

GPR2 Series

Gas Insulated Ring Main Unit





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Human quests for transcendence, with transcendence we make progress, when the pursuit of unlimited become a belief, our dream began to realize.

Hard-working, dedicated GreenPower people, will be adhering to its past glory, beginners mind, let go sailing, to face the fierce competition in the future, and always help customers make the best choice, and strive to become the best and most reliable procurement service provider in the eld of industrial electrical.

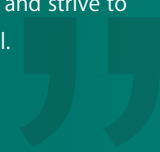


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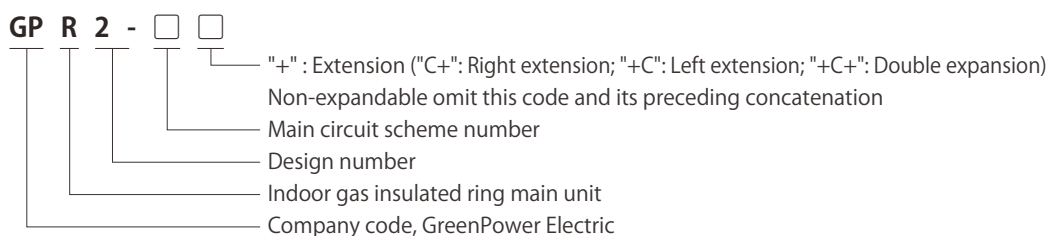
01 Product overview

GPR2 gas insulated ring main unit (hereinafter referred to as GPR2 ring main unit) is a complete set of indoor power distribution devices with three-phase AC 50/60Hz. It is a new generation of common-box gas-insulated closed switchgear in China. Its technology absorbs the advanced advantages of similar products at home and abroad, and meets the requirements of domestic users in terms of insulation. GPR2 ring main unit is equipped with SF₆ load switch or circuit breaker with international advanced level.

GPR2 ring main unit adopts SF₆ gas as insulation and arc extinguishing medium. SF₆ gas has strong electronegativity, high dielectric strength, and the dielectric strength is 2~3 times that of air. It is non-toxic, odorless, non-flammable, non-explosive, and has excellent arc extinguishing and insulation properties, making the load switch/circuit breaker extinguish the arc quickly after breaking the current. Its internal design is compact and small, saving space and resources. The gas tank is welded with stainless steel and has a fully sealed structure. The operating mechanism adopts spring type, with simple structure and flexible operation, and the operating speed is not affected by the human strength. The mechanism has perfect mechanical locking and reliable interlocking. The modular design can be flexibly combined into various power distribution schemes to meet the various needs of different occasions and different users.

At the same time, in order to meet the needs of power grid development and reduce the initial investment cost of users, our company has developed an expandable GPR2 ring main unit, and reserved expansion interfaces for users to choose and use.

1.1 Product model and meaning



1.2 Scope of application

GPR2 ring main unit is suitable for 3.6~24kV three-phase AC 50/60Hz power system, as the use of receiving and distributing electric energy. It is widely used in oil-free, high-safety and reliable small power distribution stations, opening and closing stations, urban residential quarters, airports, railways, tunnels and high-rise buildings, etc. It is especially suitable for various places with harsh or dirty environmental conditions such as industrial and mining enterprises, mountainous areas, plateaus, and coastal areas.

1.3 Use environmental conditions

- a. Altitude: Less than 3000m;
 - b. Ambient temperature: Maximum +40℃ , Minimum -25℃ ;
 - c. Earthquake intensity: Not exceeding 8 degree;
- Use in environments that can withstand dust, moisture, and short-term immersion in water.

Note: When the actual use environment conditions are inconsistent with the above conditions, please consult with our company.

1.4 Applied standards

IEC 62271-100:2012 High Voltage AC Circuit Breaker
 IEC 62271-102:2012 High Voltage AC Isolating Switch and Earthing Switch
 IEC 62271-200 High Voltage Switchgear and Controlgear
 IEC 60694:2002 Standard Common Technical Requirements for High Voltage Switchgear and Controlgear
 IEC 60298:1990 AC Metal-enclosed Switchgear and Controlgear Above 1kV and Below 52kV
 IEC 60265-1:1998 High Voltage Load Switch Part 1: Load Switch with Rated Voltage Above 1kV and Below 52kV
 GB 3906-2006 3.6kV~40.5kV AC Metal-enclosed Switchgear and Controlgear
 GB 3804-2004 3.6kV~40.5kV High Voltage AC Load Switch
 GB 1984-2003 High Voltage AC Circuit Breaker
 GB 16926-2009 AC High Voltage Load Switch - Fuse Combination Electrical Appliance
 GB 1985-2004 High Voltage AC Isolating Switch and Earthing Switch
 GB 3309-1989 Mechanical Test of High Voltage Switchgear at Normal Temperature
 GB/T 11022-2011 Standard Common Technical Requirements for High Voltage Switchgear and Controlgear
 DL/T 791-2011 Selection Guide for Indoor AC Inflatable Switchgear

1.5 Advanced technology

- The main parts and springs of the mechanism are imported materials to ensure reliable operation, and the operating lifetime of the load switch and circuit breaker can reach 5000 times.
- The injection molding parts and sealing parts have advanced processing technology, and have been strictly tested, and the service lifetime is ≥ 30 years.
- Advanced equipment such as ABB automatic welding robot and Leybold helium leak detection system are used to ensure that the annual relative leakage rate of SF₆ gas is less than or equal to 0.1%.
- Using vacuum dehumidification technology, the micro-water content of SF₆ gas can be controlled to be less than or equal to 150ppm.
- The three-position straight cylinder blowing load switch can easily break the 2200A transfer current in the application of the combined electrical unit.
- The inflation pressure is low, only the gauge pressure is 0.02MPa. And under the rated working condition of zero gauge pressure, the switchgear can operate normally and can realize 10 times of rated current switching.
- The circuit breaker adopts a three-position gas blowing arc extinguishing and magnetic swirl arc extinguishing integrated arc extinguishing chamber, and the breaking and isolation functions are performed synchronously.
- User-friendly, visual grounding system. The opening and closing status of the grounding switch can be clearly observed through the transparent observation window.

1.6 Technical performance

1.6.1 Functional structure composition

GPR2 ring main unit is composed of small and compact functional units. The functional unit consists of the following parts:

- Stainless steel sealed gas tank enclosure
Load switches, earthing switches, circuit breakers, busbars, etc. can be installed in the enclosure.
- Cable box
It can be connected to the grid or transformer through the interface.
- Secondary instrument box
- Operating mechanism box
- Fuse box
Can be combined with load switch to install separate and insulated fuse cartridges.
It can be connected to the transformer through the interface.

1.6.2 Sealed gas insulation system

In the GPR2 ring main unit, the sealed stainless steel box is filled with SF₆ gas of rated pressure as insulation and arc extinguishing medium.

- SF₆ gas has strong electronegativity, high dielectric strength, and the dielectric strength is 2~3 times that of air. It has excellent arc extinguishing and insulating properties, ensuring that the switchgear can quickly extinguish the arc after breaking the current.
- The stainless steel metal gas tank is equipped with a good grounding device to ensure the safety of the operator.
- Advanced automatic welding equipment ensures the sealing performance of the gas tank when it is working.
- The gas tightness of the gas chamber is strictly inspected before leaving the factory, and the performance is reliable and the service lifetime of more than 30 years is guaranteed.
- All components in the gas tank are maintenance-free within 30 years of service lifetime.

1.6.3 Advanced arc extinguishing technology

● Load switch

Adopt SF₆ compressed gas arc extinguishing principle.
A compact, mature and reliable arc extinguishing technology.

● Breaker

Using the arc extinguishing technology of arc rotation and SF₆ gas self-diffusion, it can reliably cut off any current up to the short-circuit current.

● Arc fault

This series cabinet designed for withstand the arc fault according to IEC 62271-200: IAC A FL class: 20kA 1s;

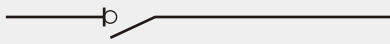
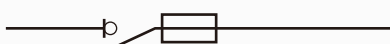
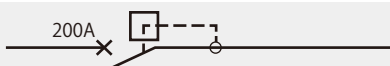
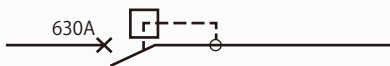
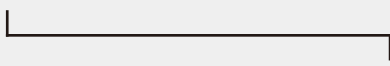
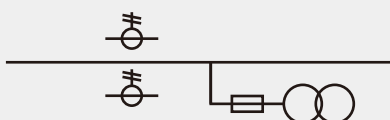
1.6.4 Breaking current capability

The load switch of GPR2 ring main unit is grade E3/M2 load switch, and the circuit breaker is grade E2/M1, namely:

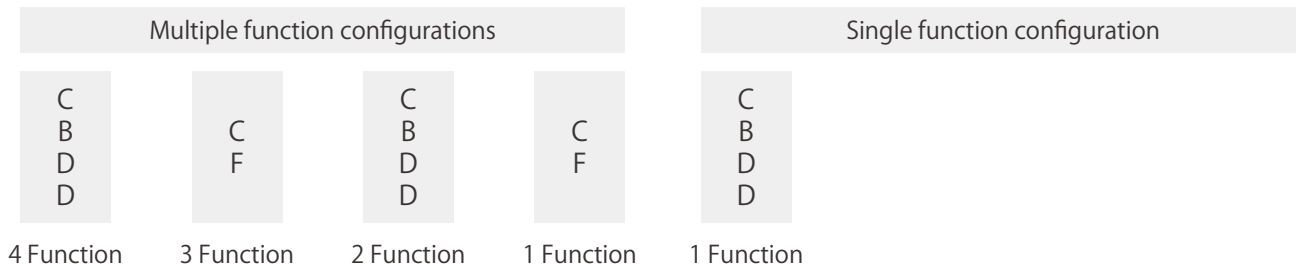
- At rated current and load power factor of 0.7, 200 "on/off" operations.
- The load switch is designed to meet 5,000 mechanical "open/close" operations, and the circuit breaker is designed to meet 2,000 mechanical "close/close" operations.
- 200 "on/off" operations at rated current.

1.6.5 Feature selection

GPR2 ring main unit can provide 1~5 functions selected by users to form a ring main unit, which can also be used as a transformer feed switch.

● Load switch	C	
● Load switch - fuse combined electrical appliances	B	
● 200A Circuit Breaker	D	
● 630A Circuit Breaker	D	
● Riser unit	L	
● Connection unit	F	
● Metering unit	M	

1.6.6 Function combination



Example of function combination: BF, DC, CBC, +CBC+, DCDC; Can be combined arbitrarily according to user needs.

