circuit breaker (VS1or VD4)						
Primary Main Equipment Units: Current transformer LZZBJ9-12/150b/2 LZZBJ9-12/150b/4	2	2	3	3	2	2
Primary Main Equipment Units: Voltage transformer	RZL-10 2	RZL-10 2	RZL-10 2	RZL-10 2	RZL-10 3	RZL-10 3
Primary Main Equipment Units: High Voltage Fuse RN2-10	3	3	3	3	3	3
Primary Main Equipment Units: Earthing switch JN15						
Primary Main Equipment Units: Arrester HY5WS-17/50						
Loop Name	Measurement + Connection(Left)	Measurement + Connection(Right)	Measurement + Connection(Left)	Measurement + Connection(Right)	Measurement + Connection(Left)	Measurement + Connection(Right)
Note	If rated current≥1600A, the width is1000mm					

Scheme Number		067	068	069	070	071	072
Primary connection scheme							
Switchgear dimensions (mm) (Width x Depth x Height)		800/1000 × 1500 × 2370	800/1000 × 1500 × 2370	800/1000 × 1660 × 2370	800/1000 × 1660 × 2370	800/1000 × 1660 × 2370	800/1000 × 1660 × 2370
Rated current (A)		630~3150	630~3150	630~3150	630~3150	630~3150	630~3150
Primary Main Equipment Units	Vacuum circuit breaker (VS1or VD4)			1	1	1(Isolation cart)	1(Isolation cart)
	Current transformer LZZBJ9-12/150b/2 LZZBJ9-12/150b/4	3	3	2	2	2	2
	Voltage transformer	RZL-10 3	RZL-10 3	RZL-10 2	RZL-10 2	RZL-10 2	RZL-10 2
	High Voltage Fuse RN2-10	3	3	3	3	3	3
	Earthing switch JN15						
	Arrester HY5WS-17/50						
Loop Name		Measurement + Connection(Left)	Measurement + Connection(Right)	line in+ Measurement	line in+ Measurement	line in+ Measurement	line in+ Measurement
Note		If rated current≥1600A, the width is1000mm					

DELIXI

Scheme Number		073	074	075	076	077	078
Primary connection scheme							
Switchgear dimensions (mm) (Width x Depth x Height)		800/1000 × 1660 × 2370	800/1000 × 1660 × 2370	800/1000 × 1660 × 2370	800/1000 × 1660 × 2370	800/1000 × 1500 × 2370	800/1000 × 1500 × 2370
Rated current (A)		630~3150	630~3150	630~3150	630~3150	630~3150	630~3150
Primary Main Equipment Units	Vacuum circuit breaker (VS1or VD4)	1	1	1(Isolation cart)	1(Isolation cart)		
	Current transformer LZZBJ9-12/150b/2 LZZBJ9-12/150b/4	3	3	3	3		
	Voltage transformer	RZL-10 2	RZL-10 2	RZL-10 2	RZL-10 2		
	High Voltage Fuse RN2-10	3	3	3	3	RN3-10 3	3
	Earthing switch JN15					Some (if necessary)	
	Arrester HY5WS-17/50						3
Sc series dry-type transformer						1	
Condenser							3
Loop Name		Measurement + Connection(Left)	Measurement + Connection(Right)	line in+ Measurement	line in+ Measurement	Power transformer	Condenser switchgear
Note		If rated current ≥1600A, the width is 1000mm,the dimension of power cabinet and condenser switchgear will be measured by actual capability					

Scheme example



9. Order information

9.1 Main connection scheme diagram code, application. Single line system diagram, rated voltage, rated current, rated short-circuit breaking current, power distribution layout diagram and switchgear arrangement diagram.
9.2 The requirements of control, measurement, protection, locking device and automatic devices of the switchgear.
9.3 Model, specifications and quantity of main electric components inside the switchgear.
9.4 Provide the busbar data of rated current flow, length and height to the ground when the switchgears need to be connected with busbar.
9.5 Indicate the switchgear operation environment when it is used in a special place.
9.6 If there is any other special requirement, please indicate and consult with supplier before ordering.

Note: If the ordered switchgear is the same as the sample stated above, please refer to the foundation diagram provided for groundwork.

KYN28A–24(SDK1–24)

Metal–Clad AC Withdrawable Switchgear (Installation and Operation Instruction)

1. Introduction

1.1 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 mis–entering 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.

1.2 Applicable standards

a) GB1984 High–voltage alternating–current circuit breaker.
b) GB3906 3~35kV alternating–current metal–enclosed switchgear.
c) GB/T11022 Common specifications for high–voltage switchgear and controlgear standards.
d) DL/T404 Ordering technical qualification of indoor AC high–voltage switch cabinet.
e) DL/T593 Common ordering qualification guide of high–voltage switchgear.

1.3 Working environment

1.3.1 General working environment

a) Environmental temperature:
Highest temperature: +40℃ ; lowest temperature: –15℃ ; daily average temperature ⩽ 35℃ ;
b) Environmental humidity:
Daily relative average humidity ⩽ 95%;
Monthly relative average humidity ⩽ 90%;
Daily average water vapor pressure ⩽ 2.2kPa;
Monthly average water vapor pressure ⩽ 1.8kPa;
Condensation may occur occasionally;
c) Altitude: ⩽ 1000m;
d) No pollution such as dust, smoke, corrosive or flammable gas, steam or salt fog;
e) The slight vibration or ground movement outside of the switchgear and control equipment can be neglected.
f) The electromagnetic interference of the secondary system should ⩽ 1.6kV.

1.3.2 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.

2. Technical parameters

2.1 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			
4	Rated current		A	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 × depth × height)		mm	800 × 1810 × 2380		1000 × 1810 × 2380	
12	Weight		Kg	840~1440			

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

2.2 Main technical parameters of VS1–24, VN2–24 vacuum circuit breaker

No.	Item		Unit	Parameter
1	Rated voltage		kV	24
2	Rated insulation ability	1min power frequency withstanc voltage(RMS)		65
		Lightening impact withstand voltage(peak value)		125

Continued

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	A	630	
10	Rated back-to-back condenser group breaking current		400	
11	Rated short circuit breaking current breaking times	Times	50	
12	Mechanical life		20000	
13	Rated operation sequence		O-0.3s-CO-180s-CO	

2.3 Technical parameters of spring operation mechanism

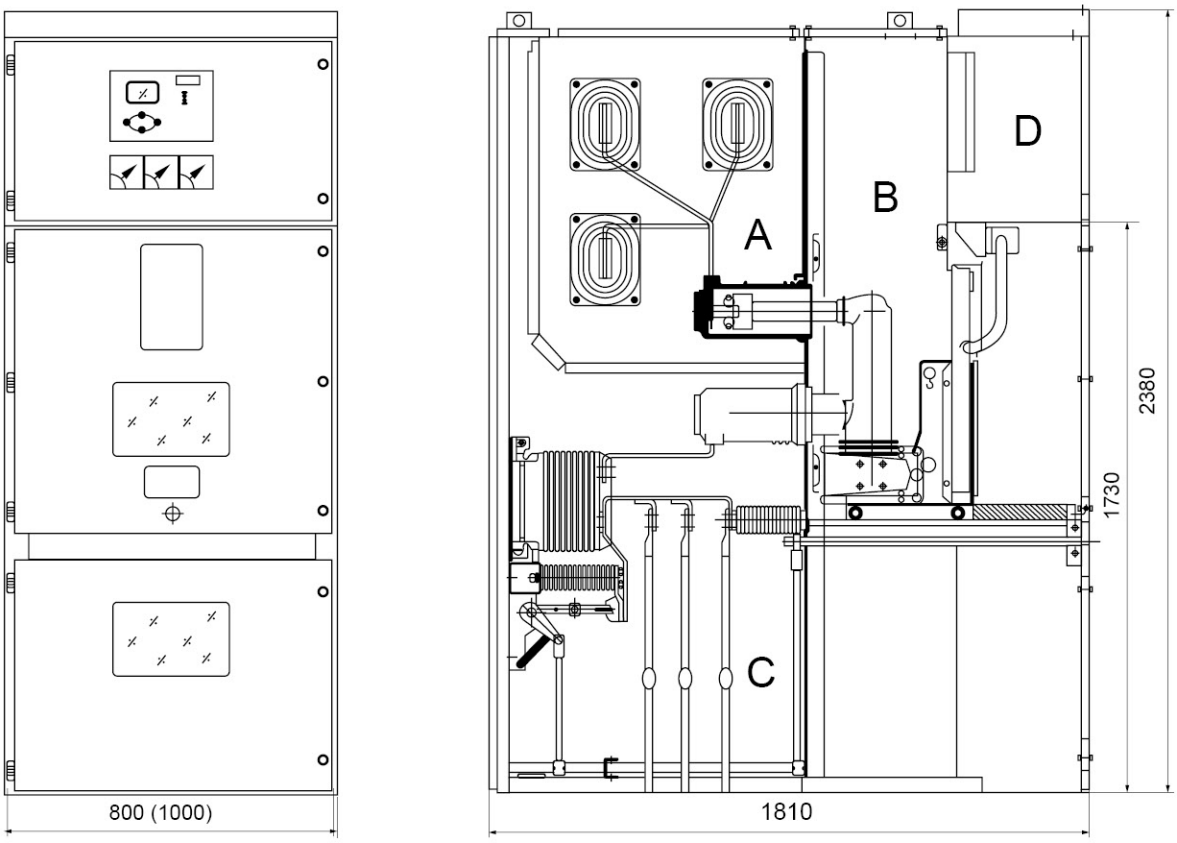
No.	Item		Unit	Parameter
1	Rated operation voltage	Closing trip coil	V	AC220,AC110,DC220,DC110
		Breaking trip coil		
2	Operation current	Closing trip coil	A	AC220 D‰C220 1$1.AC110 D‰C10 3$1
		Breaking trip coil		
3	Power of energy storage motor		W	80,100
4	Rated voltage of energy storage motor		V	AC220,AC110,DC220,DC110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

3. Structure and operating principle

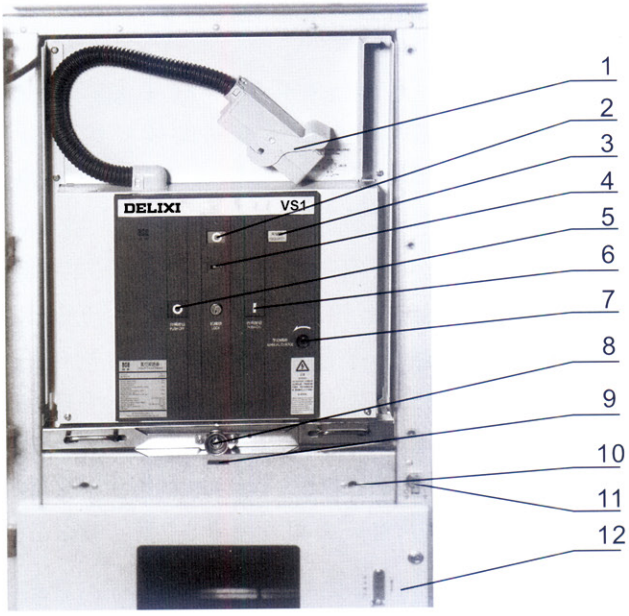
3.1 Structure introduction

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.



