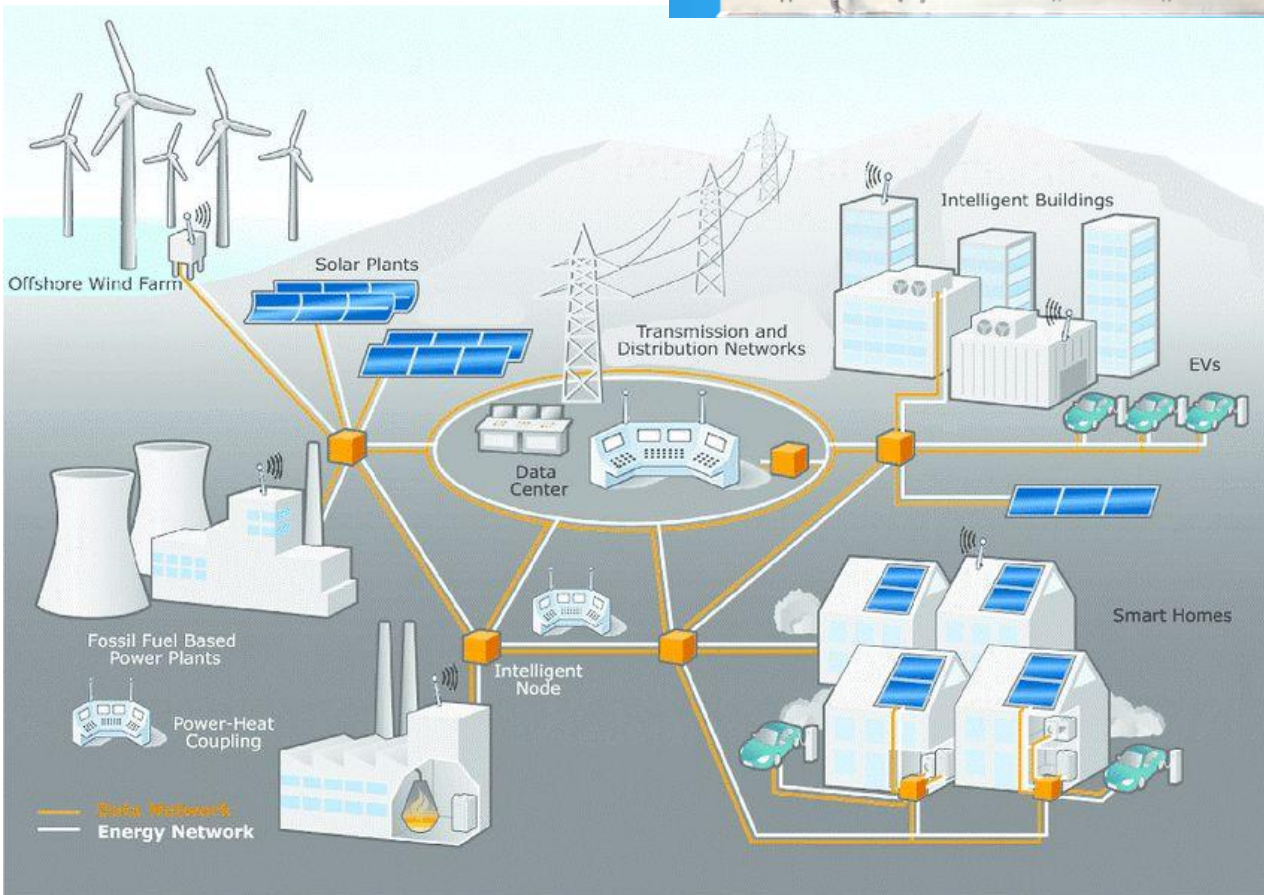


HG11-145 SF6 GIS

145kV, up to 3150A, 40kA

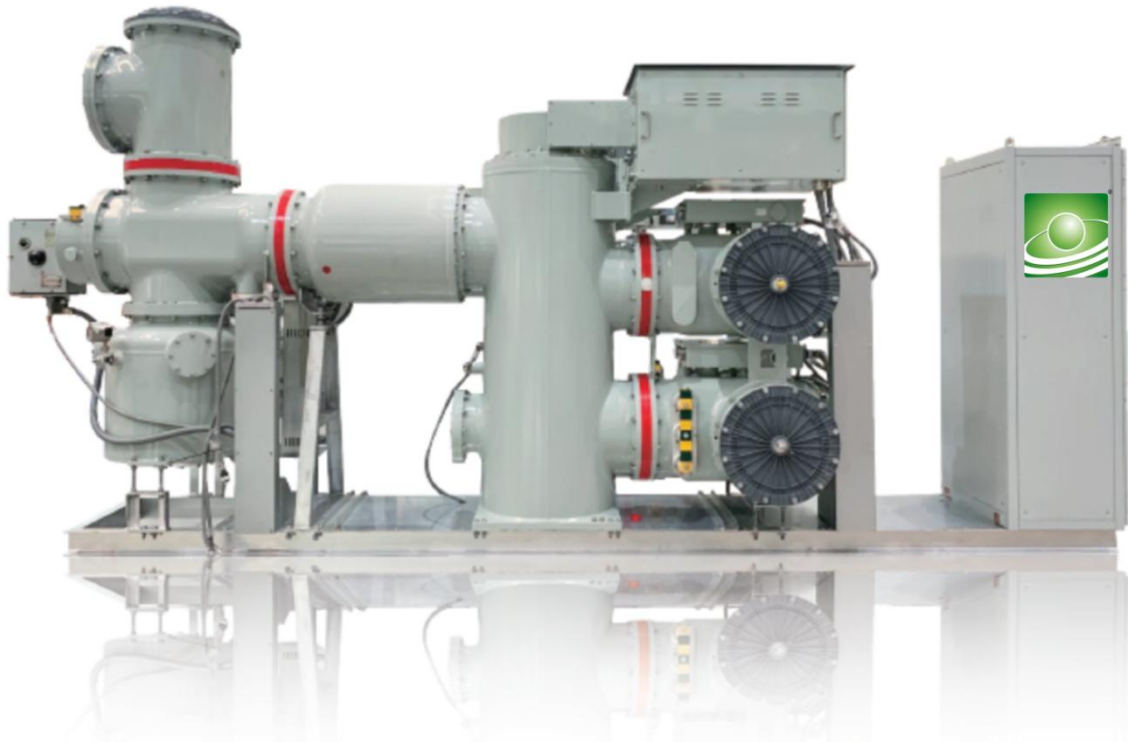


Shenyang Huade High Technology Electric Co., Ltd

HG11-145 SF6 Gas Insulated Switchgear

As the electric power industry advances, power users are placing increasing emphasis on the miniaturization of power transmission and transformation equipment. This trend is driven by the benefits of compact electric equipment, which not only conserves land and reduces civil construction costs but also minimizes the use of greenhouse gas SF6, aligning with environmental protection requirements.

Drawing on years of expertise in high-voltage electrical appliance design, Shenyang Huade High Technology Electric Co., Ltd. has developed the latest generation of the HG11-145 three-phase common tank