

Sieyuan

**Make Electric Power Transmission
and Distribution more Safe, more
Controllable and more Efficient!**

ZF28A TYPE GIS (From 72.5kV to 145kV)



Sieyuan

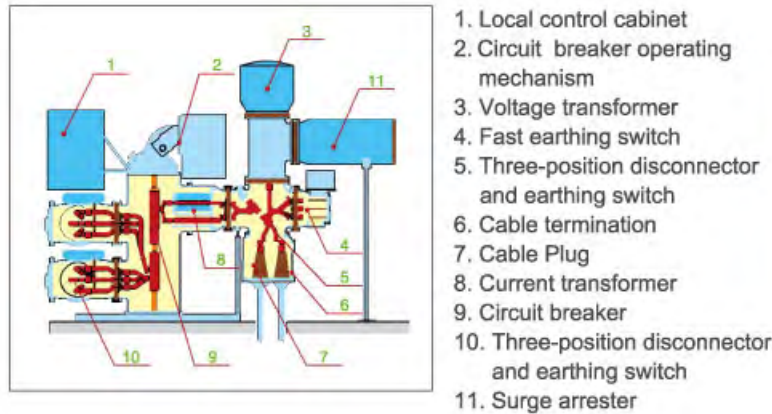
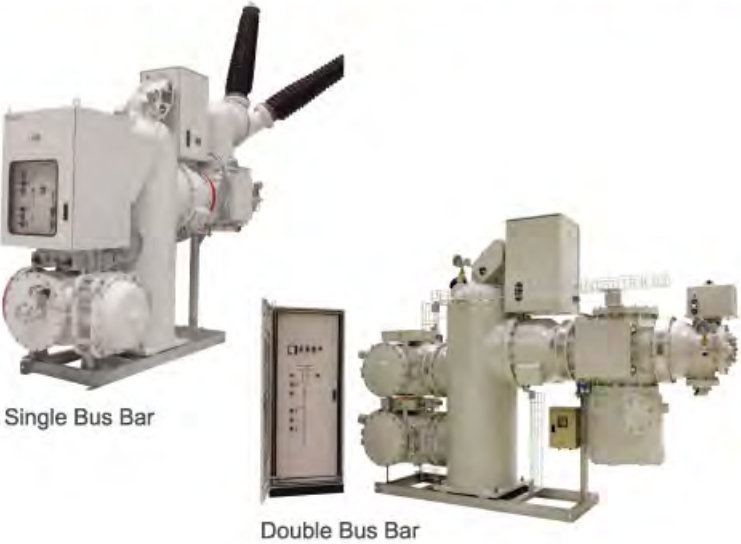
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Shanghai Sieyuan High Voltage Switchgear Co., Ltd.
Sieyuan Electric Co., Ltd.

Based on its R&D system and advanced research abilities, Sieyuan has become a well-known GIS manufacturer in China. Its GIS technology has reached the international advanced level.

Standard GIS Bay of ZF28A-72.5/126/145 Type



Advantages of ZF28A Series GIS (72.5kV-145kV)

- Full three-phase enclosed GIS, with a minimum bay width of 800mm and standard bay width of 1000mm. Compact design, less requirement of land space. Availability of whole bay transportation.
- The inspection and maintenance passages are arranged at two sides of the bay, so it is easier to enter into the bay during inspection and maintenance.
- Three- position DES are completely applied in GIS, realizing the simplified structure and reliable mechanical locking.
- To take advantage of simulation analysis and basic research on the internal electric field, gas flow field and mechanical properties by the means of finite-element analysis software, the minimizing of the GIS dimension has been achieved.
- Aluminum alloy enclosures are widely applied with advanced surface coating technology. Strict inspection on thickness and evenness of the surface coating ensures the anti-corrosion performance of the equipment, and makes the equipment adapting to the severe environmental conditions.
- The temperature rise type test was performed at 1.1x rated current, thus the ability of GIS to withstand long time rated current can be assured.
- The partial discharge test is performed under 80% power frequency withstand voltage (80 % x 275kV =220kV), which is far more strict than the voltage (1.2x145kV = 174kV) specified by IEC standard.
- According to the factory quality control requirement, all bays are subject to perform power frequency withstand voltage test, lightning impulse withstand test and partial discharge test before delivery to site, so that the quality of GIS can be assured.
- The product has performed low-temperature test in strict accordance with IEC standard, and this makes Sieyuan GIS in the leading position in China.

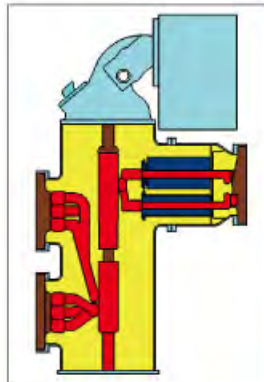
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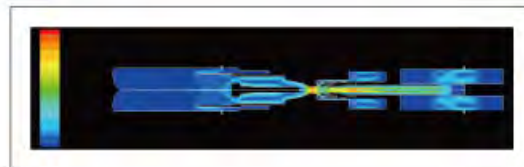


Circuit Breaker module

As the core component of GIS, the three-phase enclosed circuit breaker module consists of the vertical arcing chamber unit and the full-spring operating mechanism.



