



Gas Insulated Switchgear (GIS/HGIS) up to 252kV
Compact Gas Insulated Switchgear (GIS) up to 145kV

2011/2012

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Brief Introduction

About CHINT T&D

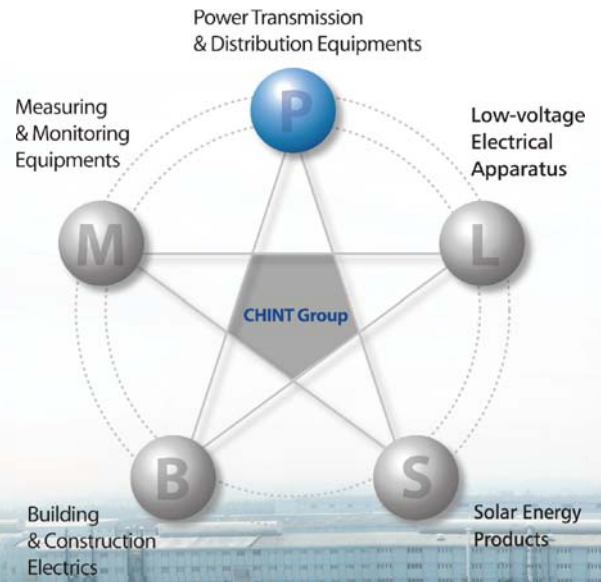
CHINT T&D is a branch company of CHINT Group Corporation. Covering 900,000m², with an investment of 450 million USD. CHINT T&D has one of the world largest power transmission & distribution equipment manufacturing centers in Shanghai.

Sales Turnover

Around 535 million USD in the year of 2010

Employee

4,300 employees





Product Range

- Power Transformer up to 750kV
- Distribution Transformer up to 35kV
- Dry-type Transformer up to 35kV
- Reactor up to 220kV
- GIS up to 252kV
- HV Circuit Breaker & Disconnecter up to 252kV
- VCB 12~40.5kV
- MV & LV Switchgear Panel, Prefabricated Substation up to 40.5kV
- LV Terminal Box, Busbar Duct
- Surge Arrester & Insulator up to 500kV, CT & PT up to 220kV
- Power Distribution Automation System
- Cable up to 36kV
- Capacitor & Capacitor Bank
- Turn-key Solution

About CHINT Group

- CHINT is the leading player in the Power Transmission & Distribution industry and Low-voltage electrics industry in China. Founded in 1984 by a few local entrepreneurs and currently hiring 18,000 employees worldwide.
- Ranked in The 2011 BCG 100 New Global Challengers (The Boston Consulting Group, 2011)
- CHINT Low-voltage Electrics launched IPO at the Shanghai Stock Exchange of China (2010)
- No.2 in China Electricity Industry's Top 10 Most Competitive Enterprises (China Machinery Industry Information Institute, 2009)
- No.3 in China Electricity Industry (China Machinery Industry Information Institute, 2009)
- No.240 in Top 500 Chinese-Companies (China Enterprise Federation, 2009).
- No.1 in Power T&D and the controlling devices (China Machinery Summit, 2009)
- Ranked in Top 100 Best Employers in China (China Entrepreneurs Summit, 2008)
- No.15 in Top 100 Private & Public Companies in China (Forbes, 2006)
- National Quality Management Award(2004) (One of top honours for manufacturing companies in China)
- Worldwide business operation with 2,000 sales offices, agents, distributors, and local partners in domestic Chinese market and distributors & local partners in over 105 countries. International branches or regional offices set up in USA, UAE, Germany, Russia, Brazil, Ukraine, Hong Kong of China, UK and Nigeria.
- CHINT stretches its business to a new frontier of solar energy by setting up a branch company specialized in the solar energy products development.
- The R&D center of CHINT is recognized as the National Level R&D Center run by the companies, which means the R&D level of CHINT Group has reached the leading position in the industry of China.

Sales References

With a worldwide presence in over 110 countries such as, Italy, Germany, Estonia, USA, Russia, Japan, Australia, Saudi Arabia, Poland, Ukraine, Mongolia, Kazakhstan, Pakistan, Myanmar, Indonesia, Thailand, Egypt, Yemen, Algeria, Morocco, Congo, Tanzania, Mali, Zambia, Kenya, South Africa, Ghana, Nigeria, Colombia, etc, CHINT T&D provides reliable and high-qualified products and solutions to clients engaged in different businesses.

Utility User (over 45 utilities)



Europe

- **Alliander-Netherland**
Products: Power transformer.
- **EAC-Cyprus**
Products: Cable.
- **Eesti Energia-Estonia**
Products: Power transformer.
- **EMS-Serbia**
Products: Power transformer.
- **ENEL-Italy**
Products: Distribution transformer, cable.
- **Fingrid-Finland**
Products: Distribution transformer.
- **HS ORKA HF-Iceland**
Products: Power transformer.
- **PPC-Greece**
Products: Cable.
- **NEC-Bulgaria**
Products: VCB.

Latin America

- **CELEC S.P.-Ecuador**
Products: Power transformer.
- **CNEL-Ecuador**
Products: Power transformer.
- **ELCOSA-Honduras**
Products: Power transformer.
- **Enersis-Chile**
Products: Power transformer, surge arrester, insulator, SF₆ circuit breaker.
- **ENDESA-Chile**
Products: Power transformer, surge arrester, insulator, SF₆ circuit breaker.
- **ICE-Costa Rica**
Products: Power transformer.
- **PREPA-Puerto Rico**
Products: Surge Arrester.