SF6 GIS. This innovation incorporates the most advanced global technology and design concepts. The product features a modular design and layout of standard components, offering advantages such as a compact footprint with an interval width of just 0.8 meters, advanced technology, and high reliability.



HG11-145/T 3150-40 GIS

Standard

HG11-145 GIS fully meets IEC 62271-203, GB7674, DL617 and other standards. With high technical parameters and stable and reliable quality.

Design concept

HG11-145 GIS improves product performance with smaller size, which greatly reduces civil costs and saves operating costs.

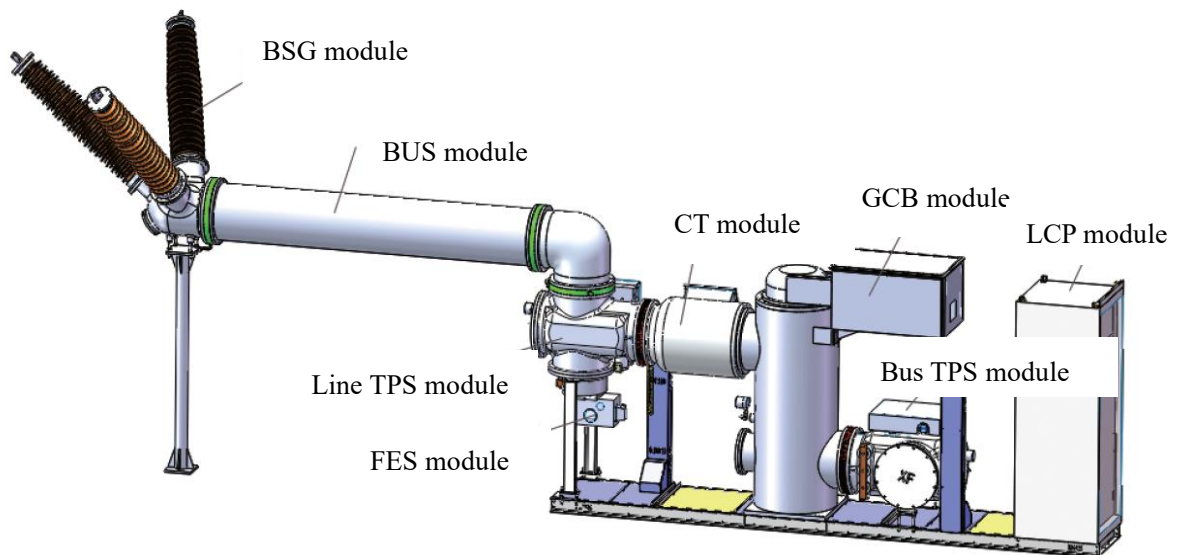
Solutions

HG11-145 GIS has maximum system reliability and minimum maintenance. Modular design adopted for easy expansion and reconstruction in the future.