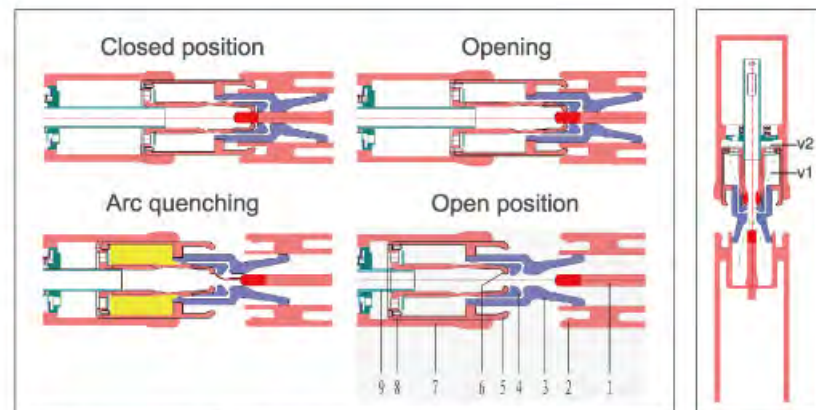
- The circuit breaker adopts the self-blast arcing principle. The self-blast arcing technology effectively reduces the operation power of the operating mechanism and improves the mechanical reliability of the product.



- It has passed short-circuit current type test in KEMA, Netherlands.
- With the excellent performance ability, the circuit breaker is in Class E2-M2-C2.
- The critical insulating components such as insulating rod and insulating pipe are imported from Switzerland.

Arc quenching principle

High current breaking (15kA ~ 40kA)
self-blast breaking technology.



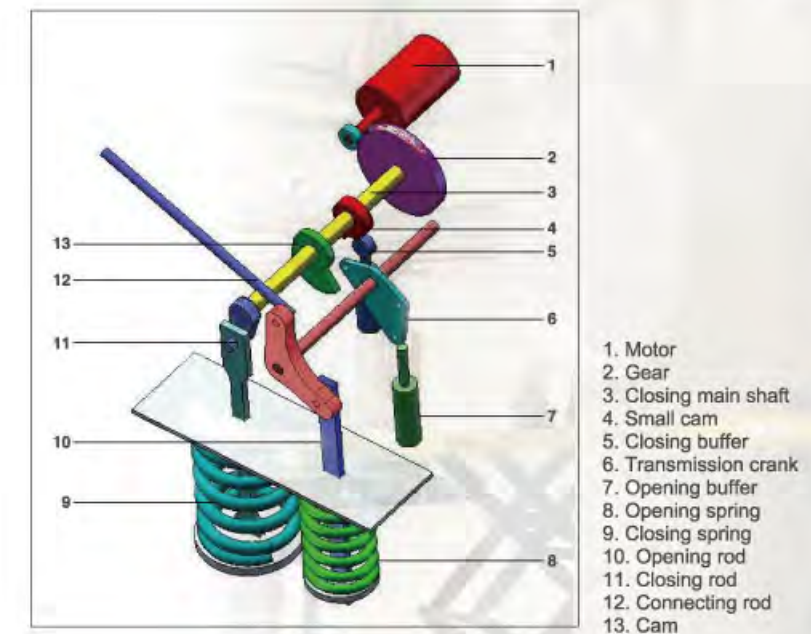
- 1.Static arc contact 2.Static main contact
3. Nozzle 5.Moving main contact 4,6.Moving arc contact
7.Cylinder 8.Static piston 9.Rod

v1: Thermal expansion chamber
v2: gas compression chamber

Low current breaking (<15kA)
Gas compression breaking technology.

Circuit breaker operating mechanism

- The full-spring operating mechanism has a small volume and achieves 10,000 times of mechanical life.
- The operating mechanism base is made of cast aluminum alloy and is produced through the precision machining in the numerical control machining center of DMG four-shaft boring and milling imported from Germany. Because of one-step molding by clamping machining, unified standard and minor machining error, the assembly accuracy of the operating mechanism can be guaranteed.
- The mechanism is perfectly combined with the interrupter to achieve the outstanding performance of the circuit breaker. The closing spring and the opening spring are arranged at positions conveniently for observation.
- Due to our powerful basic research ability, the spring is designed and produced according to the allowable stress which is lower than the testing value, so as to ensure that the 10,000 times' life endurance can be achieved.



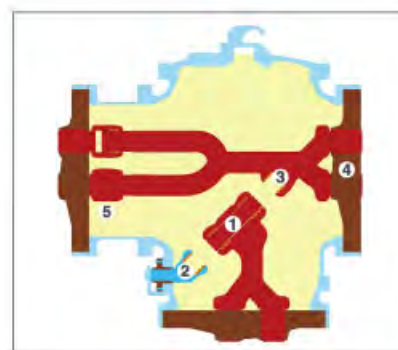
1. Motor
2. Gear
3. Closing main shaft
4. Small cam
5. Closing buffer
6. Transmission crank
7. Opening buffer
8. Opening spring
9. Closing spring
10. Opening rod
11. Closing rod
12. Connecting rod
13. Cam

Three-position disconnecter and earthing switch

The disconnecter and the maintenance earthing switch are combined with one moving contact shared. Because of the natural mechanical interlocking, the possibility that disconnecter and earthing switch are simultaneously connected in the meantime is avoided and the risk of fault operation is completely avoided.

Bus three-position DES

- The bus three-position DES integrates the bus disconnecter and maintenance earthing switch into the same module, thereby realize the direct connection for the bay and the interconnection between bays by branch bus and expansion joint.
- The bus three-position DES not only can switch the small capacitive current and small inductive current, but also can switch the bus -transferring current in the case of double-bus system.
- The humanized structural design enables the easy inspection of the opening/closing position from the overhaul patrol passage.