A. busbar room B. circuit breaker handcart room C. cable room D. relay instrument room
Figure 1. KYN28A–24(SDK1–24) switchgear structure illustration



1. Secondary plug
2. On/Off indication
3. Energy store indication
4. Counter
5. Breaking button
6. Closing button
7. Manual energy store
8. Rock mechanism
9. Steering cart lock hole
10. Steering cart location
11. Earthing switch operation hole
12. Emergency deblock

Figure 2. switch cabinet control panel illustration

3.2 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.

3.2.1 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.

3.2.2 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.

3.2.3 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.

a) 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.

b) 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.

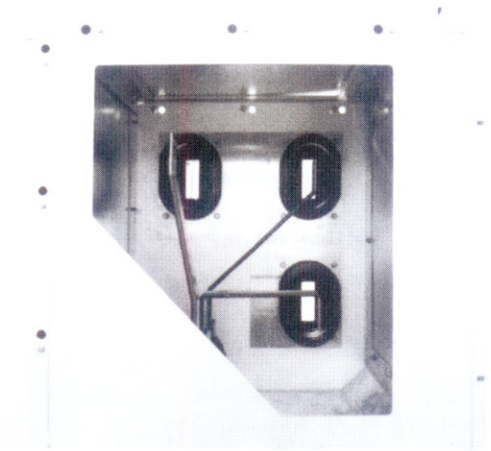


Figure 3. Bus bar compartment

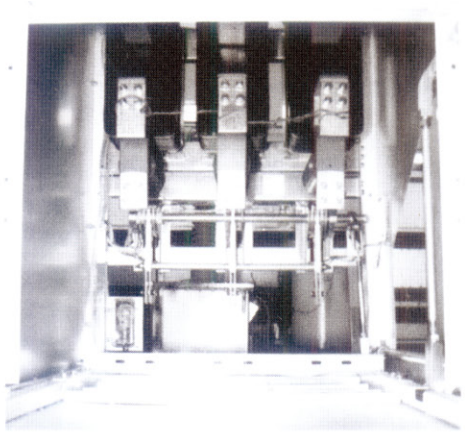


Figure 4. Cable compartment

c) 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.

d) 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.

3.2.4 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.

3.2.5 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.

3.2.6 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.

3.2.7 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.

3.2.8 Earthing device

The cable compartment has 5 × 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.

3.3 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".

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

b. 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.

c. 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 current–carrying 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.

d. If the earthing switch is at breaking site, the bottom door and rear door are locked to prevent accidental entering current–carrying separate zones.

e. 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.

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

g. 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.

3.4 Switchgear electrical circuit control connection principle

The electrical control principle of VS1–24, VN2–24 vacuum circuit breaker can be referred to Figure4 and Figure5. 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.

4. Transportation, installation and test

4.1 Transformation and storage cautions

a. 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.

b. Avoid from the rain;

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

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

4.2 Switchgear installation

a. 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.
b. 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.
c. In order to install busbar, the switchgear assembles and busbar installation can be performed alternatively.
d. 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
e. 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.

4.3 Switchgear test

a. Check the plugging depth and connection of the isolating contact.
b. 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.
c. Check the closing/breaking mechanism features of the circuit breaker and test it with indicated highest or lowest operation voltages.
d. Powered on the secondary loop and make sure there is no fault with the protection, control and signal circuits.
e. Measure the main circuit resistance. The circuit resistance of the circuit breaker should not be larger than the standard value.
f. According to the handover standards, test the power frequency withstand voltages of the phase–to–phase and phase–to–earth of the main circuit.
g. 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.

5. 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.

5.1 Operation of circuit breaker cabinet without earthing switch

a. 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.
b. 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 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.

c. 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.

d. 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.

5.2 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,

a. 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.

b. 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.

5.3 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.

6. 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.

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

b. Check the handcart in–out process and carry out the necessary adjustment and lubrication.

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

d. 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.

e. 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.

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

g. 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.

7. Attached documents

a. Product quality certificate
b. Factory inspection report
c. Installation and utility instruction
d. Secondary circuit connection diagram
e. Packing list
f. Special tools
g. Technical documents and attached files of switchgear main component utility instruction

8. Order information

a. Primary circuit connection scheme
b. Switchgear arrangement and power distribution room layout diagram
c. Model, specification and quantity of the main equipments inside switchgear
d. Secondary circuit diagram
e. If the switchgear is used in special environment, please note the manufacturer when ordering
f. Other special requirements

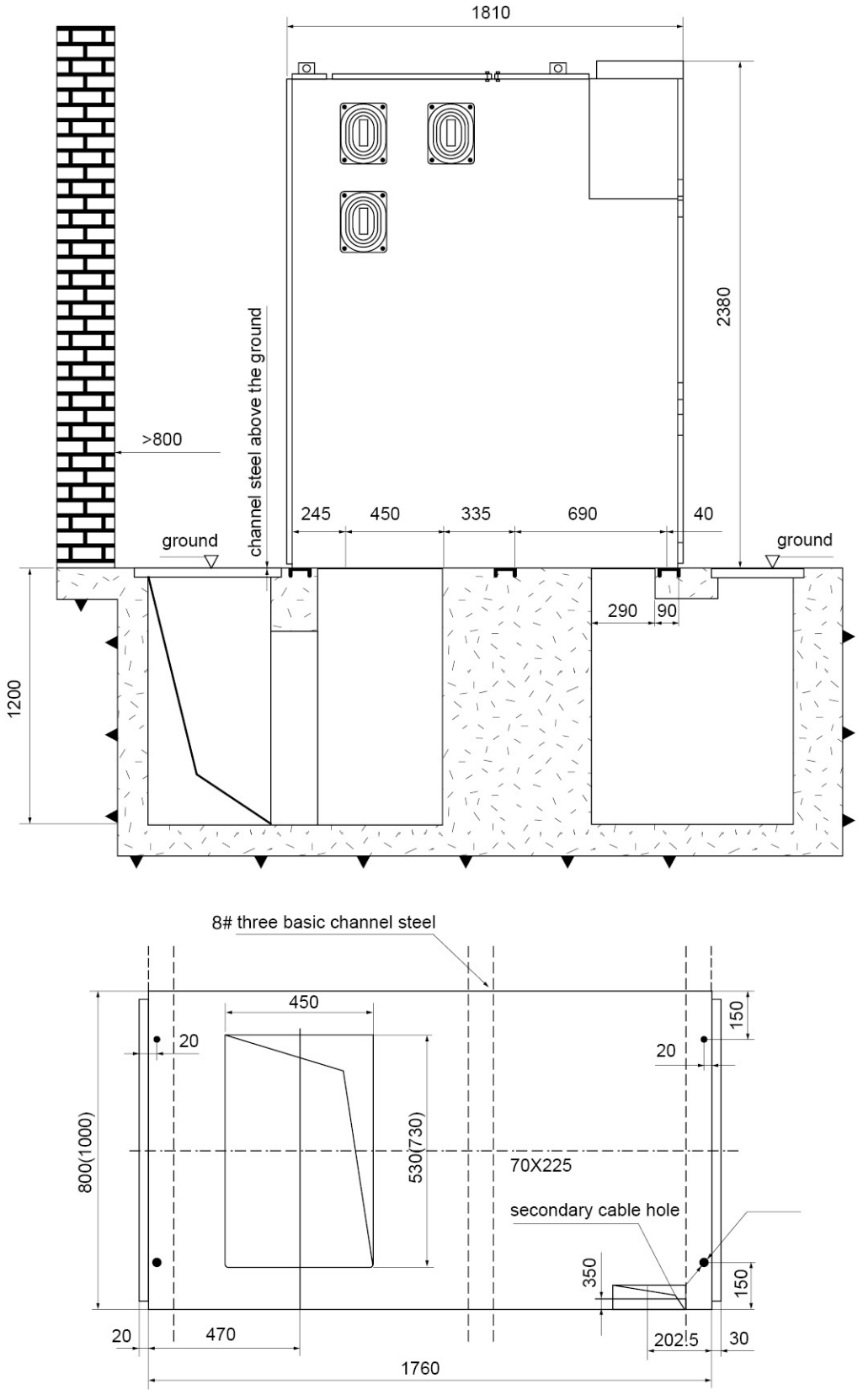
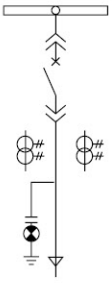
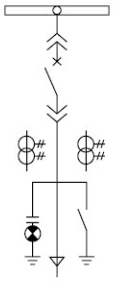
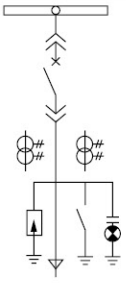
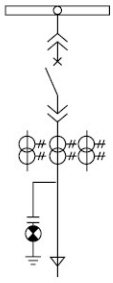
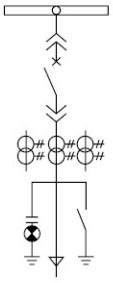
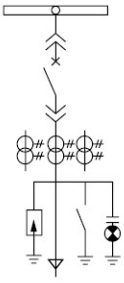
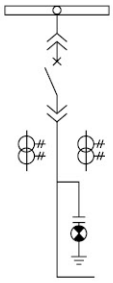
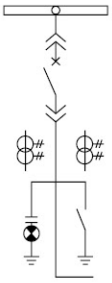
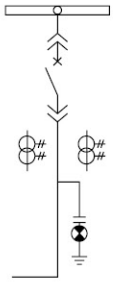
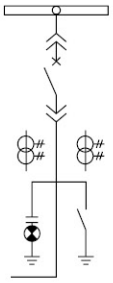
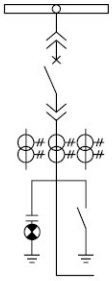
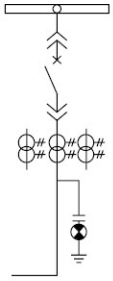
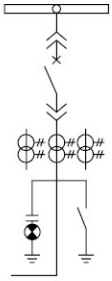
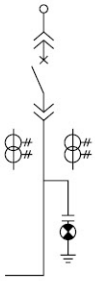


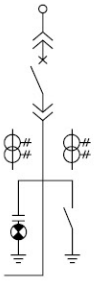
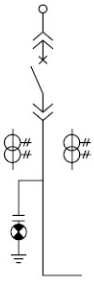
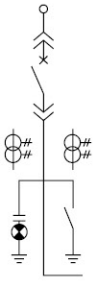
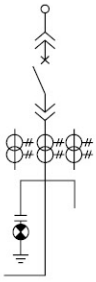
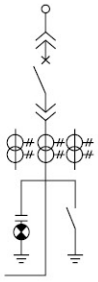
Figure 5. Switchgear installation base and bottom board hole dimension diagram