Product Structure

The HG11-145 GIS consists of several standard functional modules, including the gas circuit breaker (GCB), isolation-earthing combination switch (TPS), voltage transformer (VT), current transformer (CT), bushing (BSG), and busbar (BUS). These modules share a uniform interface form and size, allowing for flexible combinations to meet the design and layout requirements of various substations. Each module is designed for easy assembly, facilitating future reconstruction and expansion, while gas-insulating insulators minimize interaction between adjacent modules.

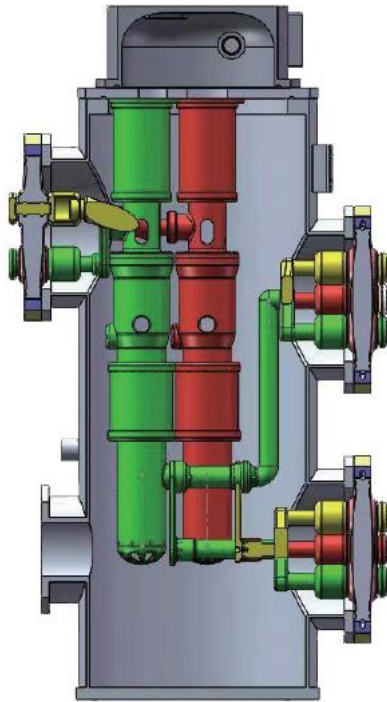
The flexible modular design optimizes substation design and layout, taking into account various factors such as main wiring, incoming line and cable routing, building size, trafficability, reserved extension, and fast troubleshooting.



HG11-145/T 3150-40 GIS

Long-term safe and stable operation of all components and functions of the substation GIS are ensured through reasonable design, error-proof system setting, careful inspection and strict quality control.

Circuit breaker (GCB) module



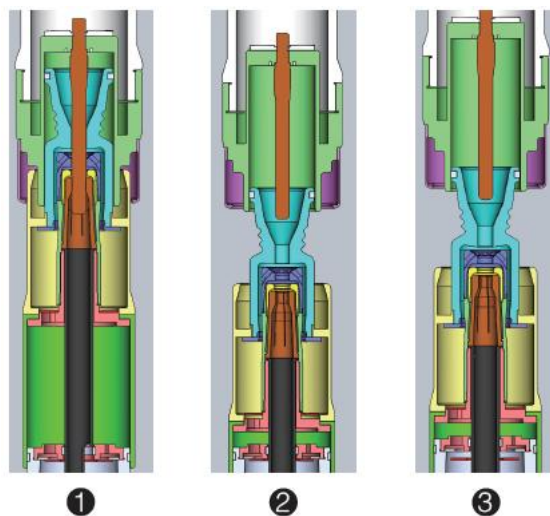
The circuit breaker features a three-phase common tank structure, with all three phases sharing a spring operating mechanism with mechanical interlock. The circuit breaker modules are equipped with three or four coupling flanges as interfaces, allowing direct coupling with all other modules for a very compact arrangement. For instance, installing a large power station with a ring bus or circuit breaker arrangement is as straightforward as building a small ring network.

The circuit breaker utilizes the latest generation of self-energy SF6 interrupting technology and a full-spring operating mechanism, resulting in minimal maintenance requirements.

Through optimized electric field calculations, the double-bus scheme integrates the internal line of the circuit breaker, simplifying the primary bus arrangement and reducing the occupied area.

Excellent breaking performance

The latest generation of self-charging SF6 interrupting mode and the optimized design of electric field and airflow field enable the circuit breaker to have excellent breaking performance, and have good opening and closing capability for various short-circuit fault currents including out-of-phase earthing and small current including line charging current; the application of new nozzle materials makes the nozzle more resistant to ablation and greatly improves the reliability of electric service life.



Circuit breaker closing
 Breaking working current
 Breaking short-circuit current
 Plenum compartment



Thermal expansion



plenum compartment

Compressed gas compartment

Principle of self-charging interrupter

High quality arc contact

The arc contact of the circuit breaker is provided by the high-quality supplier, and the full-automatic production line of the whole process ensures the high reliability and consistency of the arc contact quality. The arc contact has extremely high electrical wear resistance, extremely low ablation rate and extremely low crack tendency, thus ensuring the highly reliable breaking performance of the interrupter.



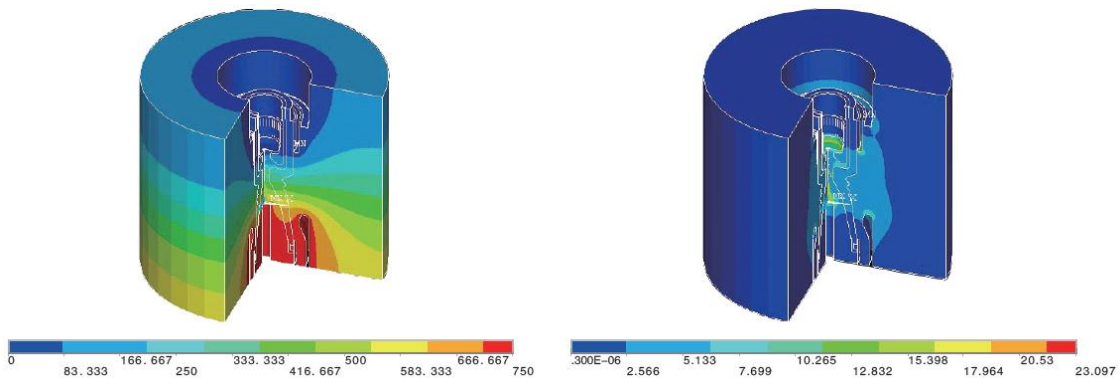
GCB quincunx arc contact



GCB arc contact bar

Continuously optimize the structure through theoretical calculation

The electric field of each insulation link is optimized. The product is designed according to the highest insulation requirement of 145kV voltage level and has a large margin. The power frequency withstand voltage is 315kV, and the lightning impulse withstand voltage is 750kV, which ensures the high reliability of insulation.