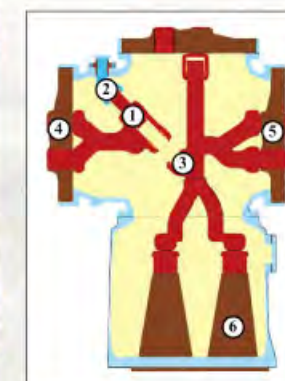
1. Moving contact
2. Static contact of earthing switch
3. Static contact of disconnecter
4. Barrier insulator
5. Expansion joint

Operating mechanism of DES

- The disconnecter and maintenance earthing switch share one common operating mechanism, and the operating mechanism can be manually operated in case of an emergency.
- The mechanism is directly spliced onto the main body without connecting rod exposed, and it also has good transmission efficiency and good weather resistance.
- Driven by double motor and mechanically interlocked, it has the clutch function.

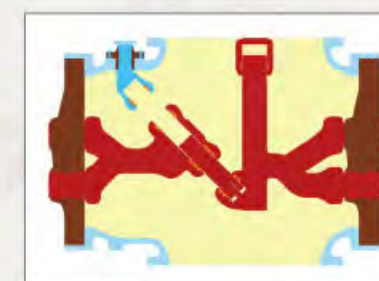
Feeder three-position DES

- The feeder three-position DES is used for connection and disconnection inside feeders. It can be connected with various terminal modules (including cable terminal, overhead line and transformer terminal) and also can realize the connection with voltage transformer and surge arrester.



1. Moving contact
2. Static contact of earthing switch
3. Static contact of disconnecter
4. Barrier insulator
5. Supporting insulator
6. Cable terminal

- The feeder three-position DES is installed in the module which realize the operation as follows.



Disconnector closed with earthing switch opened



Disconnector opened with earthing switch opened



Disconnector opened with earthing switch closed

Instrument transformer

Current transformer

The current transformer is used in GIS for current measurement and system protection.

- The electromagnetic current transformer is placed at the outlet side of the circuit breaker and is located in the same gas chamber as the circuit breaker.
- The secondary winding is casted by saturated epoxy resin, so its electric and mechanical strength is high and heat resistance is good.
- The windings use the polyester film with good moisture resistance as the interlayer insulating materials to strictly control the moisture.
- The secondary junction box adopts the cast aluminum structure, and the secondary wiring board is casted by epoxy.



Solutions for intelligent GIS

Electronic combined transformer for GIS

- Digital output
It meets the requirements of international standards and applies to the intelligent substation.
- Low partial discharge
The partial discharge is less than 5pC under 80% rated power frequency withstand voltage.
- High accuracy
Current measurement level: 0.2S
Current protection level: 5P or 5TPE
Voltage measurement level: 0.2
Voltage protection level: 3P
- Wide operating temperature range
Overall operating temperature range of transformer: -30℃~45℃
Operating temperature range of acquisition unit and combination unit: -40℃~85℃

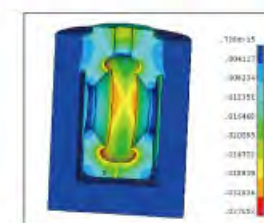
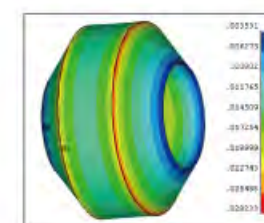
Good electromagnetic compatibility

Immunity level of voltage gradient	+20%~-20%
Immunity level of voltage sag and short supply interruption	0.1s for 50% sag and 0.05s for interruption
Immunity level of surge (impact)	Level 4
Immunity level of electrical fast transient burst	Level 4
Immunity level of oscillatory wave	Level 3
Immunity level of electrostatic discharge	Level 4
Immunity level of power frequency magnetic field	Level 5
Immunity level of pulsed magnet field	Level 5
Immunity level of damped oscillatory magnetic field	Level 5
Immunity level of radiated radiofrequency electromagnetic field	Level 3

Voltage transformer

The voltage transformer is used for voltage measurement and system protection.

- Each voltage transformer has its own independent gas chamber.
- The housing is welded by steel plate and hot galvanized. All connecting bolts are the stainless steel parts and can be used outdoors. The base is installed with bursting disc. If high-energy discharge occurs in the product, the bursting disc will be fractured to release the pressure and thus improve the product safety.



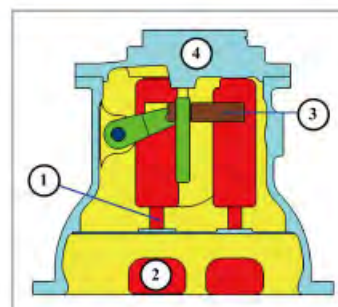
- The secondary junction box adopts the cast aluminum structure, and the secondary wiring board is casted by epoxy.
- The transformer can be horizontally or vertically installed.

Fast Earthing Switch and Surge Arrester

Transition module and bus module

Fast earthing switch

- The fast earthing switch is connected to the feeder three-position DES and shares one common gas chamber with DES.
- The fast earthing switch can switch the short-circuit current and inductive current. The operating time of contact is less than 80ms, which is better than that required in IEC Standard.
- **Electric spring operating mechanism**
- The operating mechanism for fast earthing switch is the electric operating mechanism of charging spring type. It also can be manually operated in case of an emergency.
- The transmission of energy storage process is simple, without extra intermediate link. The motor is decelerated by gear pair and is connected to the screw rod. The ball screw rod is used, so the transmission efficiency is high.
- The mechanism is directly connected without exposed connecting rod, so as to improve the transmission efficiency and enhance the weather resistance of products



1. Moving contact
2. Static contact
3. Connecting plate
4. Earthing plate

Surge arrester

As the protective element of GIS, the surge arrester is used for protecting the insulation of electrical equipment of GIS against the damage of lightning and operation impulse voltage.