1.6.7 Technical parameters of GPR2 Gas Insulated Ring Main Unit

No.	Item		Unit	Technical parameter					
				Load switch	Combination electrical appliance		Breaker	Load switch	Combination electrical appliance
1	Rated voltage		kV	12			24		
2	Rated frequency		Hz	50/60					
3	Main busbar rated current		A	630					
4	Rated current		A	630	125*	200	630	125*	200
5	Rated short-circuit breaking current		kA			630			630
6	Rated transfer current		A		31.5*	20		31.5*	16
7	Rated short circuit duration		A		2200			1400	
8	Rated short circuit duration		s	3					
9	Rated short-time withstand current (RMS)		kA	20		20	20		20
10	Rated peak withstand current		kA	20		50	50		50
11	Load switch and earthing switch rated short-circuit close current (peak)		kA	50		50	50		50
11	Power frequency withstand voltage (1min)	Phase to phase/earth	kV	42			50 (65)		
		Across the isolation distance		48			64 (79)		
12	Lightning impulse withstand voltage	Phase to phase/earth	kV	75			95 (125)		
		Across the isolation distance		85			110 (145)		
13	Rated active load breaking current		A	630					
14	Rated closed loop breaking current		A	630					
15	Rated no-load transformer breaking current		A	16					
16	Rated cable charging breaking current		A	30					
17	Mechanical endurance		times	5000					
18	SF ₆ gas rated pressure (20℃) gauge pressure		MPa	0.02~0.03					
19	Annual leakage rate of SF ₆ gas		%	≤ 0.1					

Note: *The rated current and rated short-circuit breaking current of the combination electrical appliance unit are determined according to the fuses provided;

The selection of technical parameters in () should be specified when ordering.

1.7 Factory inspection

GPR2 gas insulated ring main unit must pass the following 9 tests strictly before leaving the factory:

- Loop resistance detection
- SF₆ gas pressure detection
- Partial discharge test
- Secondary wiring detection
- Closing/opening synchronicity detection
- Micro water content detection
- Mechanical property test
- Air tightness detection
- Withstand voltage test

02 The structure of the cabinet

GPR2 ring main unit is mainly composed of cabinet body and sealed stainless steel gas tank. The cabinet is divided into operating mechanism box, cable box, secondary instrument box, etc. Each functional unit and cable box are separated into independent compartments by metal plates, which do not interfere with each other, which can effectively prevent the influence of faults in a single compartment to other compartments for maximum control over the scope of failure. Busbars, load switch, circuit breaker, connecting conductor, etc. are all installed in a sealed stainless steel gas tank, and SF6 gas is used as the insulating and arc extinguishing medium, which is small volume and simple in structure.

The protection level of the GPR2 ring main unit enclosure is IP3X, and the protection level of the stainless steel gas tank is IP67.

The enclosure of the GPR2 ring main unit and the partitions of the cable compartments of each functional unit are made of high-quality cold-rolled steel plates processed and bent by CNC machine tools and other equipment, and assembled with high-strength rivets and nuts and bolts, with high mechanical strength and excellent corrosion resistance. Compared with similar equipment, it has the advantages of high precision, light weight, high mechanical strength, beautiful appearance, etc. At the same time, due to the modular design, the versatility and interchangeability of parts and components are improved, which can effectively shorten the processing cycle and reduce production area. The surface spraying process of the cabinet adopts the most advanced electrostatic powder automatic spraying production technology in the world. It has the advantages of beautiful finish, strong adhesion, corrosion resistance, high hardness, anti-aging, and good gloss and color retention.

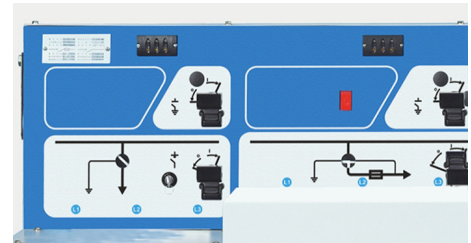
2.1 Cabinet

2.1.1 Operating mechanism

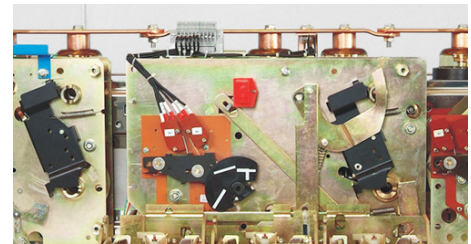
The operating mechanism box is located on the front upper part of the GPR2 ring main unit. Its height has been verified by ergonomics, which is labor-saving and convenient, and is suitable for operation. The operating mechanism adopts spring energy storage type, the operating speed is stable, and is not affected by the human strength.

The electrical and mechanical operating mechanisms are located on the back of the panel, and the analog bus can reliably display 3 positions of the switch: closing, opening, earthing.

- Closing: The moving contact is controlled by the snap action operating mechanism:
 - For the load switch, except for controlling the movement of the moving contact, there is no energy storage function;
 - For circuit breakers and load switch-fuse combination electrical appliance, when the contacts are closed, the operating mechanism can store energy at the same time.
- Disconnection: The disconnection of the switch is realized by the opposite direction action of the same quick-action operating mechanism.
Circuit breakers and load switch-fuse combination electrical appliance are disconnected by:
 - Button operation implementation.
 - Fault trip implementation.
- Earthing: The specially designed operating handle is inserted into the earthing switch operating hole to close or open the earthing contact.
The earthing switch operating hole is locked by the interlocking stopper:
 - When the switch is in the open position, the earthing switch operating hole is open.
 - When the switch is in the closed position, the earthing switch operating hole is locked.
- Switchgear Status Indicator:
Mounted directly on the drive shaft.
The three states of the switchgear can be clearly indicated by the indicator.
- Operating handle: The operating handle and mechanism have a unique design structure, which can prevent the load or earthing switch from being opened again immediately after closing.



Operating mechanism panel

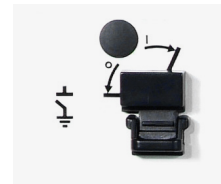


Load switch operating mechanism

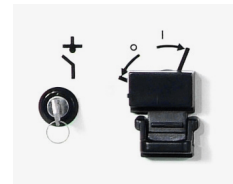


Circuit breaker operating mechanism

- **Locking device:**
1, 2 or 3 padlocks can be added, that is, the operating shaft of the load switch or circuit breaker, the operating shaft of the earthing switch and the opening button, which can prevent misoperation (that is, for locking).
- **Mechanical locking device:**
When the GPR2 ring main unit is applied to dual power supply lines, a set of key locks (2 locks, 1 key) can be added to prevent misoperation, used to lock one incoming line switch when the other incoming line is closed. The switch cannot be closed.



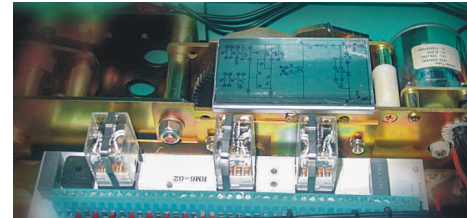
Locking device



Key and lock

2.1.2 Electric operating mechanism

- The motor can choose DC24V power supply, which is safe and reliable.
- The manual operating mechanism is generally configured, and the installation position of the electric operating mechanism is reserved. If the user needs, the electric operating mechanism can be configured at any time.



Electric operating mechanism

2.1.3 Earthing system

User-friendly, visual earthing system:

- There is a mechanical linkage earthing switch position indication system on the panel, and there are clear analog indication signs.
- On the rear upper part of the cabinet, when the earthing switch is opened and closed, the state of the earthing switch can be clearly seen through the transparent glass cover.

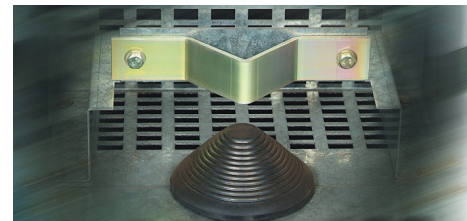


Earthing busbar system

2.1.4 Cable box

The front lower part of the GPR2 Ring Main Unit is the cable box:

- Connected to power grid or transformer through cable interface.
- The cable box, earthing switch, load switch and circuit breaker can be mutually locked by adding a locking device to ensure the safety of maintenance personnel.
- The cable box of each functional unit is separated by a metal partition, which effectively prevents failures in a single compartment from affecting other compartments.
- An observation window is installed on the sealing plate of the cable box, which is convenient for operation and maintenance.

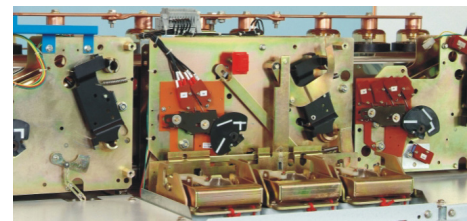


Cable box

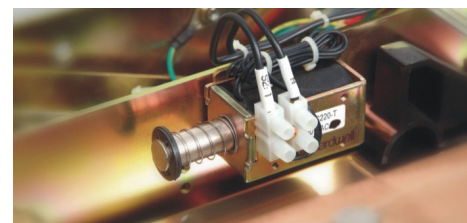
2.1.5 Tripping device

In the load switch-fuse combination electrical appliance and circuit breaker unit, the operating mechanism of the switch device is equipped with mechanical and electrical tripping devices.

- **Load switch-fuse combination electrical appliance unit**
 - **Mechanical tripping device**
When the fuse acts, the spring striker pops out, and the load switch is opened through the mechanical linkage tripping device.
 - **Electrical tripping device**
A tripping coil is installed in the operating mechanism, which can be connected to an external electrical trip or a trip contact of a protection device to open the load switch.
- **Circuit breaker unit**
 - **Electrical tripping device**
A tripping coil is installed in the operating mechanism, which can be connected to an external electrical trip or a trip contact of a protection device to open the circuit breaker.



Combination electrical appliance unit
mechanical tripping device



Electrical tripping device

2.1.6 Fuse

- Three enclosed fuse barrels. The outer layer is metal sprayed, dust-proof and moisture-proof.
- Metal spraying in the fuse barrel. Enhanced insulation properties limit electrical stress.

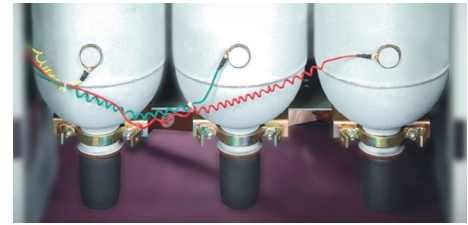
2.1.7 Electriferous display device

- Installed on each functional unit, it is used as a electriferous indication of the internal cable.
- According to user needs, with nuclear phase function.

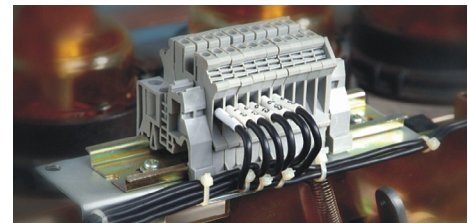
2.1.8 Secondary instrument box

The upper part of the GPR2 ring main unit is the secondary instrument box:

- All ports and spare contact outputs for user wiring are reserved.
- The wiring of each control circuit has been connected at the factory.