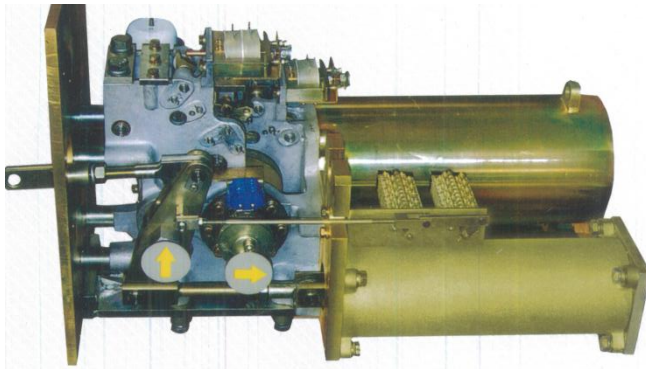
Electric field distribution diagram of insulation distance

Surface field intensity distribution diagram of insulation distance



Simulation of air flow field: distribution of Mach number at a certain time of interrupters breaking

Spring operating mechanism of circuit breaker



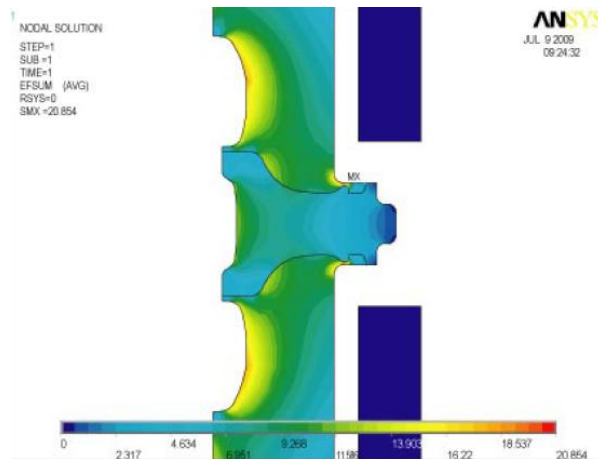
Spring operating mechanism, small volume and mechanical life up to 10,000 times meets the oil-free, non-gasification environmental protection requirements.

- electrical or manual charging
- electrical or manual operation
- Slow opening and closing operation.

Basin-type insulator



basin-type insulator



Analysis of electric field distribution of basin-type insulator

The optimal shape of the three-phase common tank insulator is selected through the modeling analysis of the electric field calculation software.

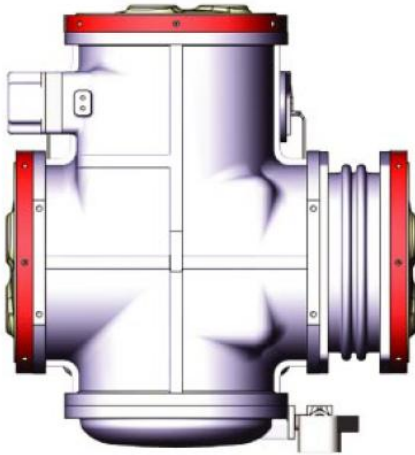
Epoxy resin and aluminum oxide filler are selected for manufacturing, vacuum casting process is adopted, and the pressure resistance level completely meets the design requirements through type test verification.

The basin-type insulator is arranged between adjacent different air pressure compartments or between adjacent spaced bus type EDS modules, plays a role in connecting and supporting a main loop conductor, maintains different gas pressures required by the adjacent compartments, and minimizes the mutual influence between the adjacent modules.

Earthing disconnecting combined switch(EDS) module

The Earthing Disconnecting Combined Switch (EDS) module integrates the disconnecting switch and the maintenance earthing switch into a single unit, utilizing a shared moving contact. It features a natural mechanical locking mechanism, effectively preventing simultaneous connection of the disconnecting switch and the earthing switch, thereby eliminating the risk of mis-operation.