- Surge arrester is mainly composed of enclosure, basin type insulator, mounting base and core body. The core body uses the zinc oxide resistor disc as the main element, with good volt-ampere characteristics. The resistor disc is connected into a cylindrical shape in series.
- The surge arrester is insulated by SF6 gas and is connected with GIS via intermediate flange. With standard connector, it is convenient for site installation.
- Each surge arrester is equipped with online monitoring device to monitor the leakage of current and record the discharge frequency.

Metal bellows



- It is made of stainless steel.
- It is used for compensating the axial length change of bus caused by expansion and contraction.
- It is used for compensating the conductor stress change caused by structural and installation errors.

Aluminum alloy pipe adjustment joint



- It is used for dismantling the faulty bay located in the middle part.

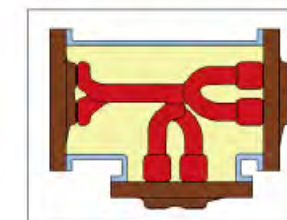
Self-balanced bellows

- It is made of stainless steel.
- Its operating temperature is $-40^{\circ}\text{C} \sim 100^{\circ}\text{C}$ and endurance life is 11,000 times.
- It can compensate the axial and radial conductor stress changes caused by foundation settlement. Its axial adjustment range is $\pm 15\text{mm}$, while its radial adjustment range is $\pm 10\text{mm}$.

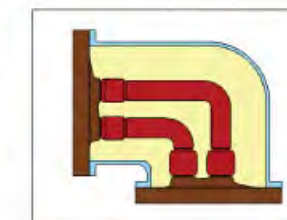


Transition module

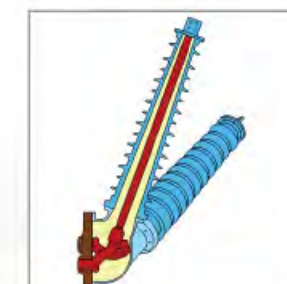
The transition module is used for realizing the interconnection inside the bay. The following several transition modules are available according to the space requirements for circuit design and alternative arrangement.



T-shaped module



L-shaped module

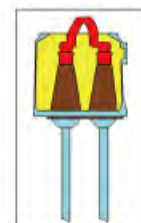


Bushing bus module

The bushing bus module is used for realizing the conversion of connection between three-phase module and single-phase module and is usually used for the connection between outlet module and bushing terminal.

Cable terminal

- Through the cable terminal module, GIS can be connected with various types of high voltage cables. The coordination between cable terminal box and cable terminal meets the requirements of IEC 60859.



Cable terminal

SF6/ air bushing

- The connection between GIS and air insulation equipment or overhead line is realized by a corner module and a SF6/air bushing. The air bushing is provided with traditional porcelain bushing and silicon rubber composite bushing, to meet different user requirements.

- The length, umbrella form and creepage distance of bushing can be designed according to insulation matching, minimum air insulation gap and pollution level. Through calculation and experimental verification, the SF6/air bushing not only can provide best insulation ability, but also can ensure a longer service life.



Solutions for cold areas

- As for the system in the low-temperature areas at below -30°C, the bushing and the branch bus exposed outdoors adopt the independent gas chamber with gas filling pressure of 0.4MPa. It has passed the type test and is applicable to the cold areas.

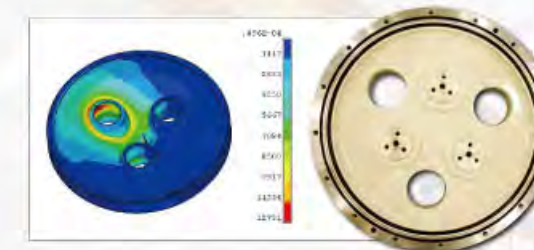
Solutions for coastal and heavy industry concentration areas

- The air bushing can be used in the coastal and heavy industry concentration areas, and especially in the highly polluted areas, like thermal power plant, oil refinery, cement plant, chemical plant and coastal oil fields.
- The silicon rubber composite bushing is recommended, which has good water resistance, strong anti-pollution flashover, high safety, and explosion and cracking protection.

Basin Type Insulator

Metal flange and double-seal design

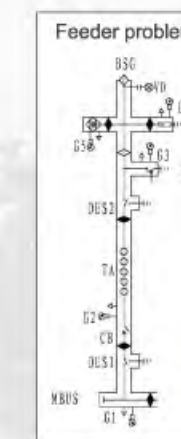
- Prevent the cracking of basin due to stress concentration of epoxy parts.
- Effectively prevent the aging of insulating materials due to ultraviolet rays and corrosive gases, etc., and prolong the service life of basin.
- Reduce the leakage of electromagnetic wave through overall shielding and reduce the radio interference.
- Prevent moisture from entering into the housing with outer sealing ring. Prevent the leakage of SF6 gas with inner sealing ring. the annual average gas leakage rate is lower than 0.3%.
- To ensure its quality, the tests including X-ray flaw detection, helium mass spectrometer leak detection, high/low temperature test, hydraulic test, partial discharge measurement and power frequency withstand voltage test shall be performed in the factory.
- The raw material of epoxy resin is imported from Switzerland.
- The basin type insulator, DES insulating rod, ES/ FES grounding base and CT secondary patching panel and other epoxy resin insulators are designed by the 145kV voltage class, with large insulation margin.
- The above insulators are casted by the Hübers vacuum mixing epoxy casting equipment imported from Germany. The power frequency withstand voltage test and partial discharge test are performed for each piece.



SF6 gas system

The design principle of SF6 gas system is to abide by the execution functions of all equipment components.

- The basin type insulator is used for separating the GIS gas chamber.
- Each gas chamber is equipped with independent gas monitoring device. The annual leakage rate of SF6 gas is less than 0.3%.
- Each density relay is equipped with non-return valve, so the relay can be checked without disassembly.