Fuse



Secondary instrument box

2.2 Gas tank

2.2.1 Switch device

The switch device has a unique structure and advanced technology:

- The moving contact of the switchgear has three positions of closing, opening and earthing during vertical movement. This design eliminates the possibility of the load switch or circuit breaker being closed at the same time as the earthing switch.
- The earthing switch has a short-circuit making current according to the standard.
- The switch device has dual functions of isolation and breaking.
- The earthing conductor dimension matches the power grid.
- The load switch adopts SF₆ compressed air arc extinguishing technology.
- The circuit breaker adopts the arc extinguishing technology of arc rotation and SF₆ gas self-diffusion, which can reliably cut off any current up to the short-circuit current.
- After the type test of 20kA and 0.5s, the equipment can meet the IAC AF AI class judgment standard specified in Appendix A of GB3906-2006.

2.2.2 Hermetic gas tank

The main primary components and conductors are installed in a hermetic stainless steel gas tank, which is sturdy, reliable and has strong environmental adaptability. There is very little chance of an internal failure.

- The gas tank is filled with SF₆ gas of rated pressure, and the insulation and arc extinguishing performance are reliable.
- The hermetic gas tank has undergone strict inspection and has a long service lifetime, which can guarantee reliable operation for 30 years.
- All components in the gas tank are maintenance-free for 30 years.
- The gas tank welding adopts advanced equipment and automatic welding technology.

2.2.3 Internal arc resistance

The gas tank is made of high-quality stainless steel plate by bending and welding, which can withstand the internal arc under the rated short-circuit current to ensure personal safety.

- The instantaneous overpressure generated by the internal combustion arc can be released by blasting the safety valve at the bottom of the metal shell, and the faulty gas is sprayed to the rear or below of the GPR2 ring main unit, the front of the GPR2 ring main unit is not affected and does not pose any danger to the operator.



Inside the gas tank



Busbar box



High-quality stainless steel gas tank and safety valve

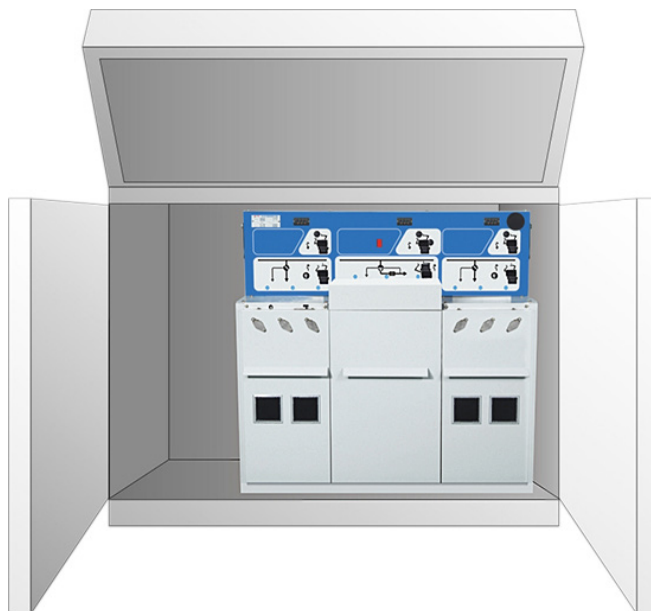
3.1 GPR2 ring main unit scalable series

- The GPR2 ring main unit expandable column allows easy and safe expansion of your power grid, while retaining all the benefits of fixed switchgear.
- The expandable series of GPR2 ring main unit can be expanded on site by merged cabinets without any gas handling and special tools, and without any basic special preparations.
- The expandable series of GPR2 ring main unit can work in the harshest environment just like the non-expandable.



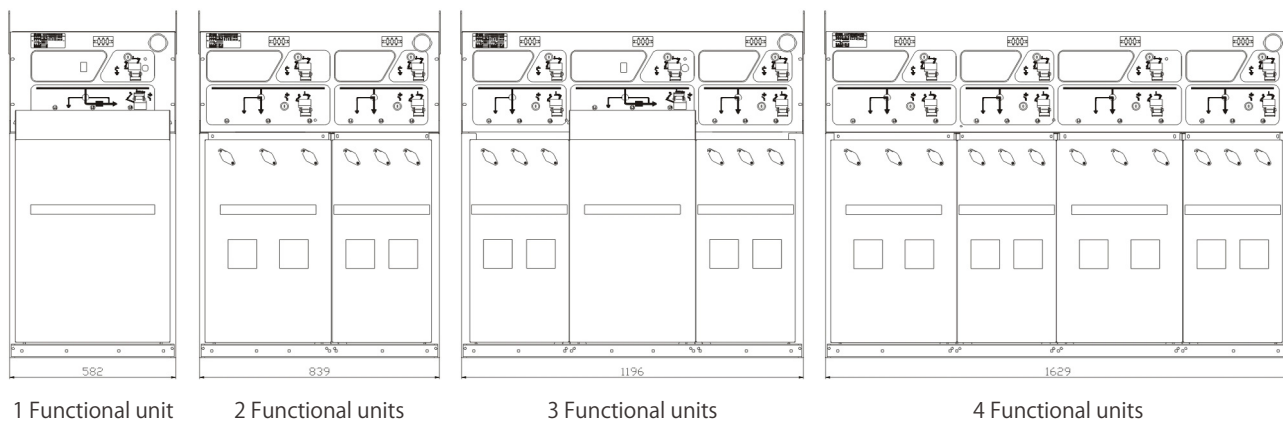
3.2 Outdoor application series

- Matching outdoor cabinets and corresponding accessories can be provided, so that the GPR2 ring main unit can be easily used in outdoor occasions to meet your various needs.
- The GPR2 ring main unit used outdoors can be equipped with an electric operating mechanism, remote operation, control, and communication systems according to the requirements of use to realize the automation function of the power distribution network.
- Outdoor cabinets structure, small footprint, small amount of civil engineering, short construction period, small operation and maintenance workload.



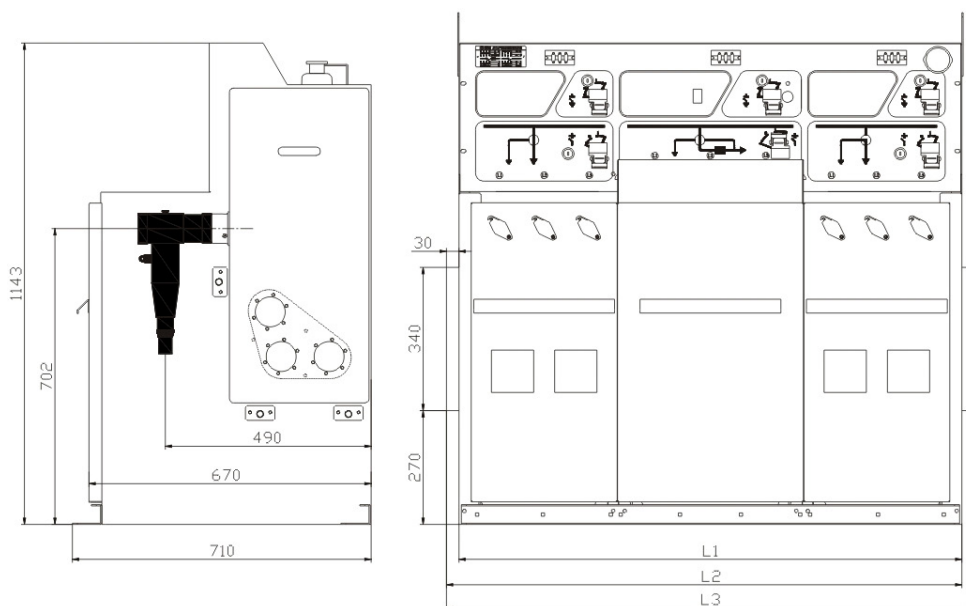
4.1 Outline dimensions

● Non-expandable type



● Expandable type

The external dimensions of the expandable type of GPR2 ring main unit are basically the same as those of the non-expandable type, and the differences are shown in the following figure.



Series size Function series	Non-expandable type L1	Left (right) extension L2=L1+30	Double expansion L3=L1+60
1 Functional unit	582	612	642
2 Functional unit	839	869	899
3 Functional unit	1196	1226	1256
4 Functional unit	1629	1659	1689

Note: The installation dimensions are the same as those of the non-expandable type.

Unit: mm

4.2 Weight

B	D	BC	DC	BF	CBC
190	140	200	185	195	280
CCC	CDC	BCBC	BCCC	CCCC	DCDC
245	255	395	360	325	345

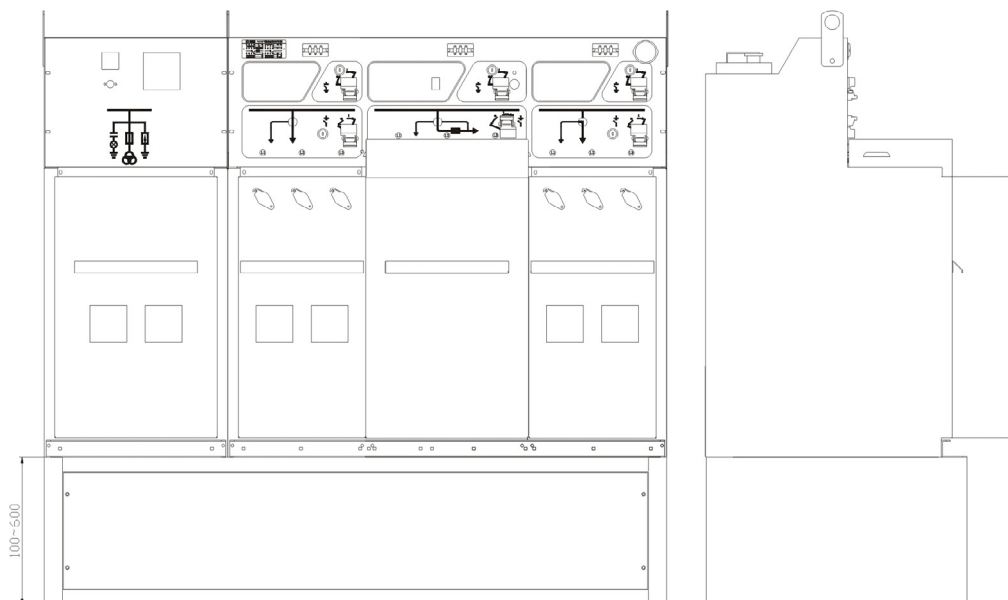
Unit : kg

Note: The non-expandable type and the expandable type of GPR2 ring main unit are basically the same in weight, with a fluctuation of ± 5 kg.

4.3 Additional rise

The GPR2 ring main unit can be installed on a raised base with a height of 100~600mm, see the figure below for details.