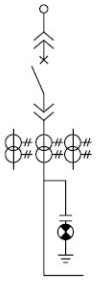
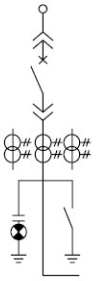
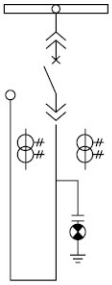
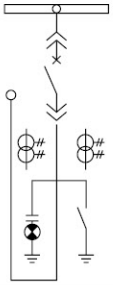
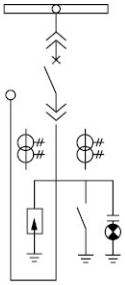
8. Primary connection schemes

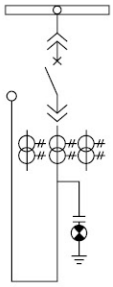
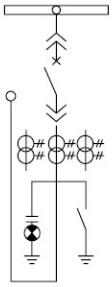
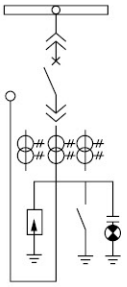
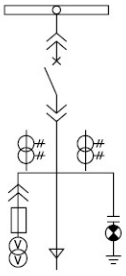
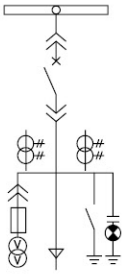
Scheme No.		001	002	003	004	005
Primary connection scheme						
Rated current (A)		630~3150				
Primary mian component	VN2-24、VS1-24 Vacuum circuit breaker	1	1	1	1	1
	LZZB9-24 Current transformer	2	2	2	3	3
	JDZ11-20/JDZX11-20 Current transformer					
	XRNP-24 0.5A HV fuse					
	N15-24 Earthing switch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

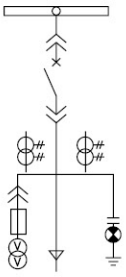
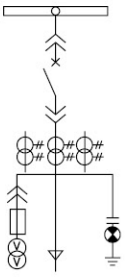
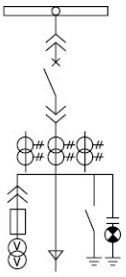
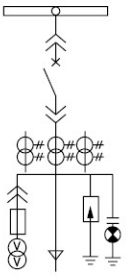
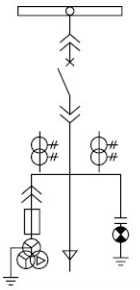
Scheme No.		006	007	008	009	010
Primary connection scheme						
Rated current (A)		630~3150				
Primary mian component	VN2-24、VS1-24 vacuum circuit beaker	1	1	1	1	1
	LZZB9-24 Current transformer	3	2	2	2	2
	JDZ11-20/JDZX11-20 Current transformer					
	XRNP-24 0.5A HV fuse					
	JN15-24 Earthing switch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

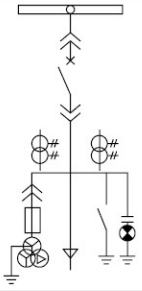
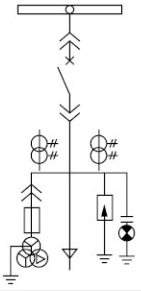
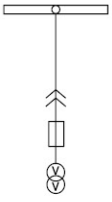
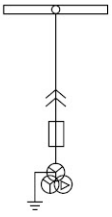
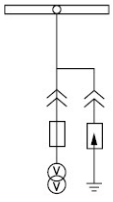
Scheme No.		011	012	013	014	015
Primary connection scheme						
Rated current (A)		630~3150				
Primary mian component	VN2-24、VS1-24 Vacuum circuit breaker	1	1	1	1	1
	LZZB9-24 Current transformer	3	3	3	3	2
	JDZ11-20/JDZX11-20 Current transformer					
	XRNP-24 0.5A HV fuse					
	JN15-24 Earthing switch		1		1	
	HY5WZ-32/84 Lightning arrester					
Utility		Connection (right)	Connection (right)	Connection (left)	Connection (left)	overhead line (left connection)

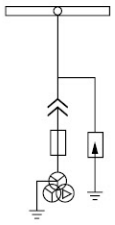
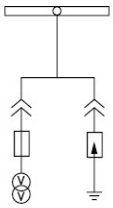
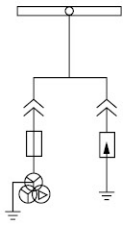
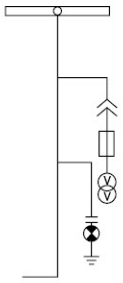
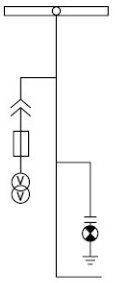
Scheme No.		016	017	018	019	020
Primary connection scheme						
Rated current (A)		630~3150				
Primary mian component	VN2-24、VS1-24 vacuum circuit beaker	1	1	1	1	1
	LZZB9-24 Current transformer	2	2	2	3	3
	JDZ11-20/JDZX11-20 Current transformer					
	XRNP-24 0.5A HV fuse					
	N15-24 Earthing switch	1		1		1
	HY5WZ-32/84 Lightning arrester					
Utility		overhead line (left connection)	overhead line (right connection)	overhead line (right connection)	overhead line (left connection)	overhead line (left connection)

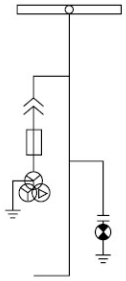
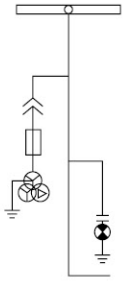
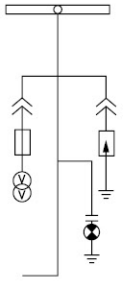
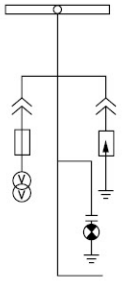
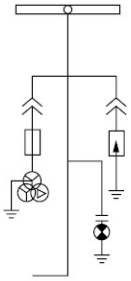
Scheme No.		021	022	023	024	025
Primary connection scheme						
Rated current (A)		630~3150				
Primary mian component	VN2-24、VS1-24 Vacuum circuit breaker	1	1	1	1	1
	LZZB9-24 Current transformer	3	3	2	2	2
	JDZ11-20/JDZX11-20 Current transformer					
	XRNP-24 0.5A HV fuse					
	JN15-24 Earthing switch		1		1	1
	HY5WZ-32/84 Lightning arrester					3
Utility		overhead line (right connection)	overhead line (right connection)	overhead line	overhead line	overhead line

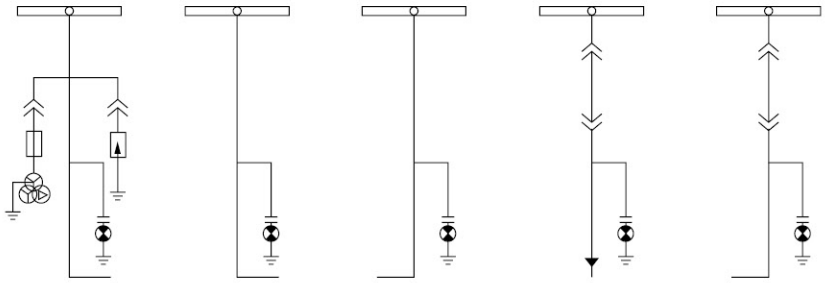
Scheme No.		026	027	028	029	030
Primary connection scheme						
Rated current (A)		630~3150				
Primary mian component	VN2-24、VS1-24 vacuum circuit beaker	1	1	1	1	1
	LZZB9-24 Current transformer	3	3	3	2	2
	JDZ11-20/JDZX11-20 Current transformer				2/3	2/3
	XRNP-24 0.5A HV fuse				3	3
	JN15-24 Earthing switch		1	1		1
	HY5WZ-32/84 Lightning arrester			3		
Utility		overhead line	overhead line	overhead line	power receiving, power feeding	power feeding

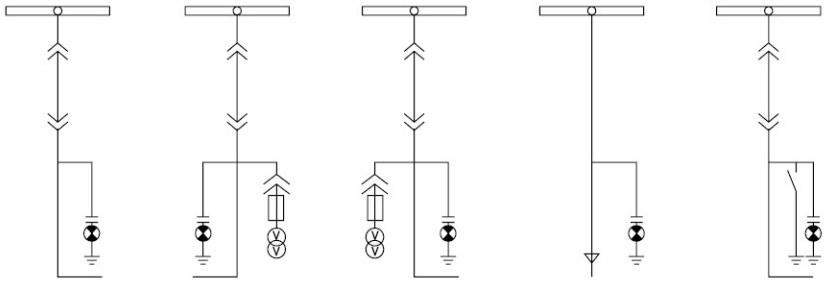
Scheme No.		031	032	033	034	035
Primary connection scheme						
Rated current (A)		630~3150				
Primary mian component	VN2-24、VS1-24 Vacuum circuit breaker	1	1	1	1	1
	LZZB9-24 Current transformer	2	3	3	3	2
	JDZ11-20/JDZX11-20 Current transformer	2/3	2/3	2/3	2/3	/3
	XRNP-24 0.5A HV fuse	3	3	3	3	3
	JN15-24 Earthing switch			1		
	HY5WZ-32/84 Lightning arrester	3			3	
Utility		power receiving, power feeding	power receiving, power feeding	power feeding	power receiving, power feeding	power receiving, power feeding

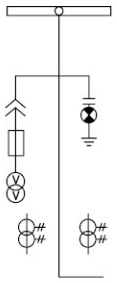
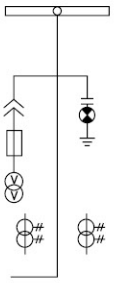
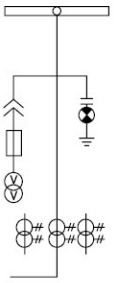
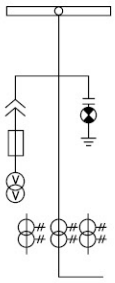
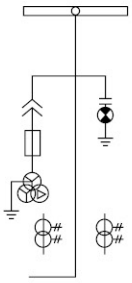
Scheme No.		036	037	038	039	040
Primary connection scheme						
Rated current (A)		630~3150				
Primary mian component	VN2-24、VS1-24 vacuum circuit beaker	1	1			
	LZZB9-24 Current transformer	2	2			
	DZ11-20/JDZX11-20 Current transformer	/3	/3	2/	/3	2/
	XRNP-24 0.5A HV fuse	3	3	3	3	3
	JN15-24 Earthing switch	1				
	HY5WZ-32/84 Lightning arrester		3			3
Utility		power feeding	power receiving, power feeding	voltage measurement	voltage measurement	voltage measurement+ lightning arrester