All auxiliary electrical equipments for bay control, monitoring and circuit protection are installed in corresponding local control cabinets.

The control cabinet is provided with free standing cabinet and integrated cabinet which can be flexibly arranged according to user requirements and site conditions.



Certificates and reports



ISO 9001 Certificate



XIARI Test Report
145kV, 3150A, 40kA



KEMA Test Certificate
145kV, 3150A, 40kA



SHARI Test Report
145kV, 3150A, 40kA



XIARI Test Report
126kV, 2500A, 40kA

Excellent integrated cabinet design

- with compact structure, it can be assembled in the factory and transported together with the bay, thereby save the floor area and also reduce the site work.
- The cold rolled steel sheet or stainless steel plate can be used for the cabinet body in accordance with the requirement of client.
- The cabinet body adopts overall bending technology, with nice appearance, high strength and good moisture resistance.
- The internal components adopt the international well-known brands, with reliable quality.
- The mimic bus adopts the screen printing technology, with long service life and nice appearance
- The reserved digital connector is easily intelligentized.



Reliable and flexible control and protection system

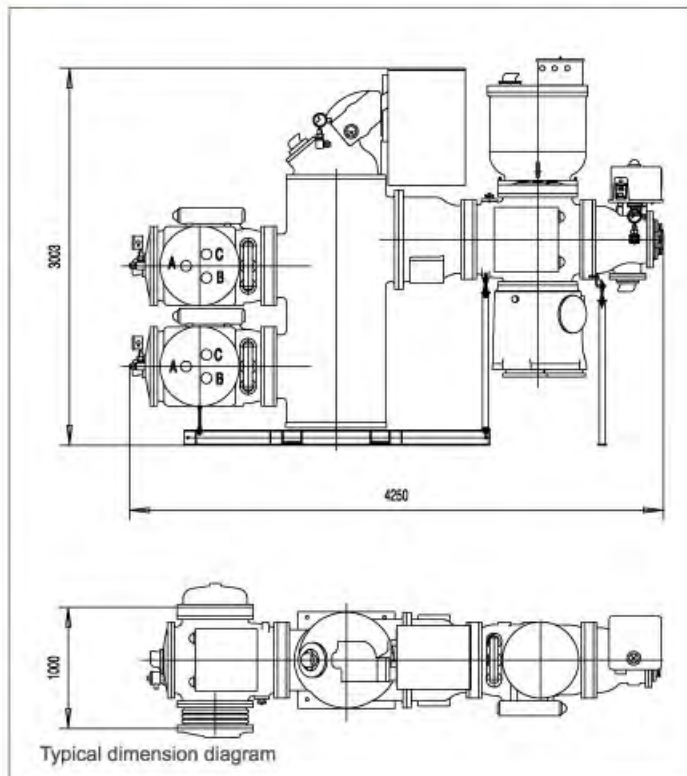
- The complete local operation interlocking and position indication device is equipped with key type local/remote interlocking/ unlocking change-over switch.
- The signals required for operation and monitoring as well as measured values of current, voltage and power in digital or analog form are displayed.
- All auxiliary circuits and voltage transformer circuit are equipped with miniature circuit breaker for protection.

Typical layout

For urban areas, populated areas, complex industrial areas and areas under harsh environmental conditions, GIS has its unique superiority.

Reasonable compact products

- With modular design and standard connector, the product has good interchangeability between modules and is easy for extension.
- With all-aluminum alloy housing, the product has small vortex loss. The standard bay is only 3 tons and is light in weight, so the civil cost is saved.
- The standard bay is 1000mm wide. The depth of the plant building required is generally 6.5m and the indoor height is generally 6m.



Cost saving for maintenance

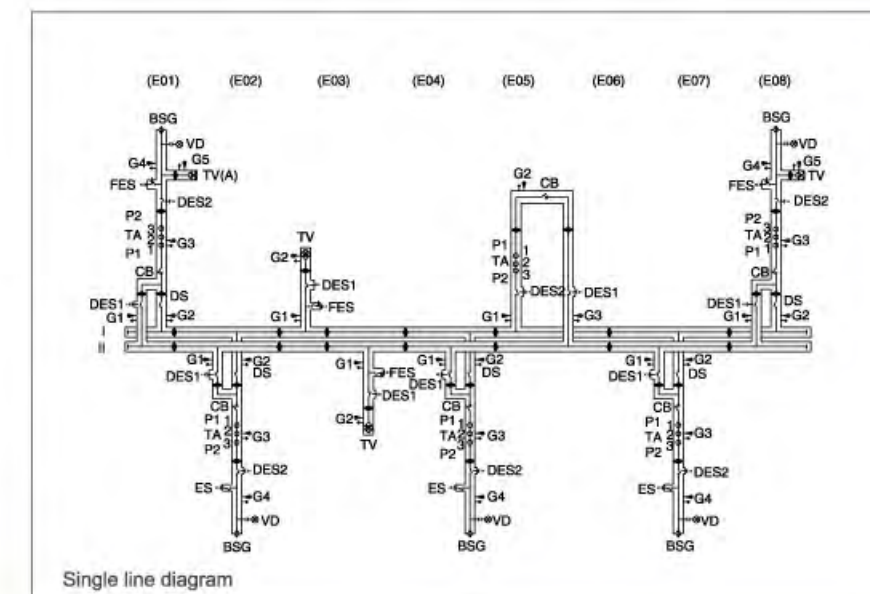
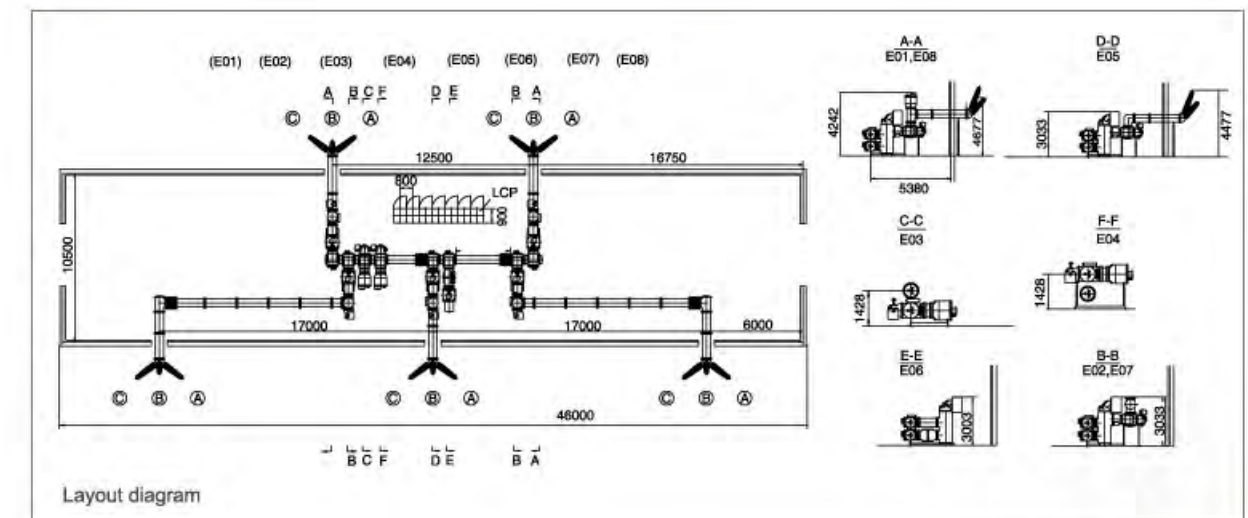
- The connection between main bus of the bay is a dismantlable structure, so overhauling maintenance is very easy.