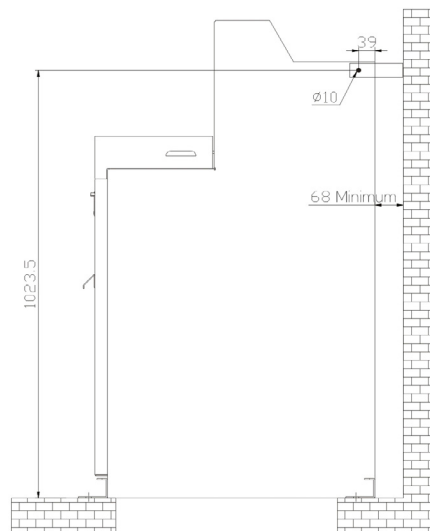
- Adding a raised seat can simplify the civil construction, reduce the depth of the cable trench, and even cancel the cable trench when the cable bending radius allows.
- The raised base can be fixed directly to the ground.



4.4 Installation dimensions

Installed on the wall

Fix it on the wall with the mounting beam, see the picture on the right.

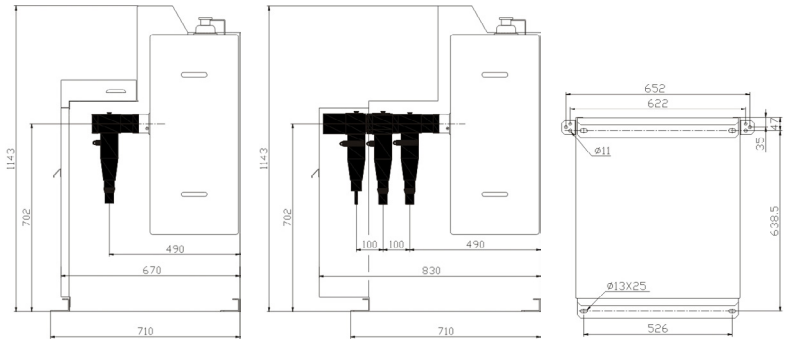


● Installed on the ground

By installation code or installation beam fixed on:

- On the ground of a electriferous cable trench or cable tray
- On cement base
- On anchor bolts
- On metal base

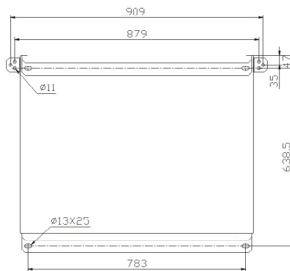
See the picture for details:



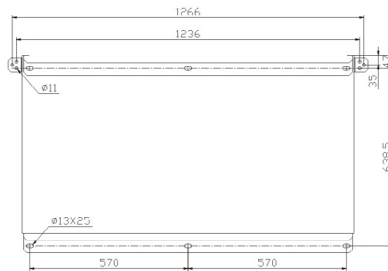
1 or 2 Connectors

3 Connectors

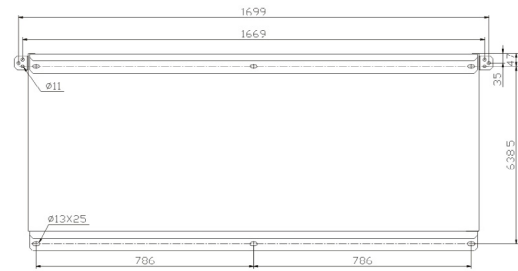
1 Functional unit



2 Functional units



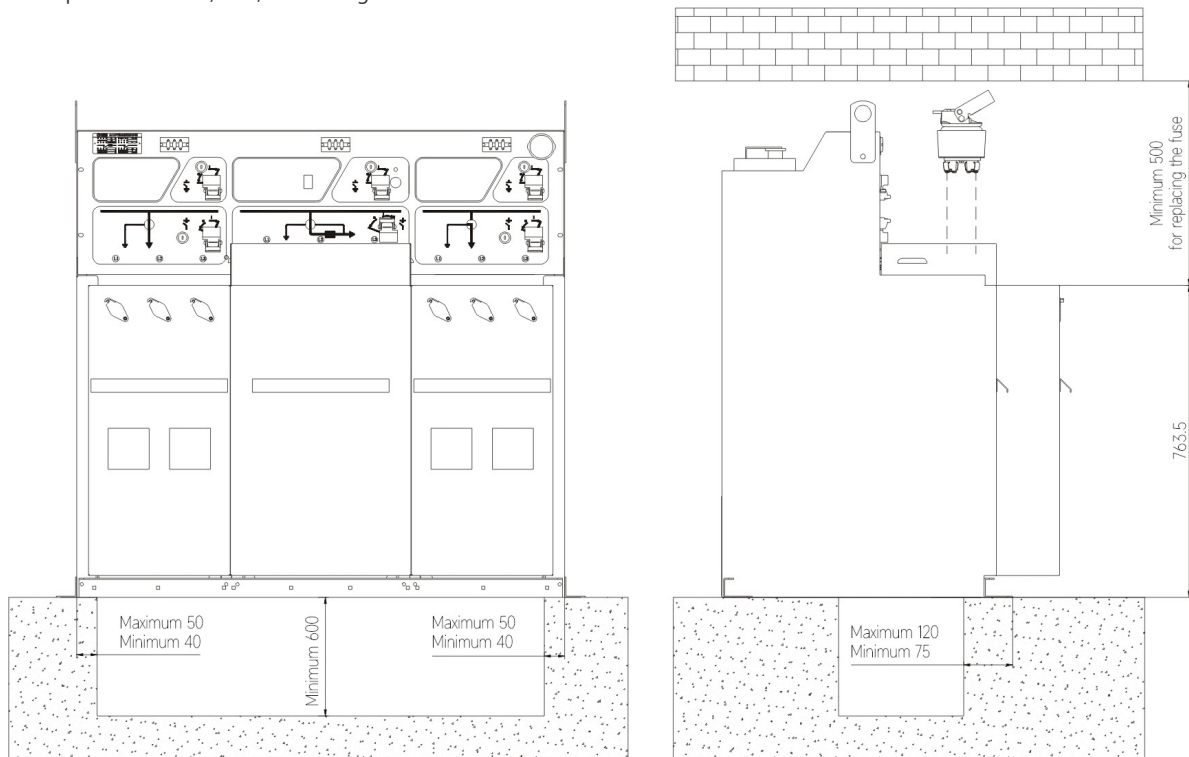
3 Functional units



4 Functional units

4.5 Schematic diagram of cable trench construction

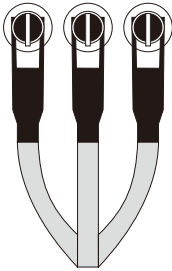
Cables can pass from front, rear, left and right.



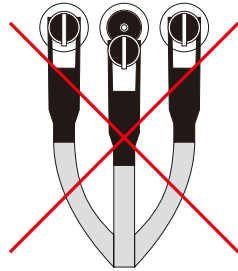
Note: In the case where no cable trench is designed, a raised seat can be selected.

4.6 Cable installation method and precautions

- The center of the cable head must be aligned with the center of the sleeve to ensure that the sleeve is not mechanically stressed.
- The length of each cable must be adjusted properly (especially the three core cable).
- After installing the cable, confirm that the force on the casing is less than 300N or not.



Correct installation



Wrong installation

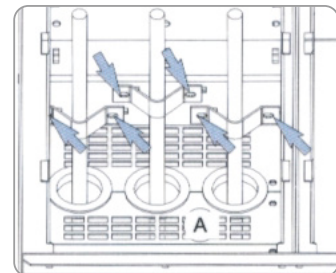
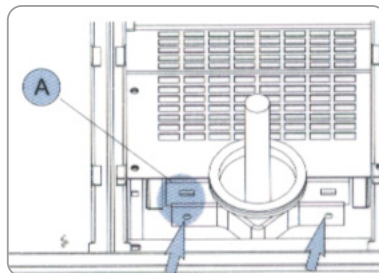
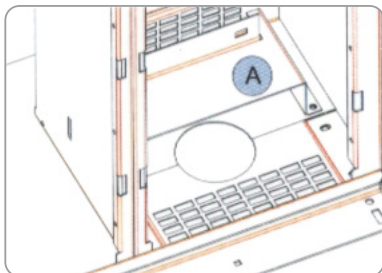
Item	Data	Unit
Torque	50	Nm
Bolt length	40	mm
Bolt specification	M16&5/8	-
Depth of sleeve thread	35	mm

Note: If M12 screws are used, the torque is 40mN.

● Cable installation precautions

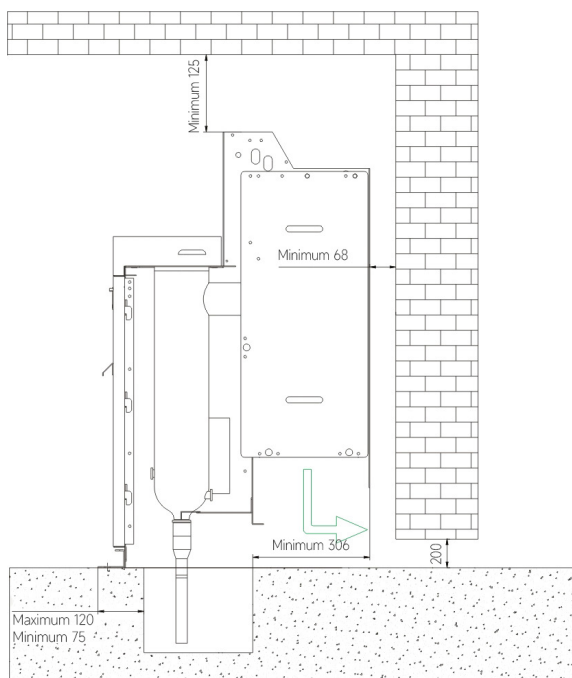
The installation of GPR2 ring main unit cables and the production of cable joints should be carried out by trained personnel who are familiar with the process, and refer to the installation manual and cable head production manual of the ring main unit. If using GPR2 ring main unit for the first time, please contact our company for installation guidance.