Bus EDS

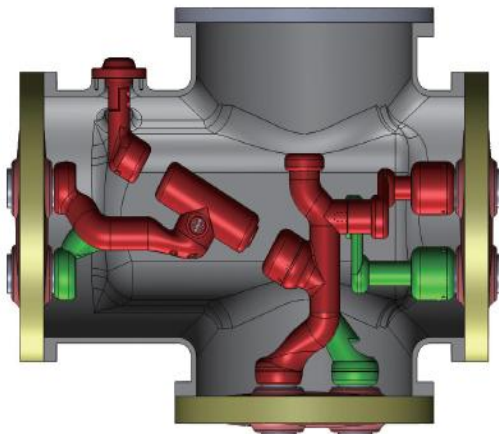


Bus EDS

- The bus EDS integrates the bus disconnecting switch and the earthing switch for maintenance within the same module. This design not only enables direct connection between compartments but also allows interconnection through the branch bus and telescopic adjusting joint.
- The bus EDS is capable of handling small capacitance and inductance currents, as well as switching the bus conversion current in double-bus transformer substations.
- The user-friendly structure design allows for easy observation of the working state of the opening and closing position indicator from the inspection path.

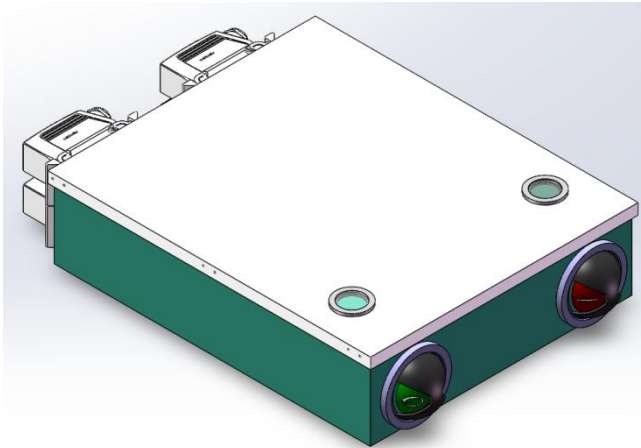
Line EDS

The line EDS includes the functions of outgoing line side disconnecting switch and outgoing line side maintenance earthing switch. It allows the compartment to be connected to various terminal modules (including cable terminations, overhead lines and transformer terminations) and to voltage transformers and surge arresters.

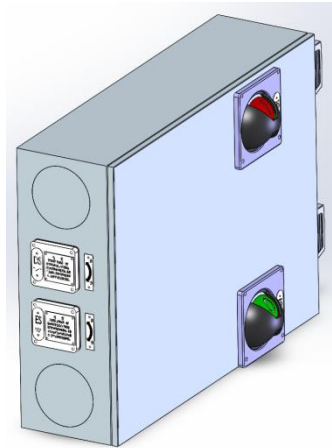


Line EDS

EDS operating mechanism



Bus EDS operating mechanism



Line EDS operating mechanism

Disconnecting switch and earthing switch share one operating mechanism, which can also be operated manually in case of emergency. The EDS operating mechanism is directly inserted on the body, without exposed connecting rod, with high transmission efficiency and good tolerance. It's driven by double motors, with mechanical interlock and clutch function to ensure the safety of motor.

Fast earthing switch FES module



Fast earthing switch FES module

The Fast earthing switch is equipped with an motor spring operating mechanism, and the motor causes the spring to store energy, and the spring releases when the spring exceeds the inflection point, so that the moving contact can be quickly opened and closed, and the quick earthing switch is especially suitable for the feeder earthing switch.

The Fast earthing switch can be isolated and disconnected with the enclosure of the working earthing. When the adjustment and test of relay protection, cable inspection, cable fault positioning and other work are needed, the outside and the conductor of the GIS main circuit can be electrically connected through the Fast earthing switch, which greatly facilitates the test work.

Current transformer (CT) and voltage transformer (VT) modules

Inductive voltage and current transformers are used for measurement and protection. These two types of transformers use gas as the main insulation (the insulation of voltage transformer consists of gas and film), so the insulation medium will not be aged and the reliability is high.



Current Transformer (CT)



Voltage Transformer (VT)

The current transformer is usually connected to the circuit breaker module and can accommodate multiple sets of secondary coils. The secondary side of the voltage transformer may have two measuring windings and an open delta winding for detecting earth faults.

The electronic transformer can be equipped according to the requirements of the user. The electronic transformer has the advantages of small volume, light weight, complete self-check protection, easy interface with secondary comprehensive protection, etc. With the digital development of electrical equipment, electronic current (voltage) transformer will be more and more widely used.

Lightning arrester (LA) module

HG11-145 GIS can be equipped with a lightning arrester module to limit the occurrence of overvoltage. The lightning arrester adopts valve plate type and gapless zinc oxide lightning arrester.

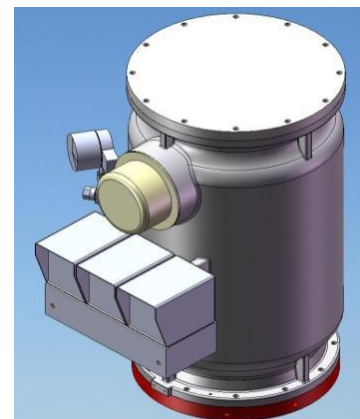
Outdoor bushings are used for connection to overhead lines or transformers. There are two kinds of high-strength porcelain and silicon rubber composite insulating bushing for users to choose.