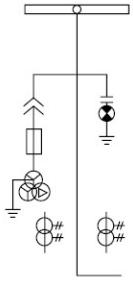
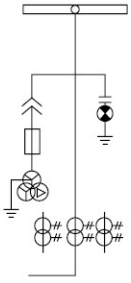
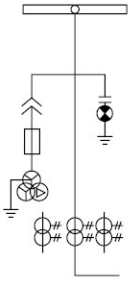
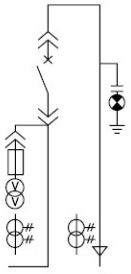
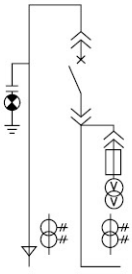
Scheme No.		041	042	043	044	045
Primary connection scheme						
Rated current (A)		630~3150				
Primary mian component	VN2-24、VS1-24 Vacuum circuit breaker					
	LZZB9-24 Current transformer					
	JDZ11-20/JDZX11-20 Current transformer	/3	2/	/3	2/	2/
	XRNP-24 0.5A HV fuse	3	3	3	3	3
	JN15-24 Earthing switch					
	HY5WZ-32/84 Lightning arrester	3	3	3		
Utility		voltage measurement+ lightning arrester	voltage measurement+ lightning arrester	voltage measurement+ lightning arrester	voltage measurement+ left connection	voltage measurement+ right connection

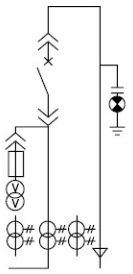
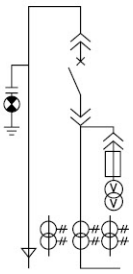
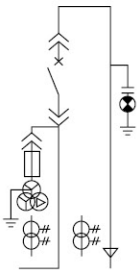
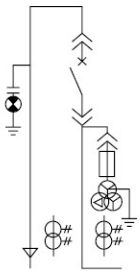
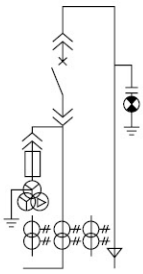
Scheme No.		046	047	048	049	050
Primary connection scheme						
Rated current (A)		630~3150				
Primary mian component	VN2-24、VS1-24 vacuum circuit beaker	1	1			
	LZZB9-24 Current transformer					
	JDZ11-20/JDZX11-20 Current transformer	/3	/3	2/	2/	/3
	XRNP-24 0.5A HV fuse	3	3	3	3	3
	JN15-24 Earthing switch					
	HY5WZ-32/84 Lightning arrester			3	3	3
Utility		voltage measurement+ left connection	voltage measurement+ right connection	voltage measurement+ lightning arrester+ left connection	voltage measurement+ lightning arrester+ right connection	voltage measurement+ lightning arrester+ left connection

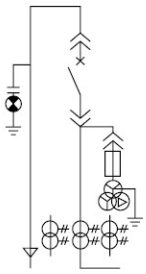
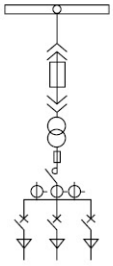
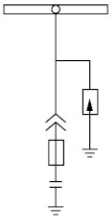
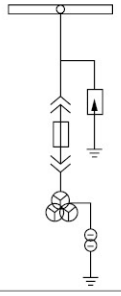
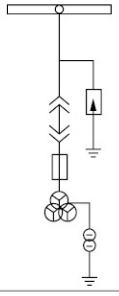
Scheme No.	051	052	053	054	055
Primary connection scheme					
Rated current (A)	630~3150				
Primary mian component: VN2-24、VS1-24 Vacuum circuit breaker					
Primary mian component: LZZB9-24 Current transformer					
Primary mian component: JDZ11-20/JDZX11-20 Current transformer	/3				
Primary mian component: XRNP-24 0.5A HV fuse	3				
Primary mian component: JN15-24 Earthing switch					
Primary mian component: HY5WZ-32/84 Lightning arrester	3				
Utility	voltage measurement+ lightning arrester+ right connection	connection (right)	connection(left)	separate	separate+ connection(left)

Scheme No.	056	057	058	059	060
Primary connection scheme					
Rated current (A)	630~3150				
Primary mian component: VN2-24、VS1-24 vacuum circuit beaker					
Primary mian component: LZZB9-24 Current transformer					
Primary mian component: JDZ11-20/JDZX11-20 Current transformer		2/	2/		
Primary mian component: XRNP-24 0.5A HV fuse		3	3		
Primary mian component: JN15-24 Earthing switch					1
Primary mian component: HY5WZ-32/84 Lightning arrester					
Utility	separate+ connection(right)	separate+connection (left) voltage measurement	separate+connection (right) voltage measurement	wire income and outgoing	separate

Scheme No.		061	062	063	064	065
Primary connection scheme						
Rated current (A)		630~3150				
Primary mian component	VN2-24、VS1-24 Vacuum circuit breaker					
	LZZB9-24 Current transformer	2	2	3	3	2
	JDZ11-20/JDZX11-20 Current transformer	2/	2/	2/	2/	/3
	XRNP-24 0.5A HV fuse	3	3	3	3	3
	JN15-24 Earthing switch					
	HY5WZ-32/84 Lightning arrester					
Utility		measurement + right connection	measurement + left connection	measurement + left connection	measurement + right connection	measurement + left connection

Scheme No.		066	067	068	069	070
Primary connection scheme						
Rated current (A)		630~3150				
Primary mian component	VN2-24、VS1-24 vacuum circuit beaker				1	1
	LZZB9-24 Current transformer	2	3	3	2	2
	JDZ11-20/JDZX11-20 Current transformer	/3	/3	/3	2/	2/
	XRNP-24 0.5A HV fuse	3	3	3	3	3
	JN15-24 Earthing switch					
	HY5WZ-32/84 Lightning arrester					
Utility		measurement + right connection	measurement + left connection	measurement + right connection	wire income+ measurement	wire income+ measurement

Scheme No.		071	072	073	074	075
Primary connection scheme						
Rated current (A)		630~3150				
Primary mian component	VN2-24、VS1-24 Vacuum circuit breaker	1	1	1	1	1
	LZZB9-24 Current transformer	3	3	2	2	3
	JDZ11-20/JDZX11-20 Current transformer	2/	2/	/3	/3	/3
	XRNP-24 0.5A HV fuse	3	3	3	3	3
	JN15-24 Earthing switch					
	HY5WZ-32/84 Lightning arrester					
Utility		wire income+ measurement	wire income+ measurement	wire income+ measurement	wire income+ measurement	wire income+ measurement

Scheme No.		076	077	078	079	080
Primary connection scheme						
Rated current (A)		630~3150				
Primary mian component	VN2-24、VS1-24 vacuum circuit beaker	1				
	LZZB9-24 Current transformer	3				
	JDZ11-20/JDZX11-20 Current transformer	/3	as user requires,[1] the dry one is recommended	BM24/$\sqrt{3}$-16-1 [3] parallel condenser	/4	/4
	XRNP-24 0.5A HV fuse	3	XRNT 3	XRNT 3	3	3
	JN15-24 Earthing switch				3	3
	HY5WZ-32/84 Lightning arrester			3		
Utility		wire income+ measurement	all transformer cabinets (applicable cabinet width)	condenser cabinet	voltage measurement+ lightning arrester	voltage measurement+ lightning arrester

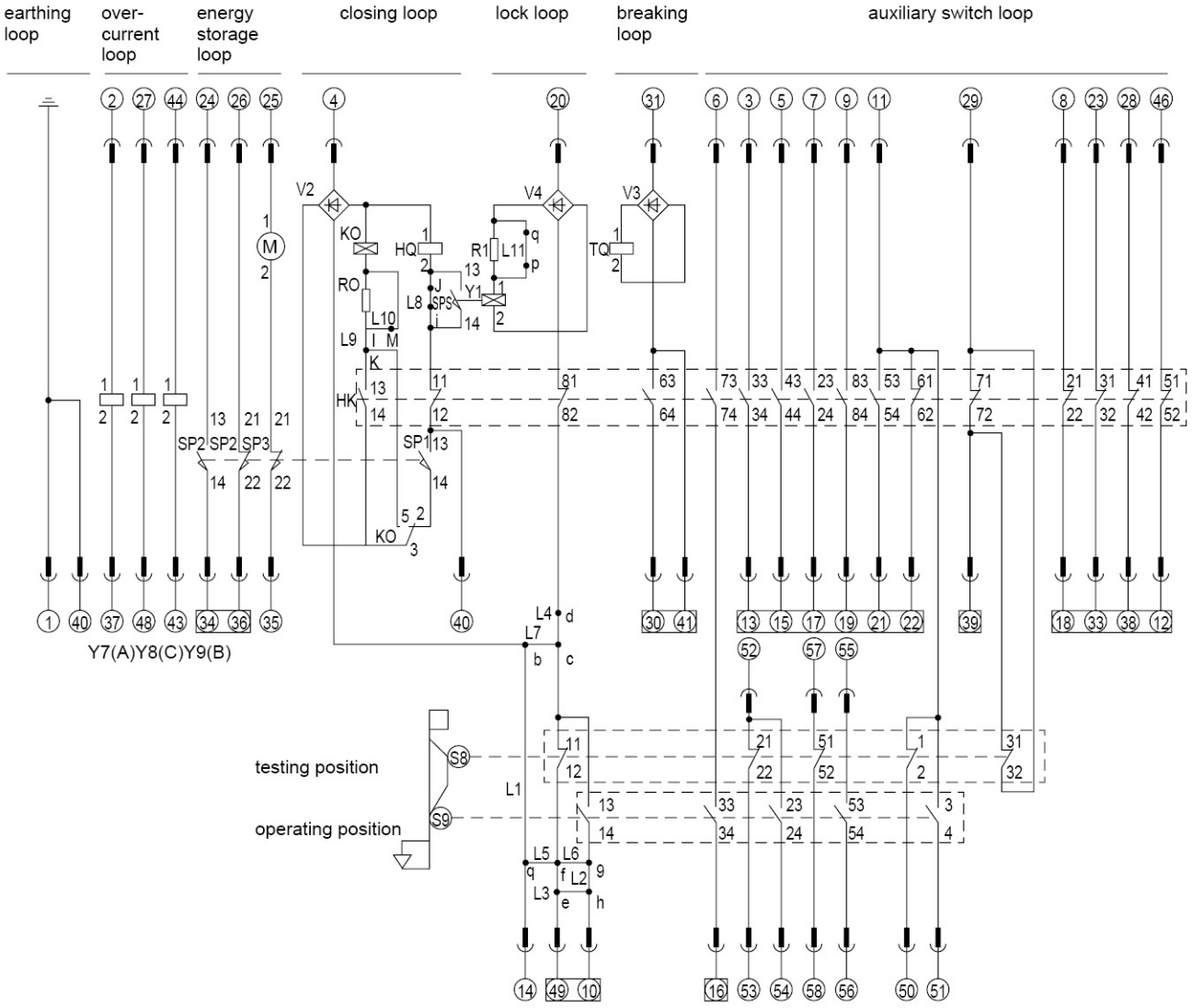


Figure 6. VS1,VN2 circuit breaker (handcart) inner control diagram

Technical requirements

a. Switch status: no energy storage; breaking position; handcart testing position;

b. Control loop is 1mm2, earthing wire is 2.5mm2;

c. XT is 58–core aeronautic plug;

d. Y7, Y8, Y9, Y1 and KO are optional;

e. Optional functions refer to the table.