- The GPR2 ring main unit must be fixed to the foundation before cable installation can be carried out, in order to avoid exerting force on the cable sleeve due to the movement of the cabinet body after the cable installation is completed.
- Ensure that the depth of the cable trench is suitable for the required bending radius of the cable used, in order to avoid long-term application of force on the sleeve after the cable is excessively bent and connected to the sleeve on the cabinet (please refer to the installation manual for the minimum depth, and it is recommended to deepen it appropriately to facilitate cable bending). Pay attention to phase sequence during cable laying to avoid replacing phase sequence by bending cables in the GPR2 ring main unit in the future.
- Ensure that the cable head is not affected by moisture to prevent dust and debris from falling into the insulation. When GPR2 is used inside outdoor boxes, it is strictly prohibited to install cable heads in foggy or rainy weather.
- The center line of the cable ear installation hole should be consistent with the center of the installation hole on the cabinet sleeve, and the burrs and oxide layer on the ear should be polished to ensure that the ear plane is tightly attached to the contact surface of the sleeve (see the figure on the right below).
- The production of cable heads should be completed continuously starting from the stripping and cutting of the cable to shorten the exposure time of the insulation layer. When peeling and cutting cables, the wire core and the insulation layer that needs to be retained should not be damaged. The stripping length should be adjusted according to each phase, especially for three core cables (see the figure on the right below).
- Before installing the cable head into the connecting sleeve on the GPR2 cabinet, first wipe the insulation surface of the sleeve with a dry cotton cloth, and then evenly apply a thin layer of silicone grease on the surface. The tightening torque of the cable connected to the M16 screw hole is 50Nm (using a torque wrench). After the installation of the cable head, tighten the fixing hook to prevent the cable head from slipping, except for the heat shrink cable head. When connecting the plug-in cable head of the GPR2-B function fuse underground, special attention should be paid to checking the fixing measures to prevent the cable head from slipping.
- The grounding copper braided tape of each phase of the cable should be reliably connected to the GPR2 cabinet shell, with a sturdy torque of 28Nm.
- After the installation of the cable head is completed, fix the cable with the cabinet body using a cable clamp with a fixing torque of 18Nm. When fixing the three core cable, it is necessary to flip the bracket downwards to ensure sufficient cable branching space (see the left figure below).

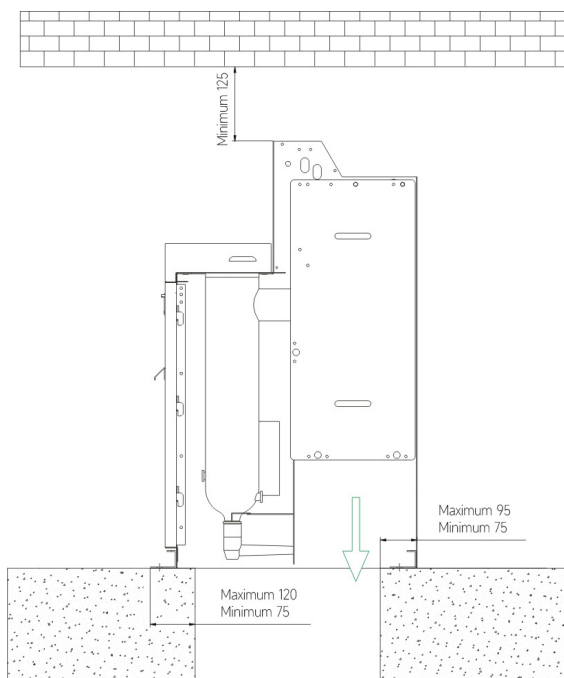


4.7 Consideration of installations against internal arcing faults

- SF₆ gas is exhausted to the rear of the substation

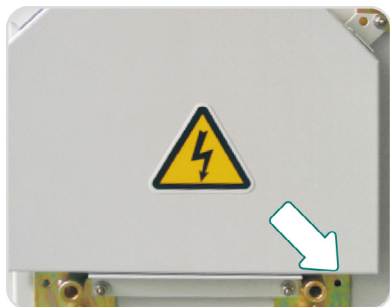


- SF₆ gas is exhausted below the substation



4.8 Installation of expansion unit bus connector

1. Remove the cable insert



Remove the protective cover plate and then remove the three expansion head sealing plates of the left or right expansion unit.



Attention: The three expansion head covers of the unused expansion units do not need to be removed.



Insert the extension puller into the center of the cable insert

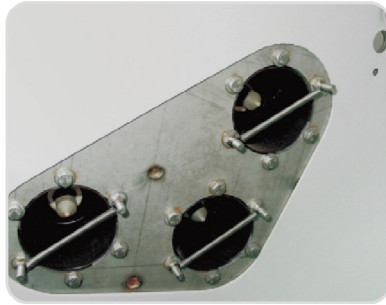


Twist vigorously clockwise until pulled out.



Attention: Silicone plugs cannot be used again.

2. Earthing of busbar connector shielding layer



Attention: The silicone grease provided cannot be replaced. Use a bottle of high vacuum silicone grease for the three bus connectors (6 contact surfaces).

Clean the residual high vacuum silicone grease inside the expansion head.
Secure the earthing spring with two M6 studs on the expansion port fixing plate of the equipment to be expanded.

3. Install busbar connectors



Thoroughly clean the conical contact surface of the busbar connector with cable cleaning paper.



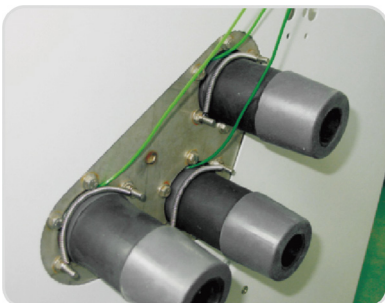
One end of each busbar connector is first evenly coated with high vacuum silicone grease.

4. Insert the extension cable



Before inserting the bus connector into the bus insulator hole, an extension pulling wire must be placed first, which is used to extract air from the inside of the bus insulator hole.

5. Install movable connectors



Move the expansion head spring to deflect it to avoid the busbar connector. After confirming that the expansion pulling busbar is on the contact surface, insert it into the busbar insulator hole in conjunction with the busbar connector. At this point, do not pull out the extension cable. Instead, place the extension cable at the top of the high voltage cable compartment. At the same time, apply high vacuum silicone grease to the other end of the busbar connector.



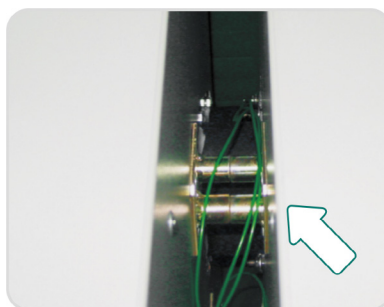
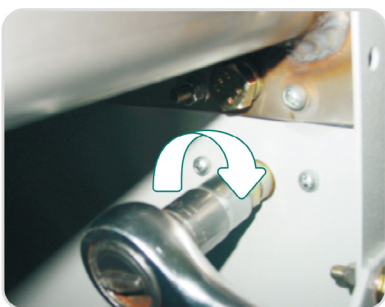
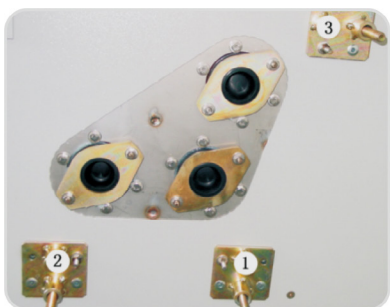
Attention: The contact must be completely covered by the connector, that is, the movable connector must be fully inserted;
The expansion head spring is used for earthing the shielding layer of the busbar connector.

6. Insert bidirectional expansion unit



Align with the axis of the active connector of the bidirectional expansion unit as the reference.

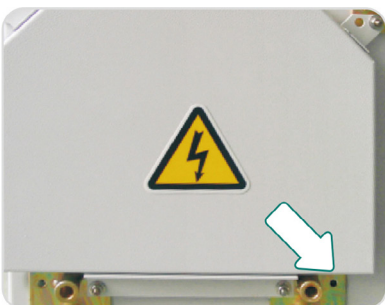
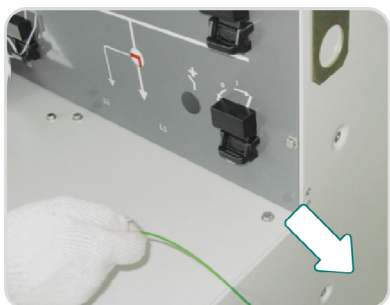
7. Tighten the expansion unit



Each threaded rod must be tightened in sequence, in the following order: 1 → 2 → 3. The purpose of this is to make the equipment to be expanded parallel to the expansion unit. Tightening torque: 18 Nm.

When these positioning components come into contact with each other, it is sufficient.

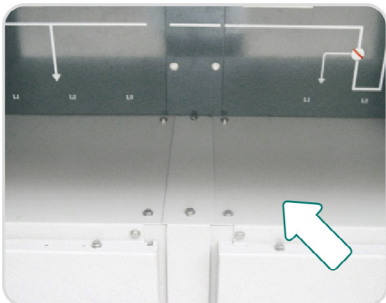
8. Extract three extension pull wires from the insulator hole



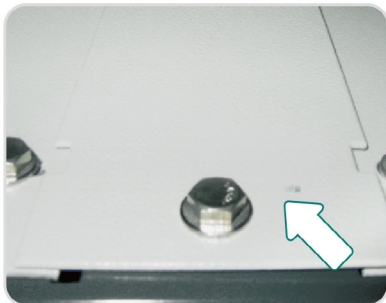
After completing the above assembly, forcefully pull out the extension cable one by one.

Replace the protective cover on the side that no longer needs to be extended.

9. Install the expansion seal board

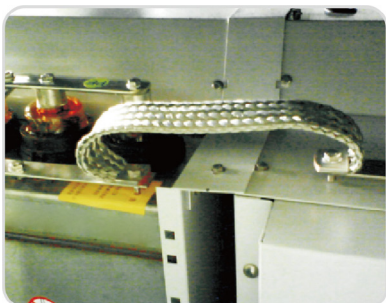


Install the expansion front sealing plate.

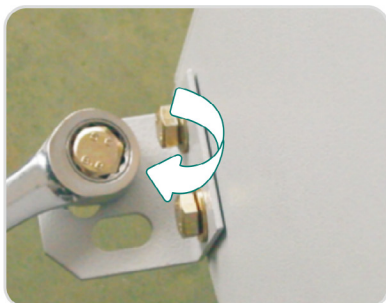


Install the expansion upper sealing plate.

10. Expansion unit earthing



Connect the earthing busbars of two devices with woven ropes.



Fix the left and right sides on the foundation with M10 bolts.

11. Assembly completed



The assembly is completed as shown in the above figure.