It is recommended to use composite insulating bushing, which is composed of supporting pipe wall made of epoxy resin reinforced by glass fiber and vulcanized umbrella group made of silicon rubber. It has many advantages such as anti-explosion and anti-cracking, strong tensile strength, convenient installation and transportation, anti-fouling, good hydrophobicity and so on.

The oil-gas bushing connection part of the transformer can be provided according to the project requirements.



Zinc oxide valve



Lightning Arrester (LA) module

Air bushing BSG module



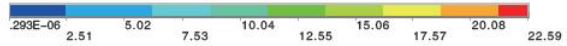
Compound insulating bushing



Air Bushing (BSG)/high strength porcelain



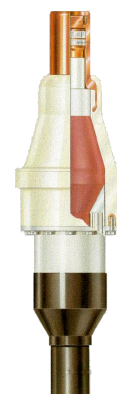
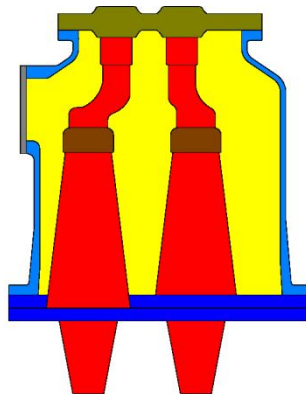
Bushing electric field distribution diagram



Bushing field intensity distribution diagram

Cable terminal

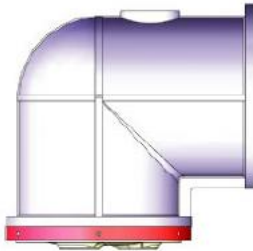
GIS can be connected with various types of high-voltage cables through three-phase common tank cable termination module. The coordination of cable termination box and cable termination comply with the requirements of IEC 60859.



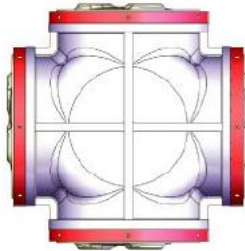
cable terminal

Transition module

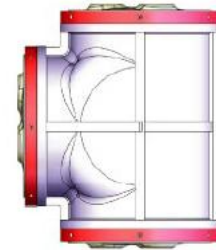
It is used for realizing interconnection inside the bays. The following transition modules are available according to the circuit design and the bay arrangement.



L-shaped bus module



Four-way bus module



Three-way bus module

Secondary control LCP module

The LCP control panel is equipped with all auxiliary electrical equipment for the purposes of command input, fault alarm, electrical interlocking and remote control, and collects the current and voltage signals required for control and protection equipment. The primary equipment is connected to the local control panel by multiple multi-core cables through plug connectors. All cables and plug connectors are prepared and passed the test before being delivered out from the factory.

The panel of the control panel is provided with components such as position indicator, control switch and fault alarm device. The user can release the interlock through the unlocking switch, and can also switch the control mode through the local/remote change-over switch.

According to the requirements of the digital substation, we design an intelligent digital control and protection module i-LCP, the output of which follows the IEC61850-9 standard format. It performs on-line detection on various functional data of the equipment and provides reference data for inspection and detection.