Be applicable to various substation connection modes.

The optimal scheme design provides the combination form with highest cost performance for users.

Double-busbar

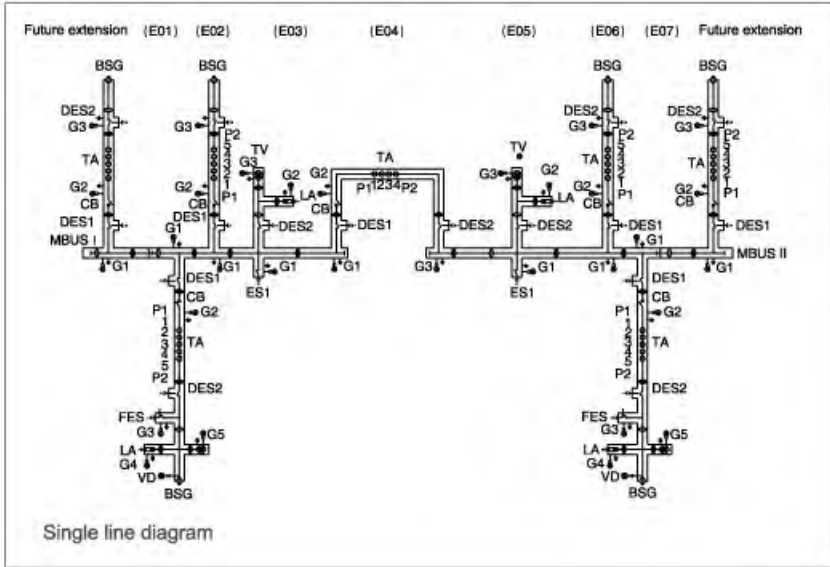
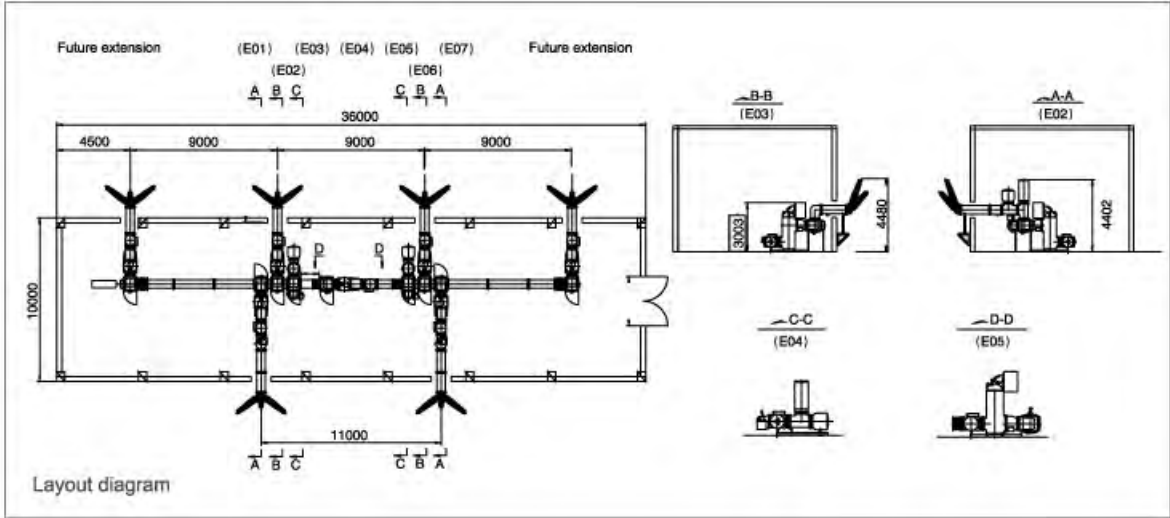
- The double-busbar connection can shorten the power outage time, and make power supply more safe and reliable.