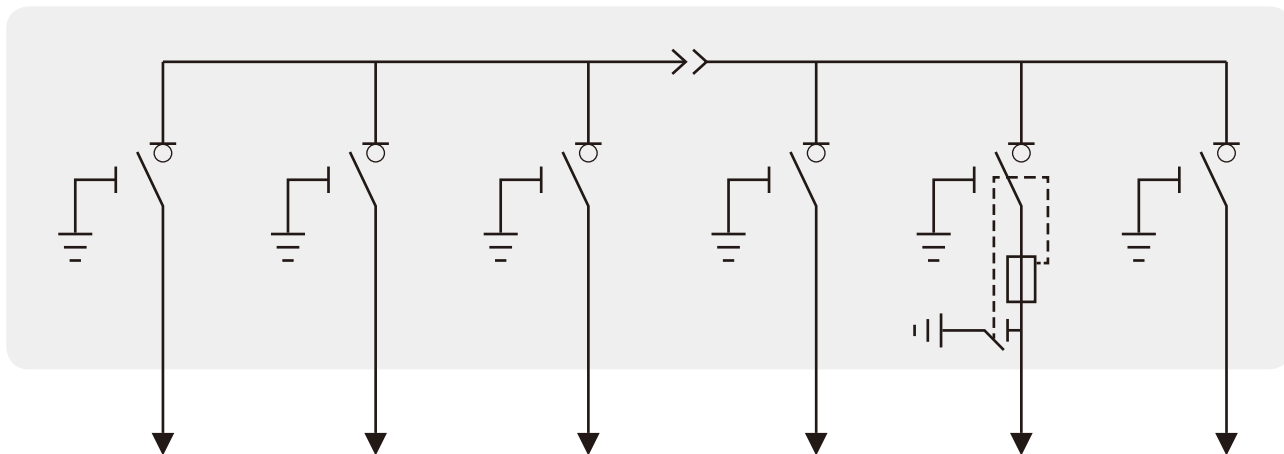


Attention: Do not transport or move the cabinet after merging.

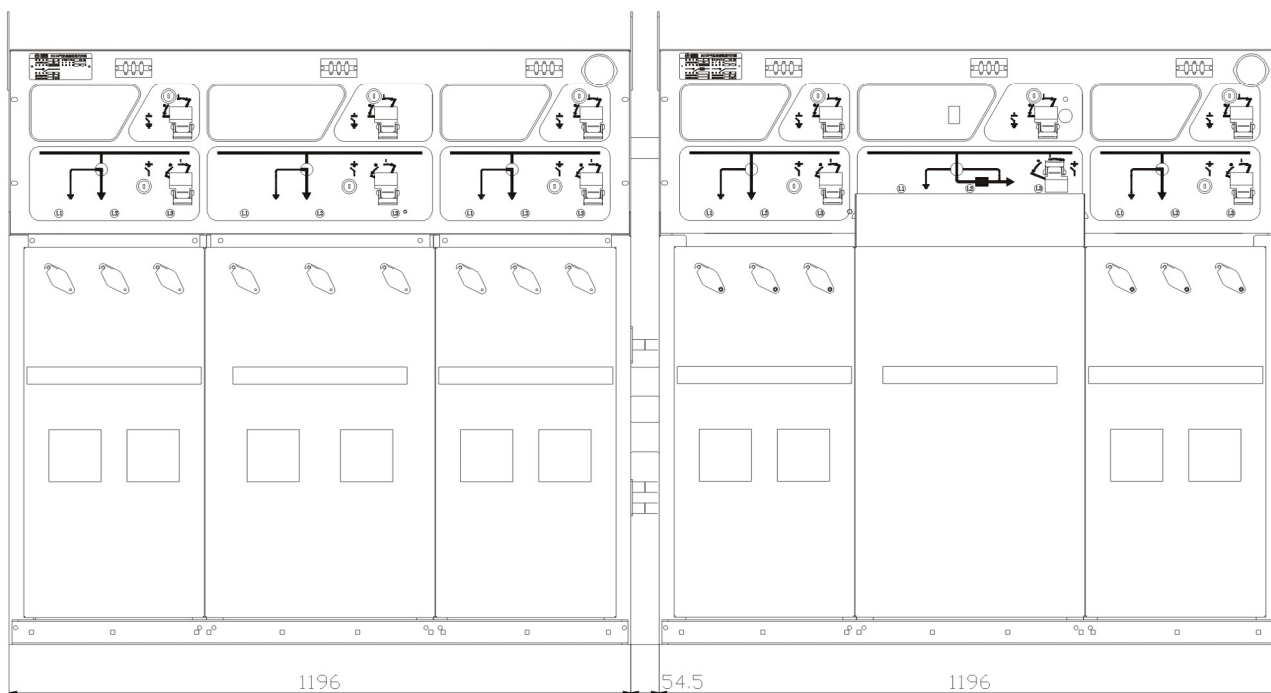
4.9 Line-up size

- GPR2 ring main unit line up size with 54.5mm.
- GPR2 ring main unit line up example: CCC + CBC.

CCC + CBC Primary diagram:



CCC + CBC Line-up layout:



4.10 Selection of bushings, cables and fuses

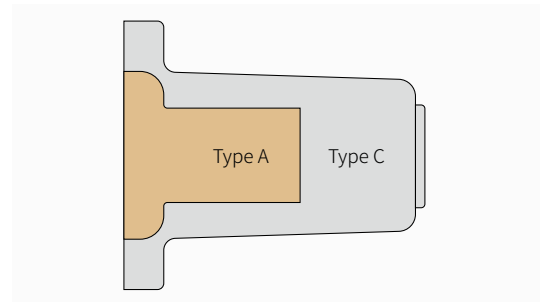
4.10.1 Overview

The outline dimension and connection of GPR2 bushings meet the definition of IEC 60137 standard, and 100% of epoxy resin bushings must pass power frequency withstand voltage and partial discharge testing. When the current flows through the bushing and enters the main circuit of the fully sealed SF₆ gas tank, the insulation between the electriferous components and the frame is guaranteed.

4.10.2 Bushing type

There are 2 types of bushings according to the connection method and short-time withstand current:

- Type A: 200A: 16kA 1s and 31.5kA peak (plug-in)
Specifications-Ø31/Ø32.5/48/Ø7.9
- Type C: 630A: 25kA 1s and 63kA peak (bolt-on, M16 bolt)
Specifications-Ø46/Ø56/91.5/M16



4.10.3 Cable selection

Cable selection include:

- Working voltage: cable voltage and power grid voltage
- Cable Type: Aluminum and Copper
- Section (unit: square millimeter)
- Insulation diameter
- Cable form: single core and three core
- Insulation type: dry and oil immersed (not dripping)
- Shield type
- Enclosed

4.10.4 Connection interface selection

The selection of connection interface depends on specific parameters. For example: rated current of connected equipment: 200A, 630A; short-time withstand current of load switch and circuit breaker functions 16kA and 25kA, thus:

- For the function of the load switch-fuse combination electrical appliance, the connection interface is type A because the fuse can limit the short-circuit current.
- Minimum connection space between phases.
- Connection type:
 - Plug-in
 - Detachable: Bolted connection
- Connection Position: Straight, Elbow.

4.10.5 Fuse selection

Consider the following factors when selecting a fuse to protect a transformer:

- Working voltage
- Transformer rated capacity
- Fuse heat dissipation
- Fuse Specifications

4.10.6 Installable fuse

SDLAJ type: According to IEC 60282-1 dimension standard, with striker.

Selection table: (A is rated value, no overload, $-25^{\circ}\text{C} < 0 < 40^{\circ}\text{C}$)

Usually the IEC 60282-1 standard, the IEC 62271-105 (replacing IEC 60420) and the DIN 43265 standard.

Fuse current selection table:

Working voltage (kV)	Transformer rated capacity (kVA)															
	50	75	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000
3	20	31.5	40	50	50	63	80	100	125*	160						
3.3	20	25	40	40	40	63	80	80	125*	125*	160					
4.2	20	25	25	40	50	50	63.5	80	80	100	125*	160				
5.5	16	20	25	25	40	40	50	63	80	80	100	125*	160			
6	16	20	25	25	31.5	40	50	50	63	80	100	125*	160			
6.6	10	20	25	25	31.5	40	50	50	63	63	80	100	125*	160		
10	10	10	16	20	25	25	31.5	40	50	50	63	80	100	125*		
11	10	10	16	20	20	25	25	40	40	50	50	63	80	100	125*	
13.8	10	10	10	16	16	20	25	31.5	40	40	50	50	63	100*		
15	10	10	10	10	16	20	25	31.5	31.5	40	50	50	63	80	100*	
20	10	10	10	10	16	16	20	25	25	31.5	40	40	63	63	80	100*
22	10	10	10	10	10	16	16	20	25	31.5	40	40	50	63	80	100*

Note: *In the case of external tripping (such as overcurrent relay), calculations must be made to ensure the normal operation of the load switch-fuse combination, please consult our company;

For fuse ratings not included in the table, please consult our company;

When the overload temperature exceeds 40°C , please consult our company;

If you choose fuses from other manufacturers, please consult our company.

4.10.7 Fuse dimension

Rated Voltage (kV)	Rated Current (A)	L (mm)	Φ (mm)	Weight (kg)
12	10 to 20	292	50.5	1.2
	25 to 40	292	57	1.5
	50 to 100	292	78.5	2.8
24	10 to 20	442	50.5	1.6
	25 to 40	442	57	2.2
	50 to 63	442	78.5	4.1
	80 to 100	442	88	5.3



4.10.8 Replacement of fuses

The IEC standard stipulates that when the one-phase fuse blows, the three-phase fuse must be replaced at the same time.

4.11 Installation of sealing plugs and DIN fuses

4.11.1 Remove the sealing plug

Close the earthing switch before performing these operations.

The three fuse replacement procedures are the same, and the following operations are repeated.

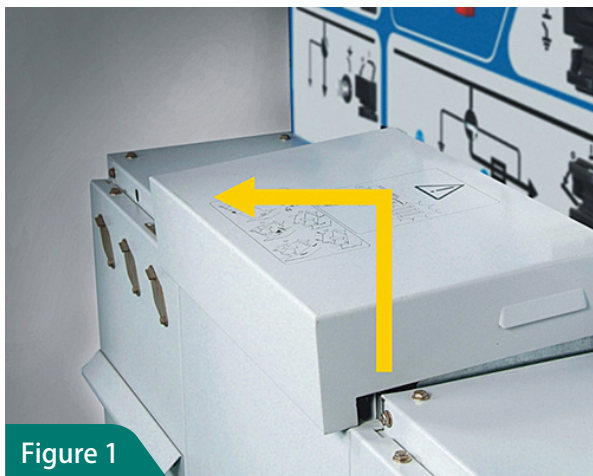


Figure 1

Open the top cover of the fuse compartment, lift it up and pull it towards you. Then lift up, refer to the operating instructions on the fuse compartment cover.



Figure 2

Remove the handle and manually push the handle to the vertical position to open the interlock on the sealing plug.

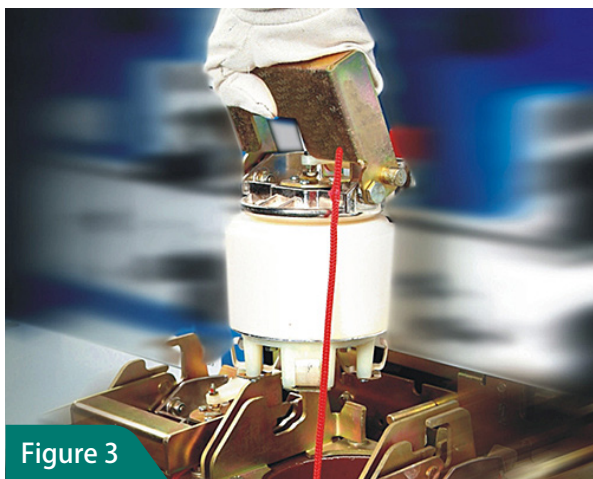


Figure 3

Turn the sealing plug counterclockwise and lift.