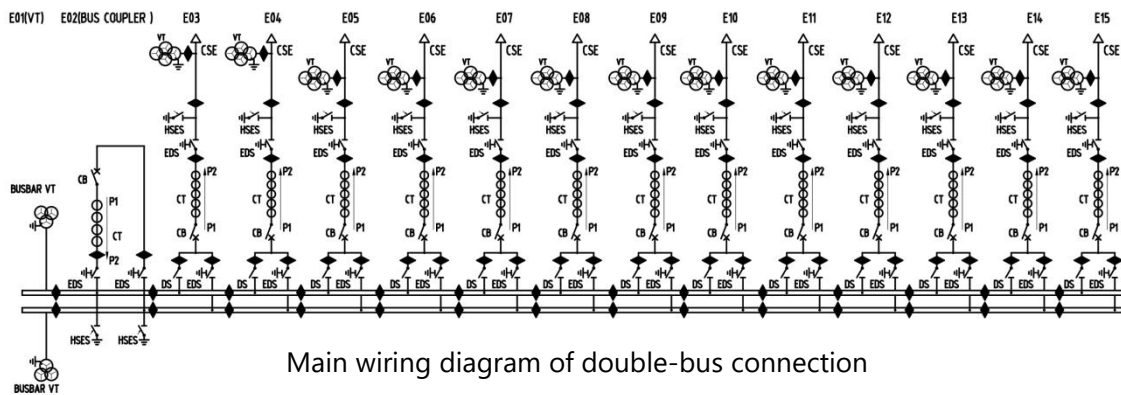
Control panel in operation

Applicable to various substation wirings

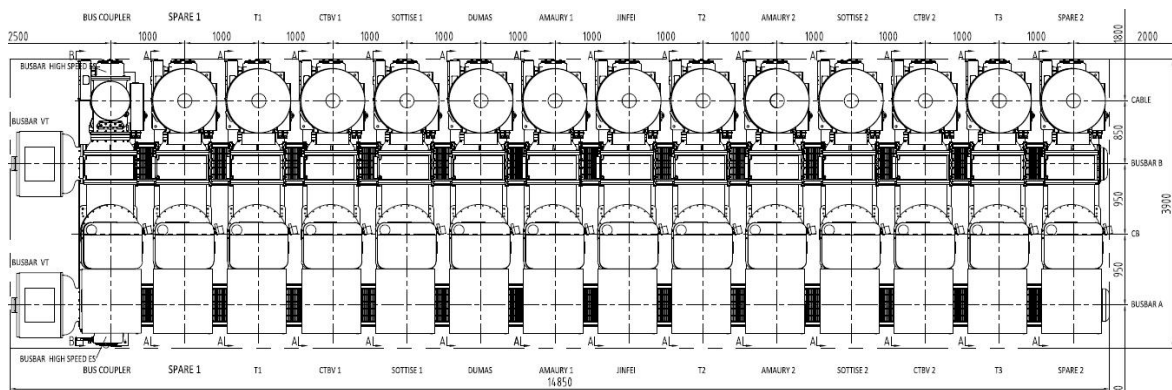
HG11-145 GIS can meet the design principle requirements of safe and reliable design, advanced technology, reasonable investment and efficient operation of modern substations. With flexible modular design, it can realize all wiring modes required by conventional substations, including single-bus, double-bus, single-bus section, double-bus section, bridge connection, ring-type bus connection, circuit breaker connection line transformer bank, etc., so that the substation can be conveniently optimized in design and layout. Conditions and factors of various substations, such as main connection, incoming line and cable direction, size of substation room, reserved expansion, rapid maintenance and troubleshooting, are fully and specifically considered. The following are several main wiring modes commonly used in HG11-145 GIS:

Double-bus connection mode:

The power supply of the double-bus connection mode is reliable, no need to interrupt the power supply during busbar maintenance, the scheduling is flexible, the expansion is convenient, and the testing is convenient. It is suitable for users who have a large number of outgoing circuits or power supplies on the busbars and who require rapid restoration of power supply after a bus failure. It is now widely used in important power plants and substations with large capacity.



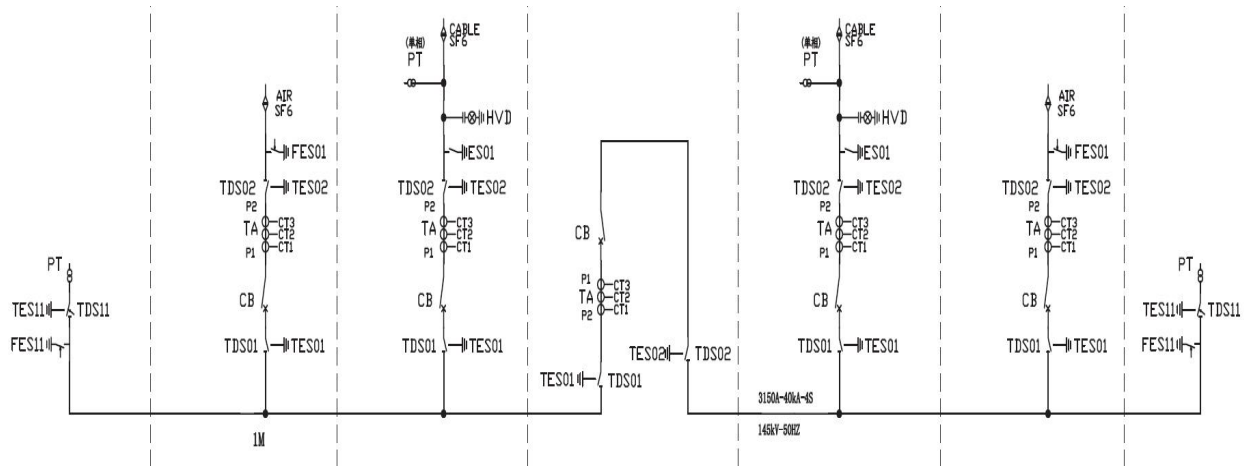
Main wiring diagram of double-bus connection