(Note: KO,V1–V4,L1–L11,A1–A14,B–B15,R0–R1 are the components on the circuit board.)

DELIXI

Symbol	Item	function
HQ	closing electromagnet	closing
TQ	breaking electromagnet	breaking
M	energy storage motor	store energy for switch closing or breaking
HK	auxiliary switch	handover of breaking or closing
V1~V4	current rectification component	current rectification
XT	aeronautic plug	control wires concourse
LXø	terminal	connect handcart link
KO	anti–trip relay	prevent switch tripping
SP1~SP4	fretting switch	handover after closing spring store energy
SP5	limit switch	lock
S8	chassis auxiliary switch	handover at testing position
S9	chassis auxiliary switch	handover at operation position
Y1	lock electromagnet	control closing loop
R0~R1	resistance	pressure resistance
Y7~Y9	over-current release	over-current protection
L1~L11	link	function handover

link / wire No. / configuration		L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11
		ba	gh	fe	dc	af	fg	cb	ij	kL	Lm	pq
with anti-hop function	with lock	■	■	■	■					■		
	without lock					■	■	■	■	■		
without anti-hop function	with lock	■	■	■	■							
	without lock					■	■	■	■			
AC/DC 110V											■	■
AC/DC 220V												

Note: ■ indicates connection and blank indicates disconnection.

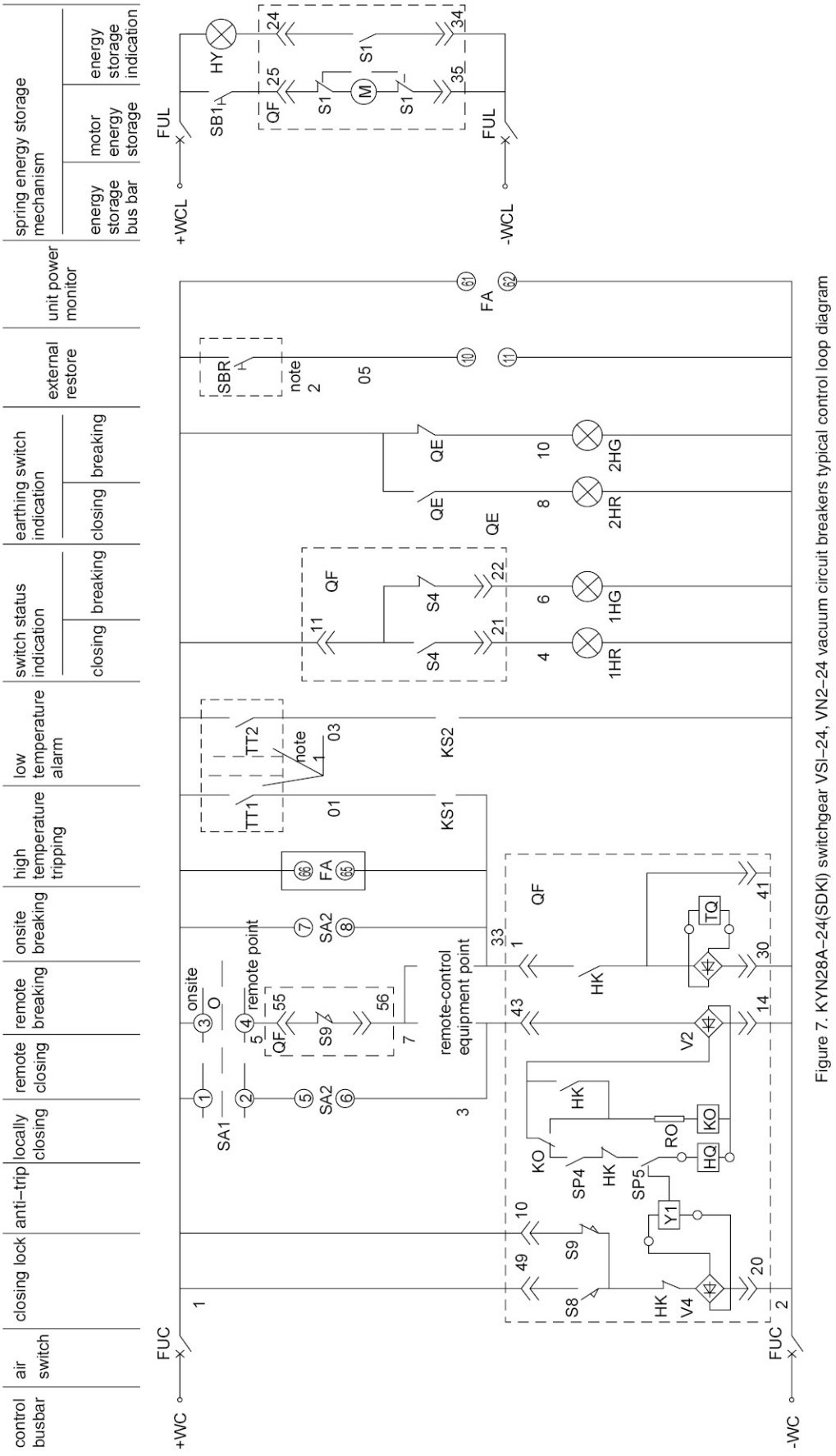


Figure 7. KYN28A–24(SDKI) switchgear VSI–24, VN2–24 vacuum circuit breakers typical control loop diagram

KYN61A–40.5
Metal–clad AC Draw–out Switchgear

1. Introduction

KYN61A–40.5 Metal–clad AC draw–out switchgear is designed by Xi'an High Voltage Apparatus Research Institute and developed by Shanghai Delixi Group Co. Ltd.

KYN61A–40.5 Switchgear is equipped with ZN85A, ZN85B vacuum circuit break, or SF1, SF2 from Schneider Company, or FP series SF6 circuit breaker from ALSTOM Company. The switchgear adopts assembled structure, which improves the appearance and production precision. The busbar adopts pyrocondensation insulating material and epoxy coating insulation. The shape of the electrode is optimized with a compact cabinet structure. It has perfect "5–defend" functions. KYN61A–40.5 Switchgears are used for 40.5kV three phase AC 50Hz electric power system. They are used to distribute electric power for power plants, electrical substation and power distribution control rooms of industrial and mining establishments. It can control, protect and monitor electric circuits. Except for general electric power system, they can also be used in places where a lot of operations are in need. The working environment is in accordance with normal working environment prescribed in GB3906"3.6–40.5kV AC Metal Enclosed Switchgear".

2. Model specification

K Y N 61A – 40.5 □ / □ – □

- Rated Breaking Current(kA)
- Rated Current(A)
- Type of Circuit Breaker
- Rated Voltage(kV)
- Design Number
- Working Condition: Indoor
- Structure Characteristic: Draw–out Type (Handcart Type)
- Product Name: Metal–clad

3. Working environment

1.Environment temperature: –10℃ – +40℃ ;
2.Altitude: lower than 1000m;
3.Relative humidity of air: Day average no more than 95%, month average no more than 90%.
4.Earthquake intensity: no more than 8 degrees.
5.It cannot be used in places with corrosive or flammable gas, steam or other distinct pollutions.
Notes: In case the working conditions cannot meet the requirements above, users can negotiate with the manufacturer.

4. Technical parameters

4.1 Rated Parameters of KYN61A–40.5 Switchgear

Item		Unit	Parameter
Rated voltage		kV	40.5
Rated current		A	1600,2000
Rated short circuit drop out current		kA	25,31.5
Rated short circuit making current		kA	63,80
Dynamic current (peak value)		kA	63,80
4s thermal current (valid value)		kA	25,31.5
Rated insulation ability	Lightning impact withstand voltage	kV	185
	Main circuit 1 min power frequency withstand voltage		95
Size(width × depth × height)	With ZN85A	m	1.2 × 2.6 × 2.4
	With ZN85B		1.4 × 2.8 × 2.8
Protection degree	Shell/inside		IP3X/IP2X

4.2 Rated Parameters of KYN61A–40.5 Switchgear

Item	Unit	Parameter
Rated voltage	kV	40.5
Rated current	A	1250,1600,2000
Rated short circuit drop out current	kA	25,31.5
Rated short circuit making current	kA	63,80

Continues

Dynamic current (peak value)		kA	63,80
4s thermal current (valid value)		kA	25,31.5
Rated insulation ability	Lightning impact withstand voltage	kV	185
	Main circuit 1 min power frequency withstand voltage		95
Rated frequency		Hz	50
Rated operating sequence			O-0.3s-CO-180s-CO
Mechanical life		Times	10000
Making time		ms	50~100
Opening time		ms	35~60

4.3 Rated Parameters of ZN85B–40.5 Vacuum Circuit Breaker

Item		Unit	Parameter
Rated voltage		kV	40.5
Rated current		A	1250、1600、2000
Rated short circuit drop out current		kA	20、25、31.5
Rated short circuit making current		kA	50、63、80
Dynamic current (peak value)		kA	50、63、80
4s thermal current (valid value)		kA	20、25、31.5
Rated insulation ability	Lightning impact withstand voltage	kV	185
	Main circuit 1 min power frequency withstand voltage		95
Rated frequency		Hz	50
Rated operating sequence			O-0.3s-CO-180s-CO
Mechanical life		Times	10000
Making time		ms	40~100
Opening time		ms	20~60

4.4 Rated Parameters of FP 40 series SF6 circuit breaker

Item		Unit	Parameter
Rated voltage		kV	40.5
Rated current		A	400、630、800、1250、1600、2000
Rated short circuit drop out current		kA	12.5、16、20、25
Rated short circuit making current		kA	31.5、40、50、63
Dynamic current (peak value)		kA	31.5、40、50、63
3s thermal current (valid value)		kA	12.5、16、20、25
Rated insulation ability	Lightning impact withstand voltage	kV	185
	Main circuit 1 min power frequency withstand voltage		95
Rated operating sequence			O-0.3s-CO-180s-CO
Mechanical life		Times	10000
Making time		ms	65~95
Opening time		ms	36~55

4.5 Rated Parameters of SF Series Schneider SF6 circuit breaker

Item		Unit	Parameter
Rated voltage		kV	40.5
Rated current		A	630、1250、2000
Rated short circuit drop out current		kA	25、31.5
Rated short circuit making current		kA	63、80
Dynamic current (peak value)		kA	63、80
3s thermal current (valid value)		kA	25、31.5
Rated insulation ability	Lightning impact withstand voltage	kV	185
	Main circuit 1 min power frequency withstand voltage		95
Rated operating sequence			O-0.3s-CO-180s-CO