Typical layout

Single-bus connection

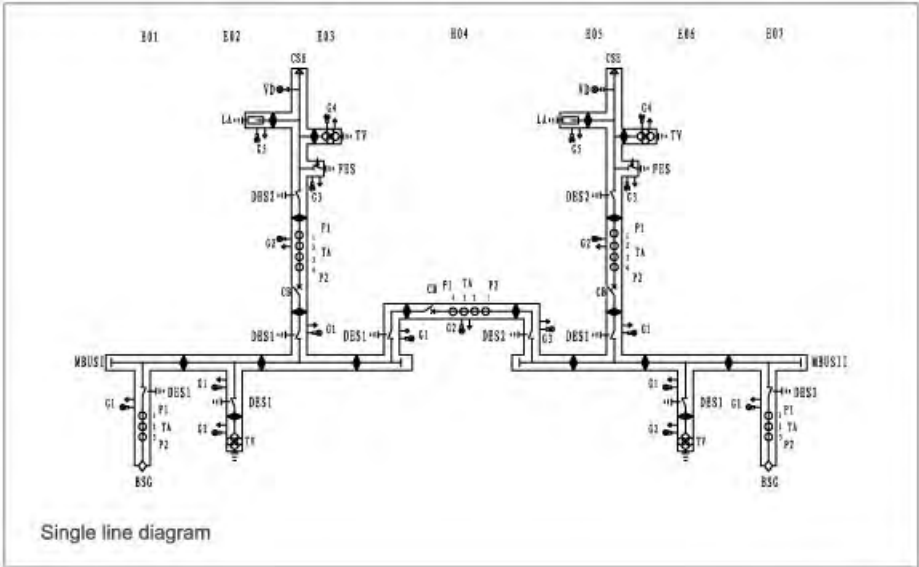
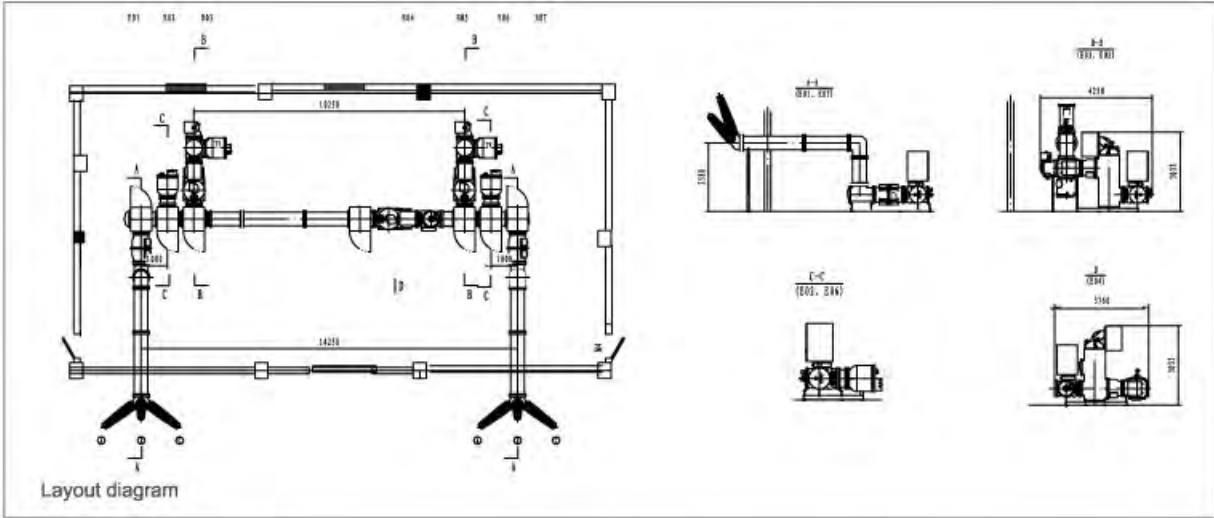
The sectionalized single-bus connection can enhance the reliability of power supply. It is simple and is easy for extension with less investment.



The optimal scheme design provides alternatives for users.