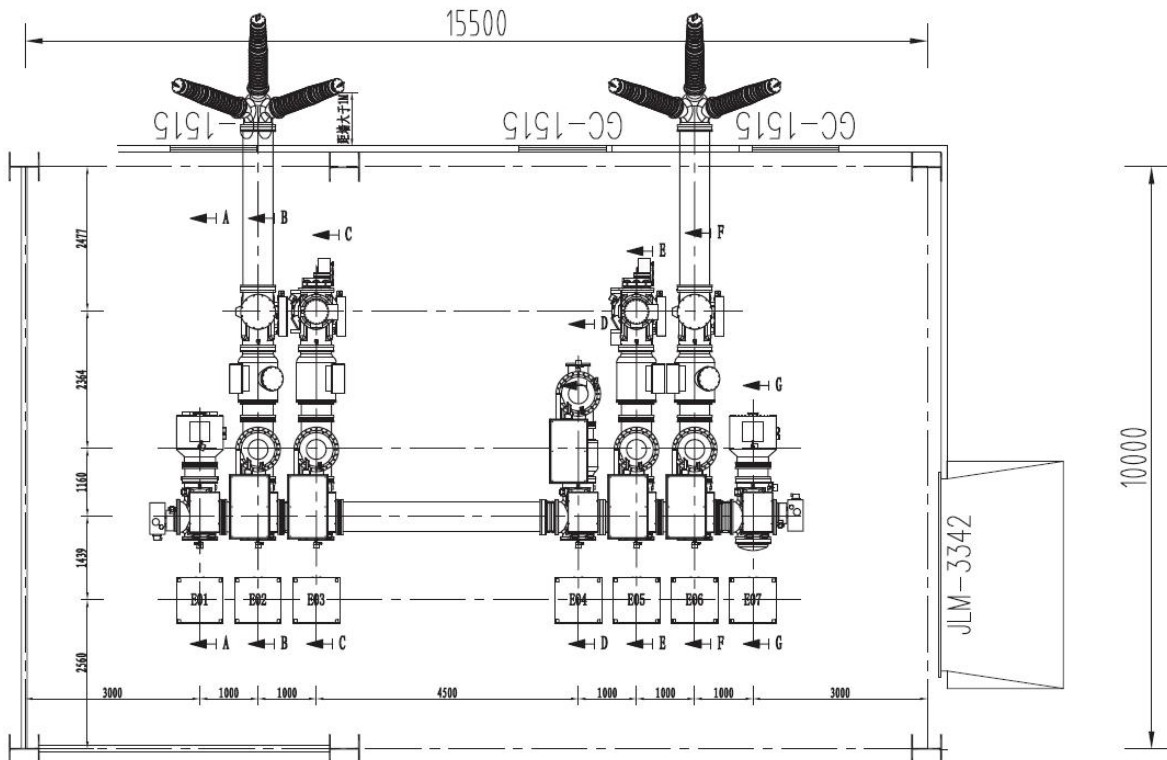
Layout plan of double-bus connection

Single-bus section connection mode:

Single bus section connection mode adopts dual power supply. The power distribution line can be overhauled by sections, and the power failure mode is small. When one section of bus fails, the section breaker will automatically cut off the faulty section to ensure uninterrupted power supply of normal section of bus and avoid power failure of important users. It is mainly used in small capacity power plants and substations and consumers with relatively high quality power supply.



Main wiring diagram of single-bus section connection



Layout plan of single-bus section connection

Technical Parameters

No.	Item		Unit	Parameters
1	Rated voltage		kV	145
2	Rated frequency		Hz	50/60
3	Rated continuous current		A	1250~3150
4	Rated short-circuit breaking current		kA	40
5	Rated short circuit making current		kA	108
6	Full breaking time		ms	≤ 60
7	Circuit breaker switching cable charging current		A	160
8	Circuit breaker switching line charging current		A	50
9	Circuit breaker closing time		ms	≤100
10	Circuit breaker opening time		ms	≤40
11	Asynchronous circuit breaker	Opening	ms	≤2
		Closing	ms	≤3
12	Rated short-time withstand current (effective value)		kA	40
13	Rated short-circuit duration		s	3
14	Rated peak withstand current (effective value)		kA	108
15	Rated power-frequency short-duration withstand voltage (1min)	Phase to earth, Phase to Phase	kV	275
		Across the isolating distance	kV	315
16	Rated lighting impulse withstand voltage (Peak value)	Phase to earth, Phase to Phase	kV	650
		Across the isolating distance	kV	750
17	SF ₆ vacuum interrupter Gas pressure (20℃, gauge pressure)	Rated pressure	Mpa	0.6
		Alarm pressure	Mpa	0.55
		Locking pressure	Mpa	0.5
18	Circuit breaker electrical life			E2 level
19	Rated operating sequence			O-0.3s-CO-180s-CO
20	Partial discharge (Under 1.2 times rated voltage)	Whole compartment	pC	5
		Insulation parts	pC	3
21	Compartment weight		T	1~5
22	Annual leakage rate			≤0.1%

Note: The complete technical parameters will be determined by the user and the manufacturer together.

Transportation, installation and commissioning

As HG11-145 GIS is light in weight and extremely convenient for transportation and installation, we usually transport and install a complete, factory-manufactured and tested bay and its control panel as a transportation unit. Its outstanding advantages are:

1. Short on-site installation time and simple and convenient commissioning;
2. The whole bay is subject to routine dielectric test, partial discharge test, air tightness, micro-water and operation test in the factory, and the equipment delivered to the site will have no insulation damage;
3. As HG11-145 GIS is small in size and light in weight, there are almost no special requirements for packaging and transportation roads.
4. The working performance of HG11-145 GIS is not affected by external factors such as dust and moisture, so the maintenance workload of GIS is extremely small and almost maintenance-free.
5. For the usual inspection, operators do not need to enter the GIS enclosure, and the substation can be kept in operation. Periodic checks include checking the correct operation of drives, auxiliary switches, density relays, etc.



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Address: 10A-2, 5th Road, Tiexi District, Shenyang, China

Post code: 110027

Tel: 024-85818396

Fax: 024-88263464

Website: www.huade-electric.com

Email: export@syhuali.com