Continues

Mechanical life	Times	10000
Making time	ms	70~90
Opening time	ms	30~60

4.6 Rated Parameters of ZN85B–40.5 Vacuum Circuit Breaker

Item		Unit	Parameter
Rated voltage		kV	40.5
4s thermal current (valid value)		kA	25,31.5
Dynamic current (peak value)		kA	63,80
Rated short circuit making current (peak value)		kA	63,80
Rated insulation ability	Lightning impact withstand voltage	kV	185
	Main circuit 1 min power frequency withstand voltage		95
	Secondary circuit 1 min power frequency withstand voltage		2

5. Structure Characteristics

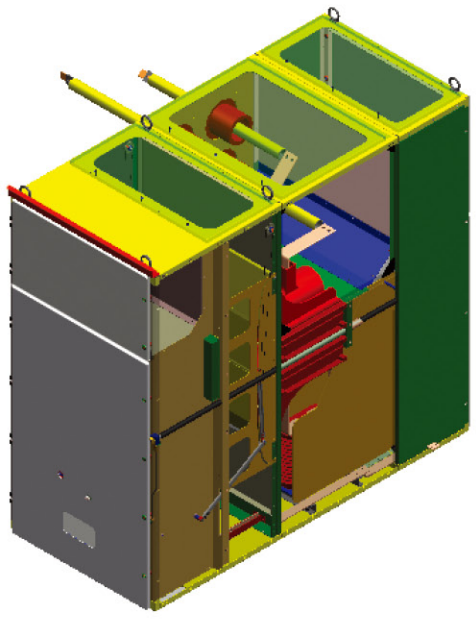


Figure 1. Structure of KYN61A–40.5 switchgear

Overview

The switchgear consists of two parts, one is cabinet and the other one is handcart. The main cabinet is made of bending sheet steel and assembled by bolts. The classic scheme (see Figure 2), the cabinet has four sections, such as relay meter cabinet, handcart room, cable room and bus bar in terms of the electric equipment functions inside the switchgear. Each part is separated by the earthing metal separator. Protection level of its shell is IP3X. When the door of handcart opens, the circuit breaker handcart is at breaking/test position with a protection level of IP2X.

The switchgear has several kinds of schemes, including incoming and outgoing cables, incoming and outgoing overhead cables, busbar connections, disconnector, voltage transformer, lightning arrester. In the cable room, there are current transformers, earthing switch. More cables can be connected owning to enough spare space.

A metal valve is installed in front of the contact box. The upper and lower valves open automatically when the handcart moves from breaking/test position to the operation position. On the contrary, they close when the handcart moves backwards to form separation zone.

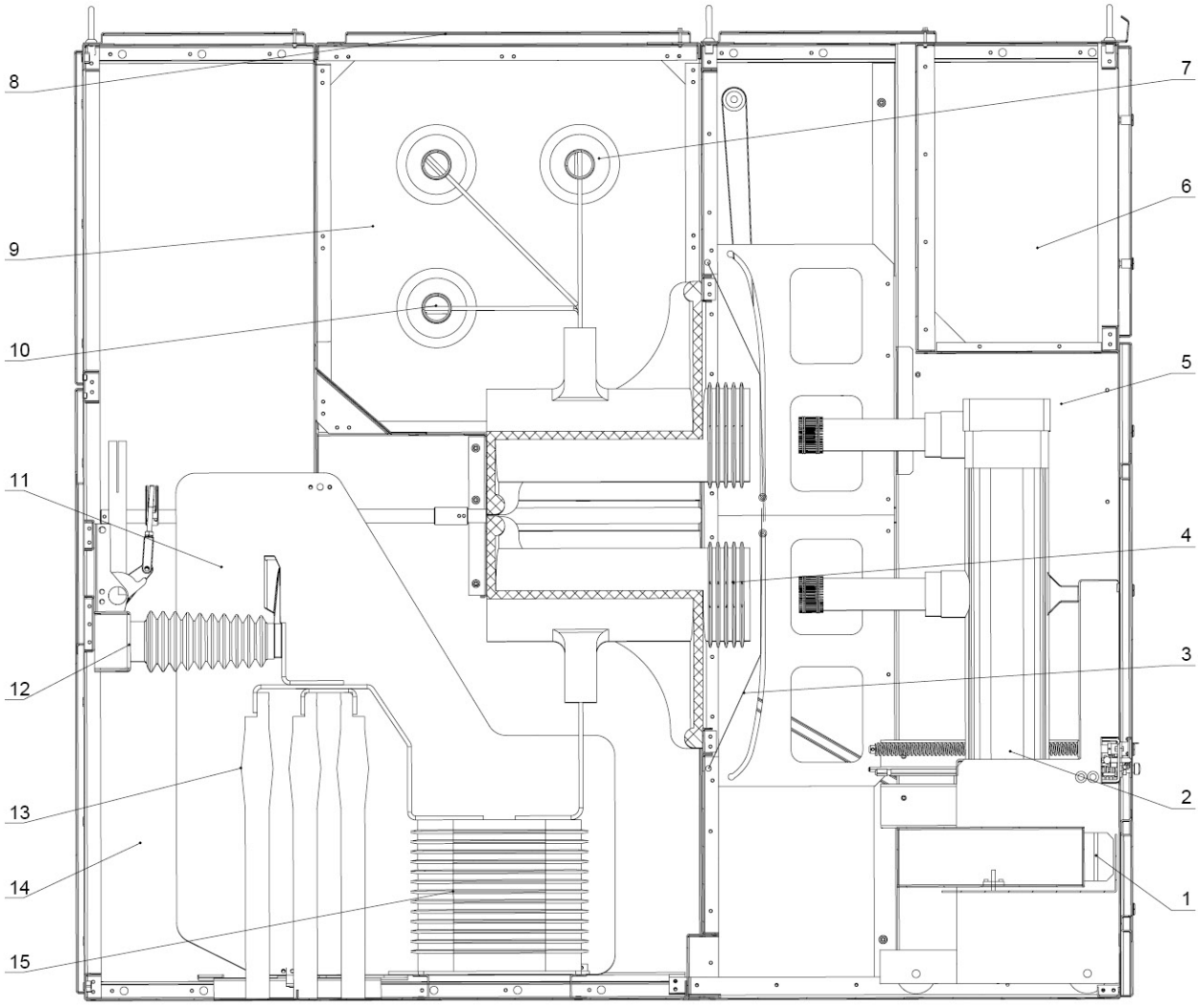


Figure 2. Inner Structure of KYN61A–40.5 Switchgear Typical Scheme

1. Secondary plug
2. Circuit breaker handcart
3. Valve
4. Contact box
5. Circuit breaker room
6. Meter room
7. Busbar casing
8. Pressure relief covers
9. Busbar room
10. Main busbar
11. Insulation separator
12. Earthing switch
13. Power cable
14. Cable room
15. Current transformer

5.1 Circuit Breaker Handcart

A fully insulated vacuum circuit breaker or SF6 circuit breaker is installed in the handcart. Handcart frame is equipped with screw nut feed mechanism and overrunning clutch. The screw nut feed mechanism can be operated easily to make handcart move between breaking/test site and operation site. With the help of screw nut self-locking performance, handcart can be locked at operation site stably, defending the force occurred by electrodynamics. The overrunning clutch will work after handcart moves to breaking/test site and before handcart moves to operation site. It makes operation shaft blank spin by separating it from guide screw axis. This design avoids fault operation to damage the feed mechanism.

5.2 Interlock

Interlock devices between main switch, handcart, earthing switch and cabinet doors, which are applied mandatory mechanical latch. It satisfies "five-defend" function.

The circuit breaker can be closed only when the circuit breaker handcart is on the breaking/test site or working site. In addition, when the circuit breaker is closed, the handcart feed mechanism cannot work, in order to avoid moving circuit breaker handcart with load.

The circuit breaker handcart can move from breaking/test site to working site only when the earthing switch is separated. The earthing switch can process switch-on operation only when the circuit breaker handcart is at breaking/test site. In this way, closing earthing switch with load is avoided.

When the circuit breaker handcart is at test or operation site without control voltage, manual breaking can be processed while manual closing is not permitted.

When the circuit breaker handcart is at the operation site, the secondary plug is locked and cannot be removed.

5.3 Busbars

The main busbar is supported by the branch busbar and busbar bushing. Adjacent cabinets are separated with busbar bushing . It stops accidents spreading effectively, as well as be as support for the busbar. The busbar adopts shrinking insulating bushing or vulcanization coating technology to form a reliable compound insulation.

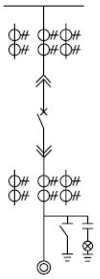
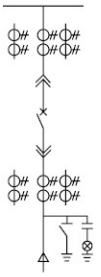
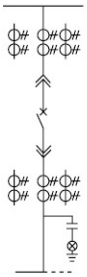
5.4 Voltage Monitoring Device

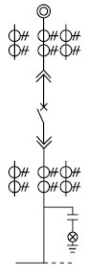
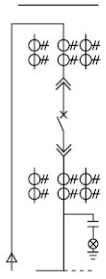
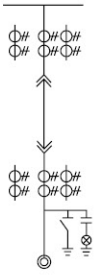
Voltage monitoring insulator is combined with the earthing switch as a whole. The terminal display device is placed at the front of the switchgear. It can emit visible light at 50% of the rated voltage. As a result, it provides a reliable human safety solution.

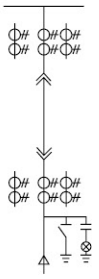
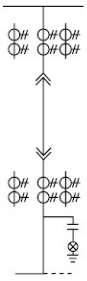
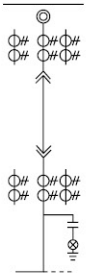
5.5 Anti-condensation solution

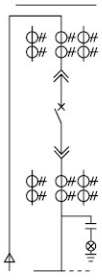
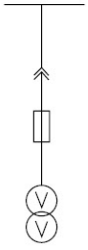
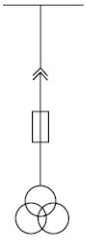
Heaters are installed in circuit breaker room and cable roomd to avoid hazards of condensation resulted from high humidity or temperature fluctuation

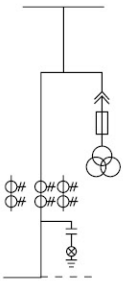
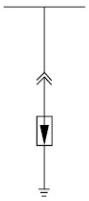
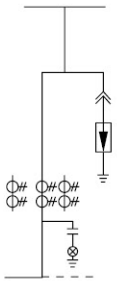
6. Primary connection schemes

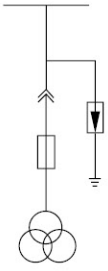
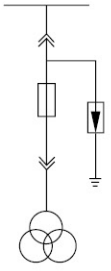
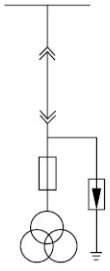
Scheme No.		01～11	12～22	23～33
Main connection diagram				
Main electric equipmentsM	Current transformer LDBJ/	0～3	0～3	0～3
	Vacuum circuit breaker ZN85A/ZN85B	1	1	1
	Current transformer LZZB9/LZZB12	0～3	0～3	0～3
	Earthing switch JN□	0～1	0～1	
	Supporting insulator ZNZ	0～3	0～3	0～3
	Usage	Overhead cable-in (out)cabinet	Cable-in(out)cabinet	Left(right)connection cabinet