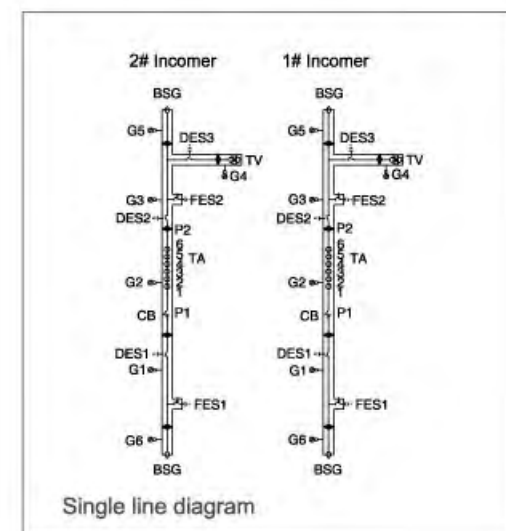
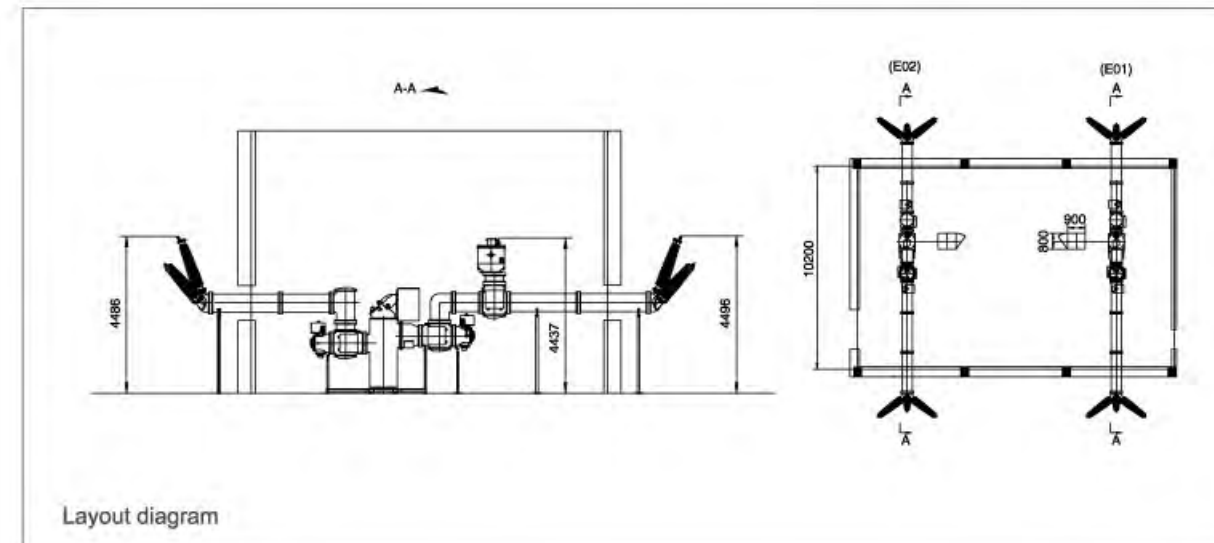
H circuit

The H circuit saves floor area and requires less investment and is economical and practical.



Line-transformer

- The substation which has only one incomer and one transformer can adopts the line-transformation group connection. It is convenient for operation and easy for extension with less investment.



Technical parameters

Rated Voltage		72.5kV/145kV	
Rated Frequency		50Hz/60Hz	
Rated Current		2500A/3150A	
Rated Power Frequency 1Min withstand Voltage		Phase to earth and between Phases	275kV
		Across the isolating distance	275kV+84kV
Rated Lightning impulse withstand Voltage		Phase to earth and between Phases	650kV
		Across the isolating distance	650kV+118kV
Partial Discharge		Test voltage	220kV
		Whole bay	5pC
		Insulator	3pC
Rated Short Circuit Breaking Current			31.5kA/40kA
Rated Peak withstand Current			80kA/100kA
Rated Short Duration withstand Current			31.5kA/4s, 40kA/4s
SF ₆ Gas Pressure at 20℃	Circuit Breaker Compartment	Rated Pressure	0.68MPa
		Alarm Pressure	0.63MPa
		Lockout Pressure	0.60MPa
	Other Compartments	Rated Pressure	0.68MPa
		Alarm Pressure	0.63MPa
		Lockout Pressure	0.60MPa
Moisture Content of SF ₆ Gas	Circuit Breaker Compartment	Commissioning	150ppm(uL/L)
		Operation	300ppm(uL/L)
	Other Compartments	Commissioning	250ppm(uL/L)
		Operation	500ppm(uL/L)
SF ₆ Gas Leakage Rate			≤0.3% per year
Breaking times of rated short circuit breaking current of circuit breaker (Electrical Endurance)			20 times
Mechanical	Circuit Breaker	10000 times	
Endurance	Disconnecter and earthing switch/fast earthing switch (DES/FES)		5000 times
Service Life			≥30 years
Maintenance Cycle			≥20 years
Making times of Rated Short Circuit Making Current (FES)			Twice
Structure			Three Phase in One Tank
Standard Dimension (Width x Depth x Height)			1000x4270x3003mm



Transportation, installation, maintenance and service

Performance

Meet the customer requirements to the best extent and provide excellent services for customers.

Transportation

- N2 or SF6 is filled into the bay under transportation pressure, and the whole bay is transported together in waterproof, rustproof and anti-corrosion packaging.
- Our company was the first to conduct the transportation test in the industry, so the products can bear the vibration and impact under severe road conditions and the products finally delivered to the user's site are qualified.
- With standardized transportation route and controlled transportation speed, our company has established long-term cooperative relations with the transportation company.



Installation and maintenance

- The transportation units are fully assembled and tested in the factory, so the site installation cost is low.
- With simple working procedures, detailed installation training and few special tools, the installation work strictly abides by the provisions of "instructions for field operation" and is carried out rapidly and effectively under the guidance of after-sales service engineers who have rich electrical experience in Sieyuan.



Service

Quality management of full process and full life cycle

- Establish the archives of product installation and maintenance and perform the spare parts management of full life cycle.
- Professional services: standardized work and trained service team.
- Establish the emergency service barrier-free channel, so as to ensure the contact channel smooth and effective and make the acceptance of customer service demand more rapid and more convenient. Periodically pay a return visit to customers, understand the customer demand.
- The service personnel communicate with the company in real time, so the service operation can get real-time guidance from the company.



Performance



110 kV substation engineering for ship plates of Zhongpu (Handan) Iron & Steel Co., Ltd.



Vietnam An Hua Pulp and Paper Co., Ltd.



Yilan Wuguocheng Substation of Heilongjiang Electric Power Company



Garbage power generation engineering of Shanghai Laogang Renewable Energy Sources Co., Ltd.



220kV Gangnan Substation Engineering of Xinjiang Electric Power Company



110kV Substation of Baiyinhua Third Mine of CPI Mengdong Energy Group Co., Ltd.



Qinhuangdao Nanlizhuang 110kV Substation engineering of North China Power Grid



Jining Yinhe Substation of Shandong Electric Power Company



Dengke Hydropower Station in Baoshan, Yunnan