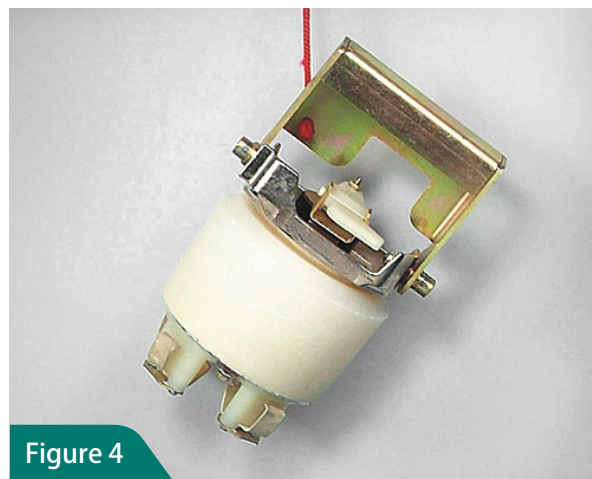


Figure 4

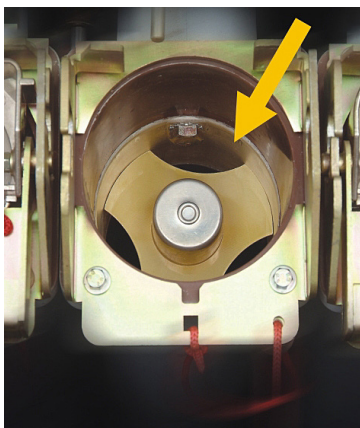
Let the sealing plug hang freely. Before installation, make sure the sealing plug is clean.

Note: To clean the sealing plug, use a lint-free cloth or sponge moistened with clean water.

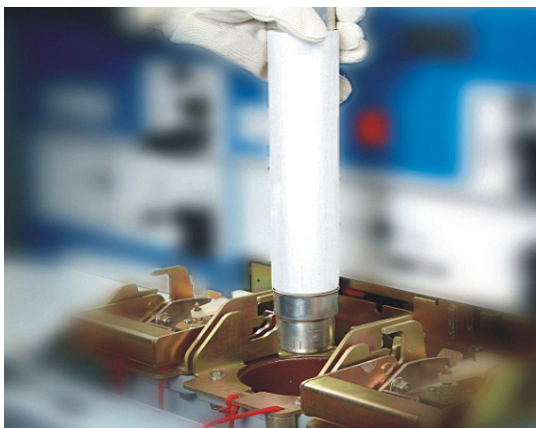
4.11.2 Install DIN fuses



Under no circumstances should a bumped fuse be installed.
It is recommended to check the fuses with a tester before installation.



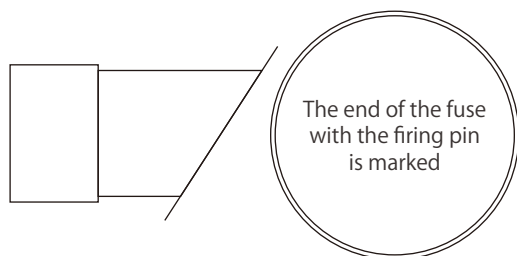
Locate the centering ring from the fuse compartment.



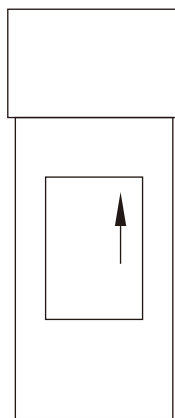
Insert the fuse into the compartment, place the centering ring on the fuse, insert the sealing plug pin into the metal bracket, and turn clockwise.

4.11.3 Firing pin fuse assembly direction

The fuse blows to release the firing pin, which opens the three-phase circuit of the switch and prevents reclosing.

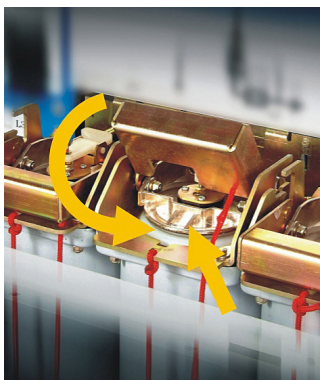


The end of the fuse with the firing pin is marked

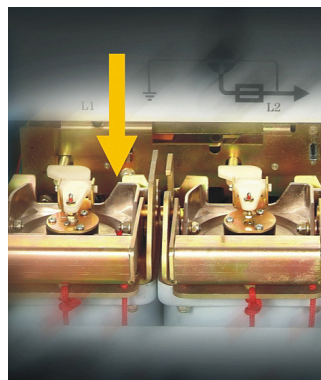


Specification and assembly direction are printed on the fuse enclosure (firing pin up).

4.11.4 Lock the sealing plug



Confirm the sealing plug trunnion is seated in the metal bracket slot and manually press down on the handle to lock the sealing plug.



There is a fuse action release device on the sealing plug, which is used to open the three phases of the load switch at the same time.

When replacing a fuse that has released the firing pin, press the reset lever to reset it.

4.12 Relay protection

The protection relay adopts the WIC1 self-powered protection relay (hereinafter referred to as WIC1) provided by German SEG Company, with inverse time and definite time protection characteristics, especially suitable for medium voltage switchboards with circuit breakers, CT units and extremely small rated output current.

The WIC1 is a CT-powered protection relay, and its minimal space requirements meet the highest requirements for digital protection devices. Simple and safe wiring, high immunity to electromagnetic interference, the ability to adjust and change different parameters according to the switchboard, can meet the needs of various operating modes.

Note: If you need to configure other types of comprehensive protection, please contact our company.



Note: We could match for other brands protection relay, Such as ABB, Schneider, Siemens, and China brand Nari, etc., The details specification will follow the related brands specifications.

4.12.1 Current Transformer

The WIC1 protection system can be configured with 5 CT with different current ranges. Depending on the system primary current, the following CT can be selected:

CT Model	Rated primary current range
WIC1-WE2	16~56A
WIC1-W2	16~56A
WIC1-W3	32~112A
WIC1-W4	64~224A
WIC1-W5	128~448A
WIC1-W6	256~896A

4.12.2 CT Measurement accuracy

CT WE2, W3, W4, W5	CT W2
$\leq 5\%$ in the temperature range of $0^{\circ}\text{C} \sim 50^{\circ}\text{C}$ $\leq 7.5\%$ in the temperature range of $40^{\circ}\text{C} \sim 85^{\circ}\text{C}$	In the temperature range of $0^{\circ}\text{C} \sim 50^{\circ}\text{C}$ $\leq 12.5\%$ at 14.4A $\leq 7.5\%$ at 20A $\leq 5\%$ at 28.8A In the temperature range of $-40^{\circ}\text{C} \sim 85^{\circ}\text{C}$ $\leq 15\%$ at 14.4A $\leq 10\%$ at 20A $\leq 7.5\%$ at 28.8A

4.12.3 WIC1 Protection function

- Phase current overcurrent protection and its phase-to-phase fault protection
Inverse-time phase-to-phase protection is provided when the phase current exceeds a certain multiple of the rated value, depending on the current level and selected characteristics.
The minimum trip time of the WIC1 protection system can reach 40ms.
- Ground fault protection
- Fault value record
The built-in fault value record of WIC1 is used to store the data of the last fault event, and the following fault information can be obtained:
 - The protection unit causes a trip or an externally triggered trip
 - Trip current value or ground fault current between phases

4.13 Operation instructions for power outage and transmission

4.13.1 Operating instructions for load switch of GPR2 ring main unit

● Power failure operation procedure

- a) Opening load switch b) Closing earthing switch c) Open the cabinet door
(At this time, the ring main unit is in the maintenance position)

● Power transmission operation procedure

- a) Close the cabinet door b) Opening earthing switch c) Closing load switch
(Note: This step is cancelled when there are no specific components in the program)
(Operate clockwise to close, as indicated by panel screen 1)
(Counter clockwise operation is divided into minutes, as indicated by panel screen printing 0)
(It is strictly prohibited to power on the incoming unit when the earthing switch is in the closed state)

4.13.2 Operating instructions for GPR2 ring main unit fuse-load switch

● Power failure operation procedure

- a) Opening load switch b) Closing earthing switch c) Open the cabinet door
(At this time, the ring main unit is in the maintenance position)

● Power transmission operation procedure

- a) Close the cabinet door b) Opening earthing switch c) Closing load switch
(Note: This step is cancelled when there are no specific components in the program)
(Operate clockwise to close, as indicated by panel screen 1)
(Counter clockwise operation is divided into minutes, as indicated by panel screen printing 0)
(It is strictly prohibited to power on the incoming unit when the earthing switch is in the closed state)

4.13.3 Operating instructions for GPR2 ring main unit circuit breaker

● Power failure operation procedure

- a) Opening load switch b) Closing earthing switch c) Open the cabinet door
(At this time, the ring main unit is in the maintenance position)

● Power transmission operation procedure

- a) Close the cabinet door b) Opening earthing switch c) Closing load switch
(Note: This step is cancelled when there are no specific components in the program)
(Operate clockwise to close, as indicated by panel screen 1)
(Counter clockwise operation is divided into minutes, as indicated by panel screen printing 0)
(It is strictly prohibited to power on the incoming unit when the earthing switch is in the closed state)

5.1 Lifetime and maintenance

The GPR2 ring main unit complies with the IEC60694 standard and can work for 30 years under normal operating conditions.

The GPR2 ring main unit should be opened/closed at least every 3 years, the state of the mechanism (including contamination, corrosion and lubrication) and the cleanliness of the earthing switch observation cover (contamination) should be checked every 5 years, and the battery should be replaced every 4 years (optional equipment).

5.2 Shipping and storage

The following points should be paid attention to during the transportation and storage of GPR2 ring main unit:

1. Do not overturn, invert and suffer severe vibration to prevent cabinet deformation and paint surface injury;
2. It should be stored in a dry and ventilated box or a dry place that can avoid rain, snow and sand;
3. Do not disassemble components and parts at will;
4. Any operation that may damage the sealing performance of the gas tank is prohibited.