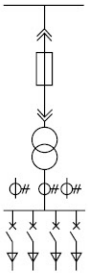
Scheme No.		34～44	45～55	56～66
Main connection diagram				
ain electric equipments	Current transformer LDBJ/	0～3	0～3	0～3
	Vacuum circuit breaker ZN85A/ZN85B	1	1	
	Current transformer LZZB9/LZZB12	0～3	0～3	0～3
	Earthing switch JN□			0～1
	Supporting insulator ZNZ	3～9	3～9	0～3
	Usage	Overhead cable-in and connectioncabinet	Cable-in and connection cabinet	Overhead cable-in (out)separation cabinet

Scheme No.		67～77	78～88	89～99
Main connection diagram				
Main electric equipmentsM	Current transformer LDBJ/	0～3	0～3	0～3
	Vacuum circuit breaker ZN85A/ZN85B			
	Current transformer LZZB9/LZZB12	0～3	0～3	0～3
	Earthing switch JN□	0～1		
	Supporting insulator ZNZ	0～3	0～3	3～9
	Usage	Cable-in(out) separation cabinet	Left(right) connection separation cabinet	Overhead cable-in and connection separation cabinet

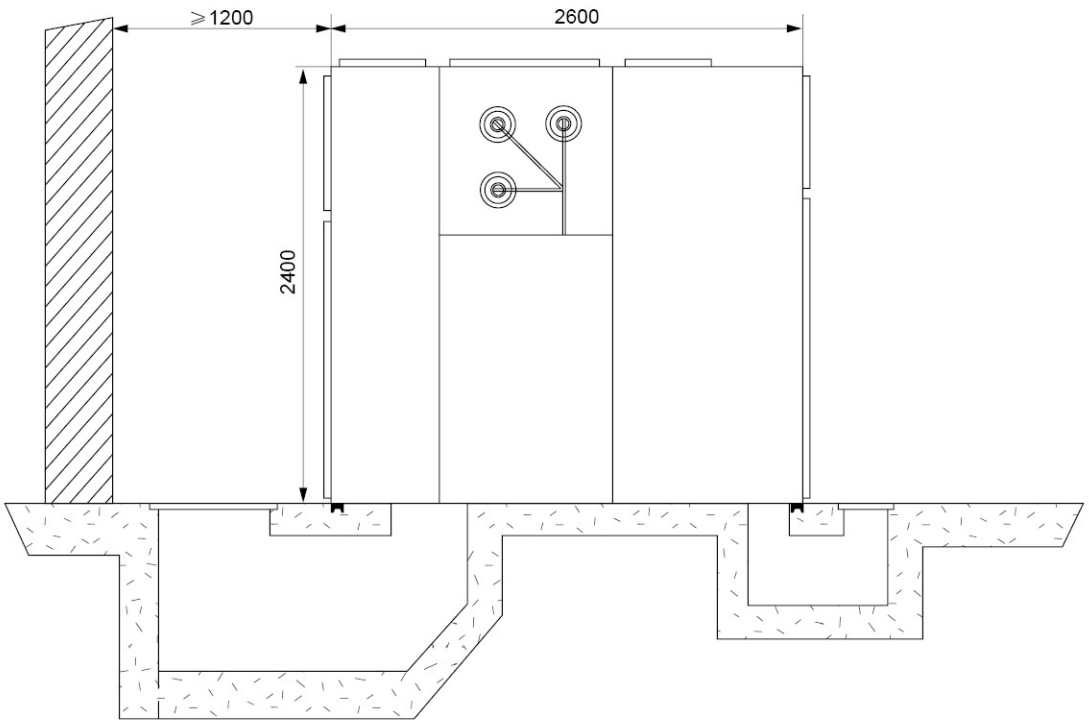
Scheme No.		100～109	110～111	112
Main connection diagram				
ain electric equipments	Current transformer LDBJ/	0～3		
	Vacuum circuit breaker ZN85A/ZN85B	1		
	Current transformer LZZB9/LZZB12	0～3		
	Earthing switch JN□		2～3	3
	Supporting insulator ZNZ		1～2	3
	Usage	Cable-in and connection separation cabinet	Voltage transformer cabinet	Voltage transformer cabinet

Scheme No.		113～116	1171	18～120
Main connection diagram				
Main electric equipments	LZZB9/LZZB12 Current transformer LDB9/LZZB12	0～3		0～3
	XRNP-0.5A Fuse XRNP-0.5A	2～3		
	JDZ9/JDZX-35 Voltage transformer JDZ9/JDZX9-35	1～2		
	Lightning arrester carriage YH5WZ-51/YH5CZ□-42		3/group	3/group
	Usage	Voltage transformer and left (right) connection cabinet	Lightning arrester cabinet	Left(right)connection and liggtning arrester cabinet

Scheme No.		121～122	123～124	125～126
Main connection diagram				
Main electric appliance	Fuse XRNP-0.5A	2～3	2～3	2～3
	Voltage transformer JDZ9/JDZX9-35	1～2	1～2	1～2
	Lightning arrester carriage YH5WZ-51/YH5CZ□-42	3/group	3/group	3/group
	Usage	Voltage transformer and lightning arrester cabinet	Voltage transformer and lightning arrester cabinet	Voltage transformer and lightning arrester cabinet

Scheme No.		127～130
Main connection diagram		
Main electric equipments	Fuse carriage XRNP-□A	3/group
	Transformer used SC9-50kVA	1
	Current transformer LMK	0～3
	Air switch CDM 1/DZ47	0～6
	Usage	Transformer cabinet used (50KVA and lower)

6. Scheme of foundation installation



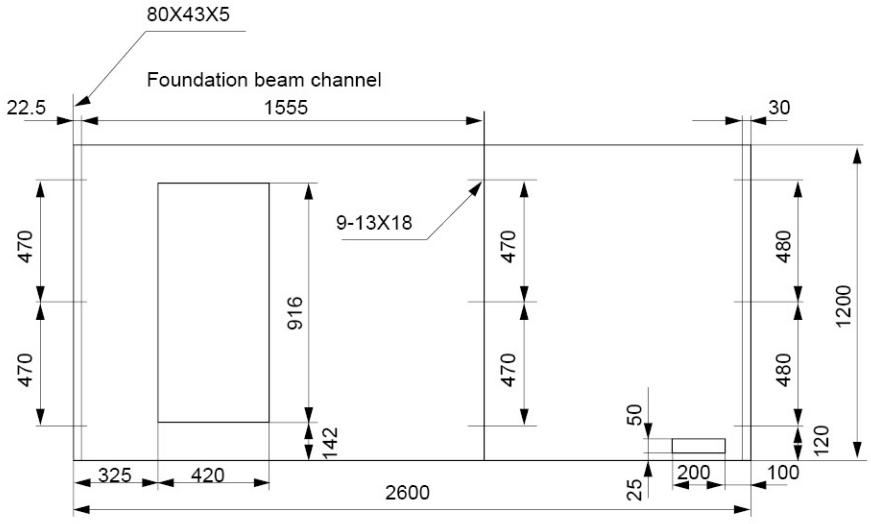


Figure 3. KYN61A–40.5 Switchgear used ZN85A–40.5 vacuum circuit breaker installation foundation figure and size of base plate hole

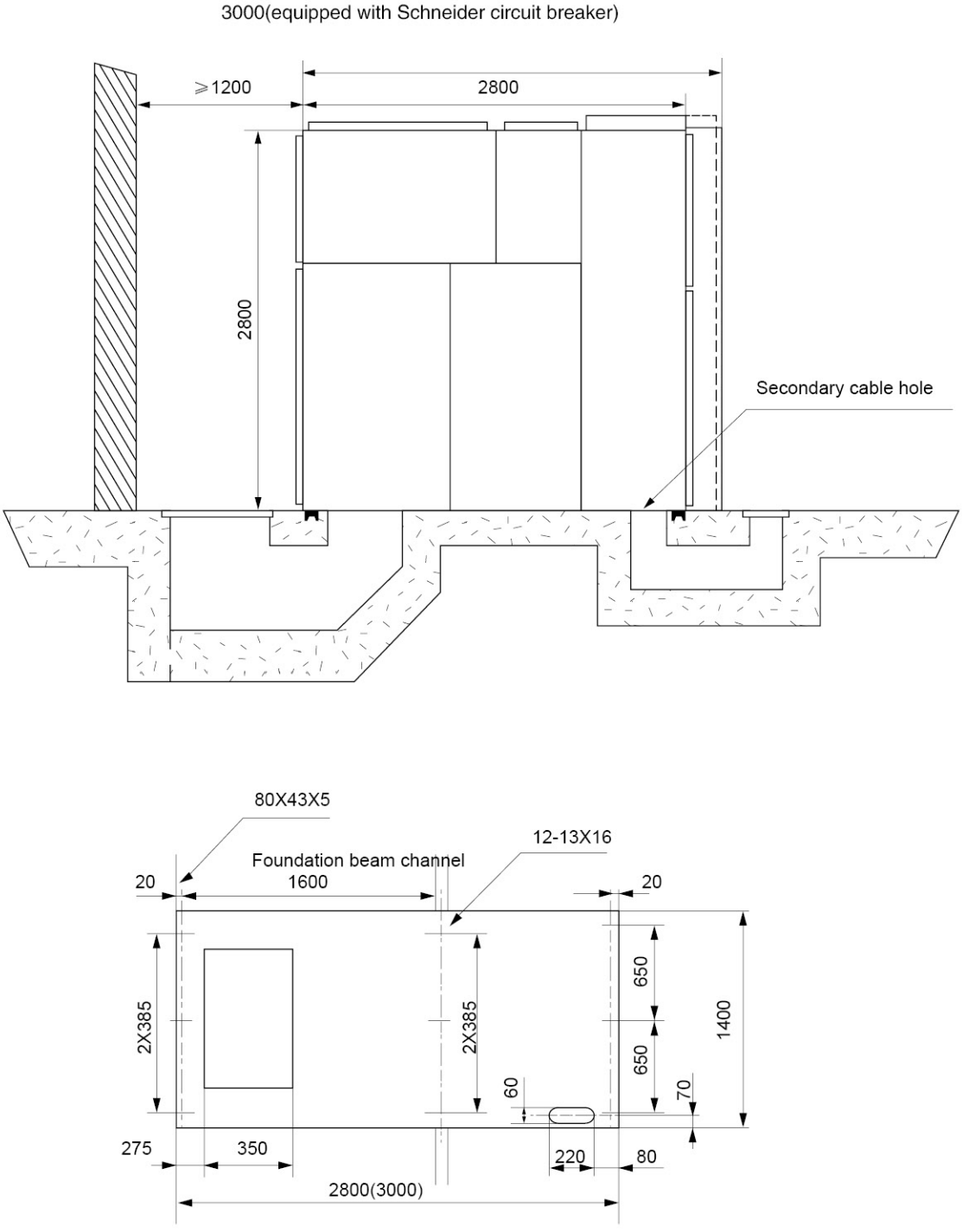
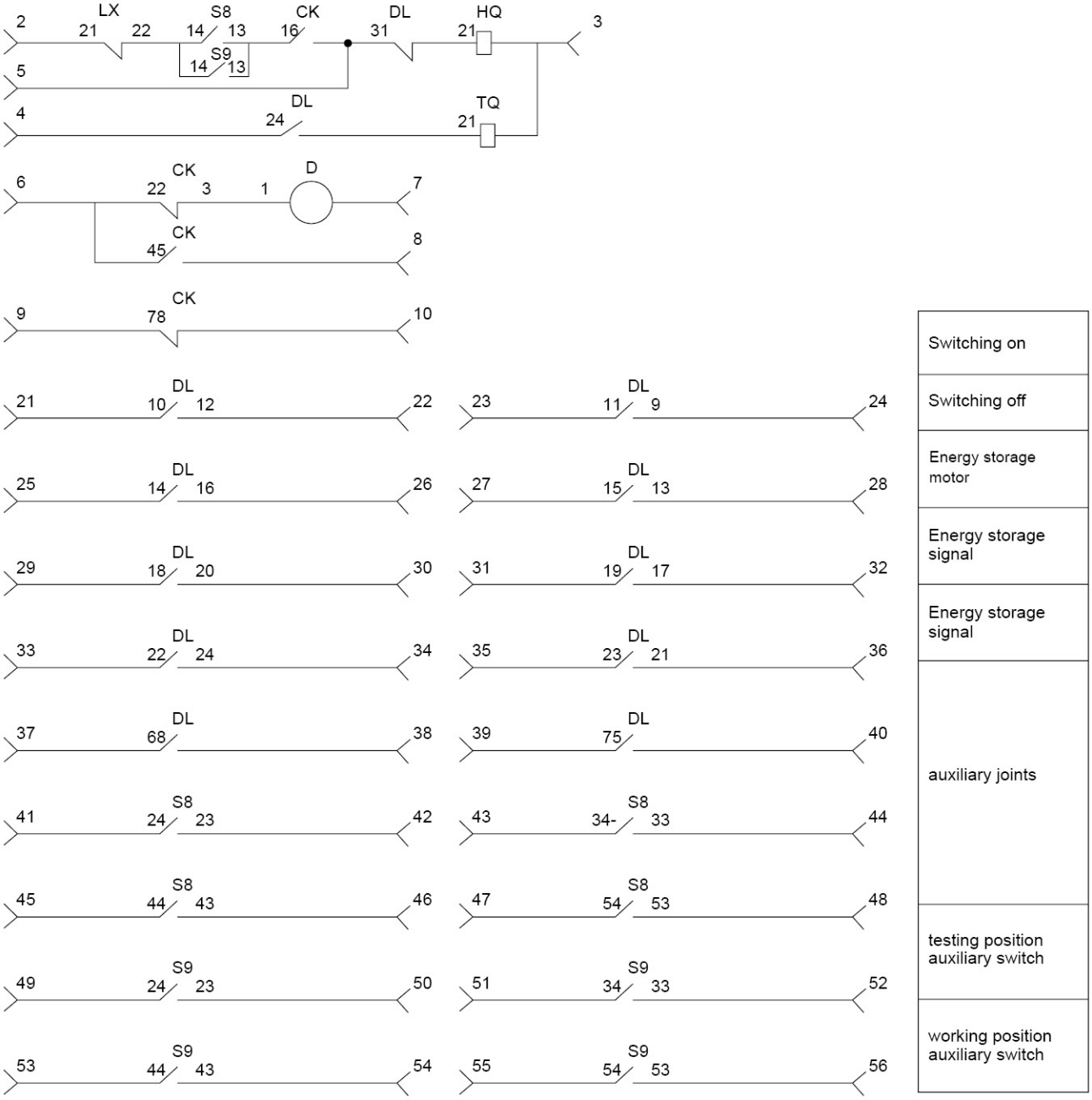
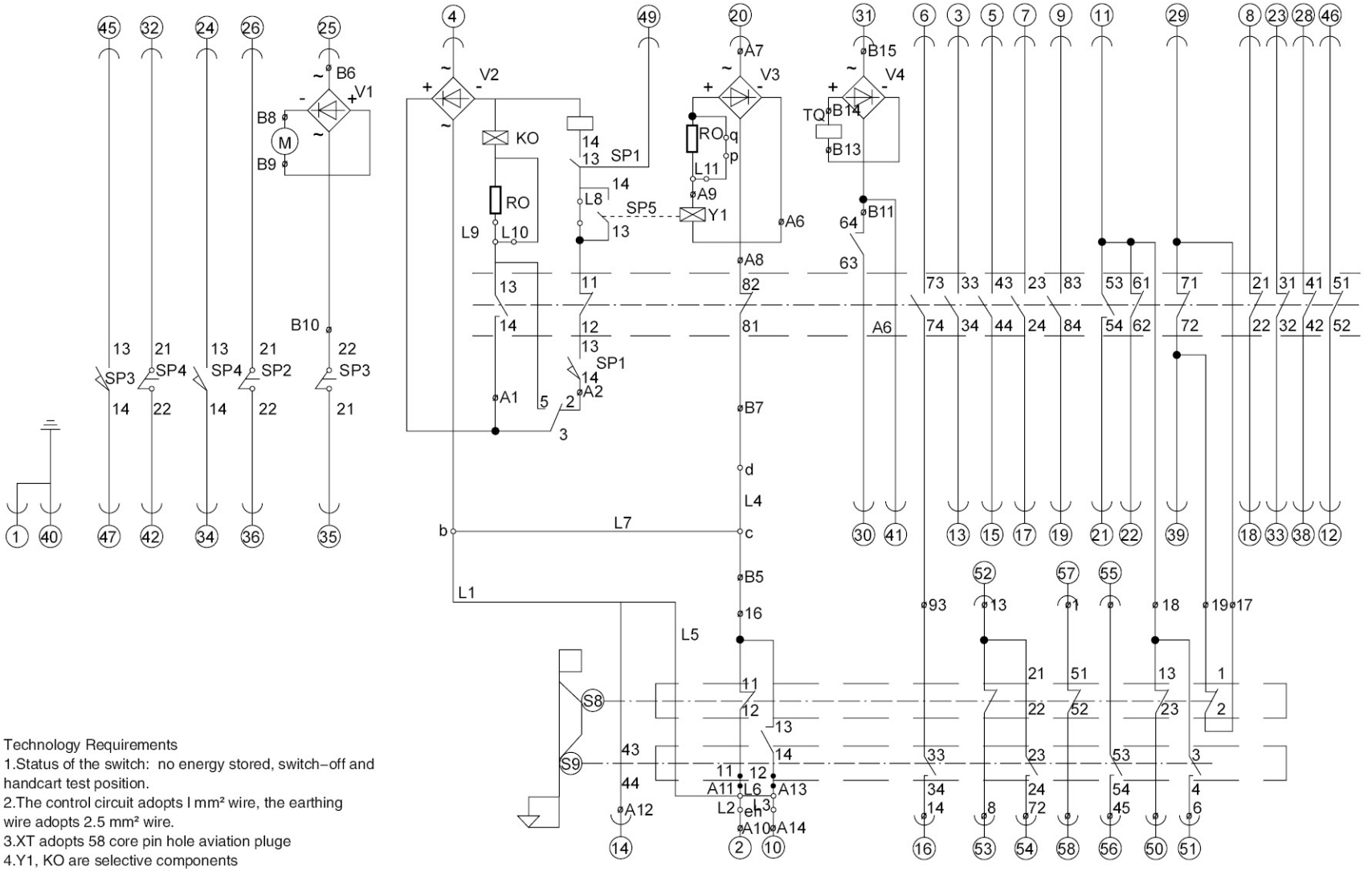


Figure 4. KYN61A–40.5 Switchgear used ZN85A–40.5 vacuum circuit breaker installation foundation figure and size of base plate hole



Schematic Diagram of ZN85A–40.5 Vacuum Circuit Breaker

No.	Code.	Name	Item No.Q	TY	Remark
1	LX	Sensitive switch	LXW20-11	1	
2	CZ	Secondary plug	CZ-46	1	
3	DL	Auxiliary switch	Spring operate mechanism inner accessories	1	
4	CK	Travel switch	Spring operate mechanism inner accessories	2	
5	HQ	Closing coil	Spring operate mechanism inner accessories	1	
6	TQ	Opening coil	Spring operate mechanism inner accessories	1	
7	D	Energy storage motor	Spring operate mechanism inner accessories	1	
8	JX	Connection terminal	Spring operate mechanism inner accessories	24	
9	S8	testing position auxiliary switch	FK10-Ⅱ	1	
10	S9	working position auxiliary switch	FK10-Ⅰ	1	



Technology Requirements
1.Status of the switch: no energy stored, switch–off and handcart test position.
2.The control circuit adopts I mm² wire, the earthing wire adopts 2.5 mm² wire.
3.XT adopts 58 core pin hole aviation pluge
4.Y1, KO are selective components
5.Selective function configuration
6.When used in DC circuits, remove VI, V2, V3 and V4.

Symbol	Name	Function
HQ	Switching on electromagnet	Control switch on
TQ	Switching off electromagnet	Control switch off
M	Energy storage motor	Storing energy for switching on
HK	Auxiliary switch	Breaking/closing switchover
V1~V4	Rectifier cell	Rectifying for the circuit
XT	Aviation plug	Collection of controlling wire
LX0	Connection terminal	Connecting to handcart wire
KO	Anti–tripping relay	Protect the switch from tripping
SPI~SP4	Sensitive Switch	Switch over after the spring stores energy
SP5	Limit switch	Latch function
S8	Chassis auxiliary switch	Switchover at the test position
S9	Chassis auxiliary switch	Switchover at the working position
Y1	Latching electromagnet	Control the closing circuit
RO–RI	Resistor	Divider resistance
Y7~Y9	Over coated trip	Overcurrent protection
L1~L11	Connection wire	Function conversion

Connection / Line No. / Arrangement		L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11
		ba	gh	fe	dc	af	fg	cb	ij	kl	lm	pq
With anti-tripping functions	With enclose	■	■	■	■					■		
	Without enclose					■	■	■	■	■		
Without anti-tripping functions	With enclose	■	■	■	■							
	Without enclose					■	■	■	■			
AC/DC 110V											■■	
AC/DC 220V												

Note: ■ indicates connection, blank indicates open

7. Information required when ordering

7.1 No. of main connection scheme, single line system diagram and arrangement diagram.
7.2 Secondary circuit connecting schematic diagram and terminal arrangement diagram.
7.3 Type, specification and quantity of electric components inside the switchgear.
7.4 Make comments if the switchgear is used in a special environment.
7.5 Declare the type and quantity when need accessories and spare parts.
7.6 Special requirements and environment need to be written in the contact.
(Note: If SF6 product is needed, the lead time will be extended.)