5.3 Product package documents

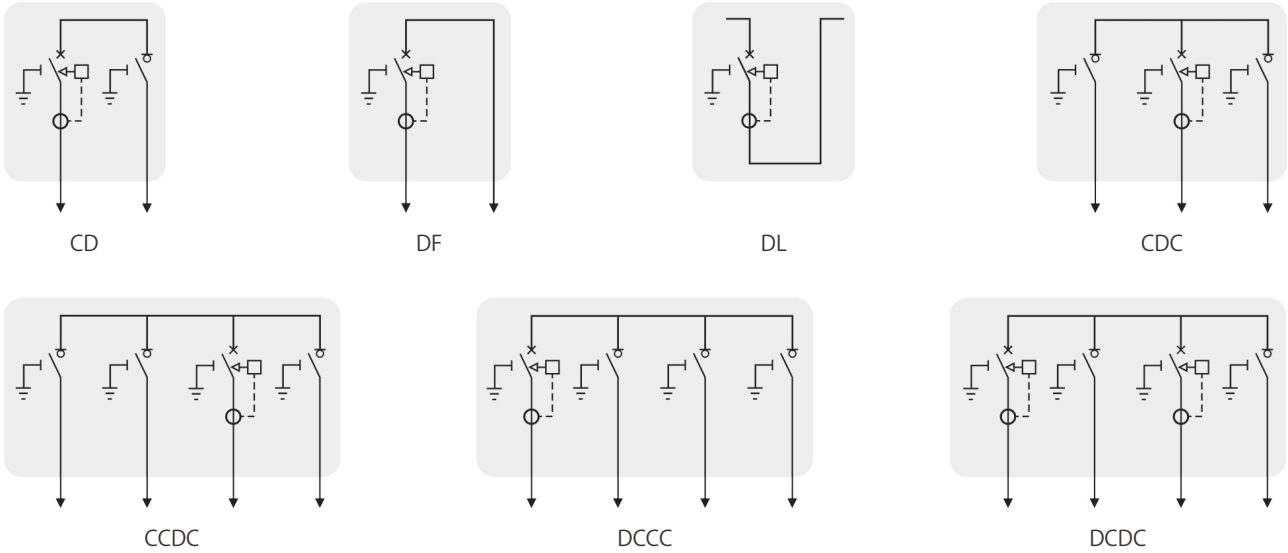
1. Product routine;
2. Product packing list;
3. Product factory test report;
4. Installation manual book;
5. Control circuit wiring diagram.

5.4 Ordering notice

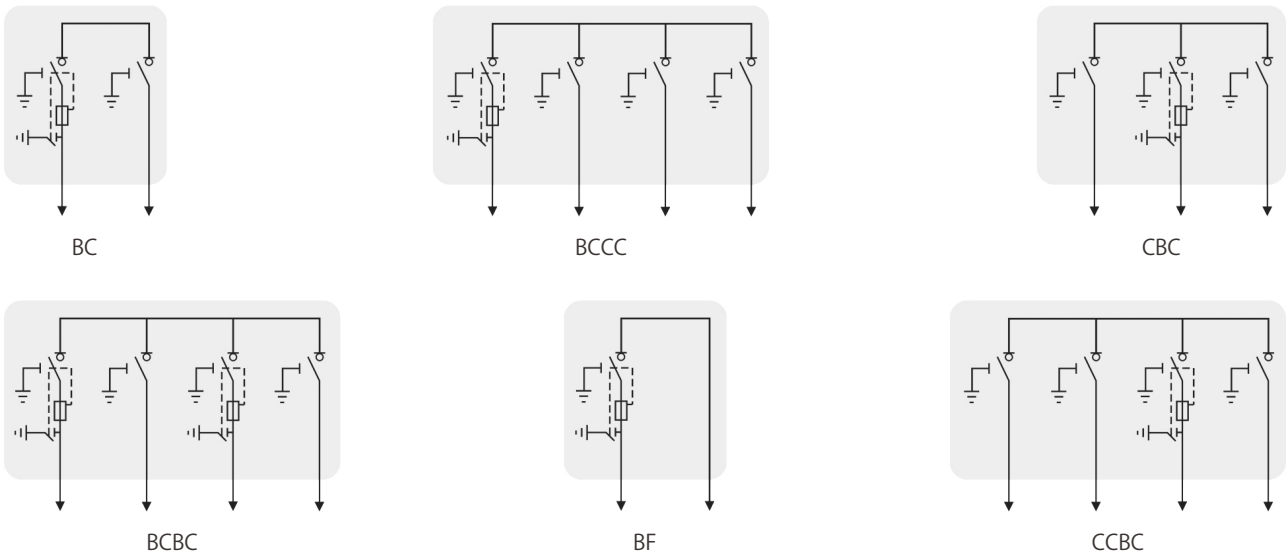
The following information should be provided when ordering:

1. Main circuit wiring scheme, main circuit diagram and arrangement diagram;
2. Summary table of electrical equipment;
3. When the switchgear is used in a special environment, it should be put forward when ordering;
4. Non-standard designs can be made according to user requirements;
5. When other or more accessories are needed, the type and quantity should be mentioned.

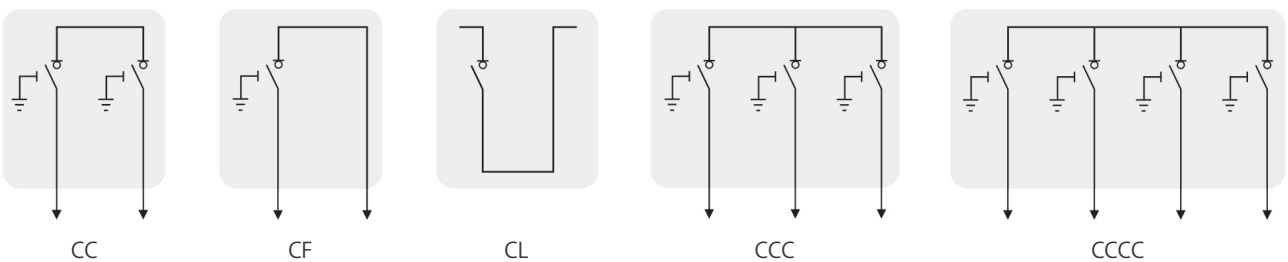
● Transformer protects 200A circuit breaker



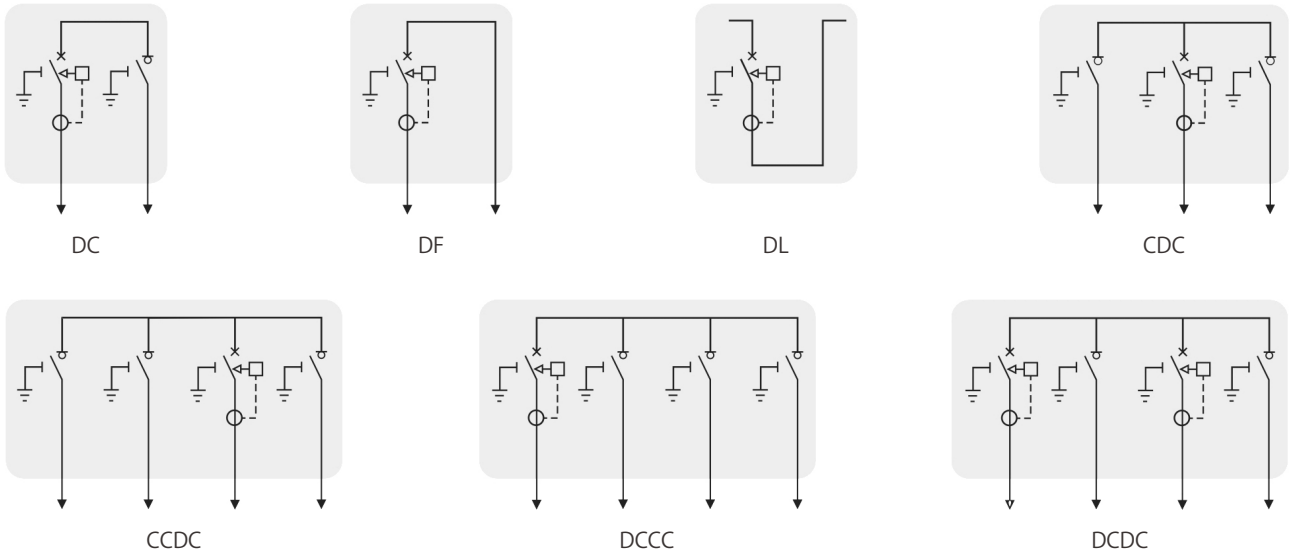
● Transformer protects load switch-fuse combination electrical appliance



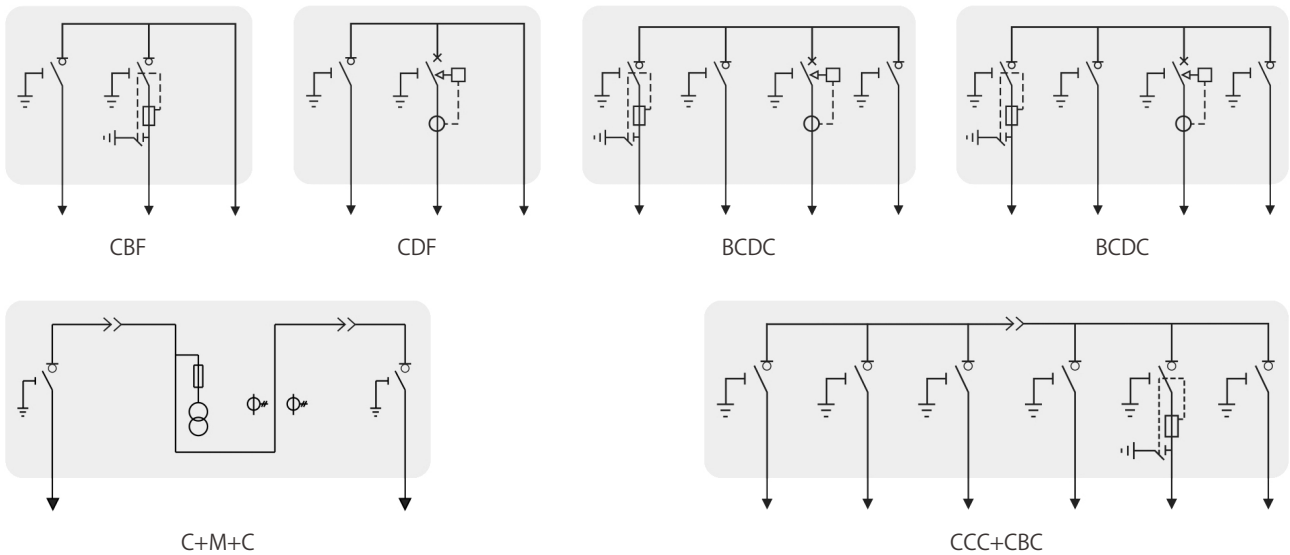
● Network node load switch



● Network node 630A circuit breaker



● Other combination scheme



Note: The above is a typical combined circuit scheme, and any other combined circuit scheme can also be provided according to user requirements.

E2.1203ME-202309

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Professional Power Equipment Provider

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