Asia-pacific

- **BPC-Bhutan**
Products: Surge arrester.
- **EVN-Vietnam**
Products: Switch disconnector, power transformer, etc.
- **Kamoki-Pakistan**
Products: Substation turn-key project.
- **MEPE-Myanmar**
Products: Reactor, power transformer.
- **WRUD- Myanmar**
Products: Substation equipment supply, MV switchgear panel.
- **NEA-Nepal**
Products: Substation turn-key project.
- **NTDC-Pakistan**
Products: Substation turn-key project.
- **QESCO-Pakistan**
Products: Surge arrester.
- **TEPCO-Japan**
Products: Power transformer, circuit breaker, disconnector and CT&PT.

Africa

- **EPCO-Ethiopia**
Products: HV Circuit breaker, disconnector, earthing switch, surge arrester, insulator, CT.
- **ENE-Angola**
Products: GIS.
- **JIRAMA-Madagascar**
Products: Reactor.
- **KENGEN-Kenya**
Products: Surge arrester.
- **KPLC-Kenya**
Products: Cut-out fuse, surge arrester, insulator.
- **PHCN-Nigeria**
Products: Transformer protection & control panel.
- **RECO-Rwanda**
Products: Distribution transformer, etc.
- **REGIDESO-Burundi**
Products: Power transformer, distribution transformer.
- **SBEE-Benin**
Products: Power transformer.
- **SNEL-D.R. Congo**
Products: Power transformer.
- **SONABEL-Burkina Faso**
Products: Power transformer, reactor.
- **TANESCO-Tanzania**
Products: Substation turn-key project.
- **VRA-Ghana**
Products: MV switchgear, DC panel, disconnector.
- **ZESCO-Zambia**
Products: CT-VT metering unit.
- **STEG-Tunis**
Product: Cut-out Fuse.

Middle-east

- **NEC-Sudan**
Products: Power transformer.
- **NEPCO-Jordan**
Products: Power transformer, earthing transformer.
- **PEC-Yemen**
Products: Substation turn-key project.
- **PEDEEE-Syria**
Products: Insulator, surge arrester, substation turn-key project.
- **PEEGT-Syria**
Products: Insulator.
- **TEIAS-Turkey**
Products: Surge arrester, insulator.
- **WARD-Lebanon**
Products: SF₆ circuit breaker, disconnector, surge arrester, insulator.
- **Oman Power Generation Authorities-Oman**
Products: Power transformer.

CIS

- **ENA-Armenia**
Products: HV circuit breaker, switch disconnector, etc.

More >>>

Global Operation in Over **110** Countries

Industrial End User

Mining Industry

- BHP Billiton-Australia
Products: CT & PT, distribution transformer, etc.
- Rio Tinto-Australia
Products: Distribution transformer, CT.
- FMG-Australia
Products: Power transformer.

Iron-steel Industry

- JFE Steel-Japan
Products: Disconnecter.
- Bao Steel-China
Products: Power transformer, MV switchgear panel.

Cement Industry

- Serebryabskiy Cement Plant-Russia
Products: HV capacity compensation device, HV capacitor.
- Viet Quang Cement Plant-Vietnam
Products: Power transformer, HV circuit breaker, disconnecter, MV&LV switchgear panel.

Petroleum & Gas Industry

- Chevron-USA
Products: Switchgear panel, distribution transformer.
- PDVSA-Venezuela
Products: Power transformer, distribution transformer.
- CNPC-China
Products: Power transformer, GIS, MV switchgear panel.

Power Rental Industry

- Aggreko-UK
Products: Power transformer.
- APR Energy-USA
Products: Power transformer, HV circuit breaker, disconnecter, CT, PT.

Paper Industry

- VISY-Australia
Products: Switchgear panel
- UPM-Finland
Products: MV switchgear panel.

Chemical Industry

- Saint Gobain-France
Products: Power transformer, MV switchgear panel, cable, busduct.
- INVISTA-USA
Products: Distribution transformer, switchgear panel, DC panel.

Power Generation

- TATA Power-India
Products: Power transformer.
- SIBAYAK Geothermal Power Plant-Indonesia
Products: MV&LV switchgear panel, surge arrester, insulator, CT, VCB.

Commercial & Civil Construction

- Shangri-la Hotel-Philippine
Products: Distribution transformer.
- Kiev Boryspil International Airport-Ukraine
Products: Power transformer, GIS.

Shipbuilding Industry

- Fincantieri-Italy
Products: Power transformer.

More >>>

Engineering & Contracting

- EIFFAGE-France
Products: Power transformer, reactor.
- FLUOR-USA
Products: Power transformer.

More >>>

Turn-key Project

- Kamoki-Pakistan
Projects: 230kV substation EPC.
- Saint Gobain-France
Projects: 35kV substation EPC.
- PEC-Yemen
Projects: 132kV and 33kV substation EPC.
- NEA-Nepal
Projects: 132kV and 33kV substation EPC.
- SMCO-D.R. Congo
Projects: 220kV substation EPC.
- TANESCO-Tanzania
Projects: 35kV and 66kV substation EPC.
- NTDC-Pakistan
Projects: 220kV substation EPC.

More >>>





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1. General

1.1 Introduction

The Gas Insulated Switchgear(GIS/HGIS) is composed of the major equipments used in a substation such as circuit breaker, disconnecter, earthing switch, voltage transformer and surge arrester in a grounded metallic enclosure. GIS complies to IEC standard:62271-203.

1.2 Application

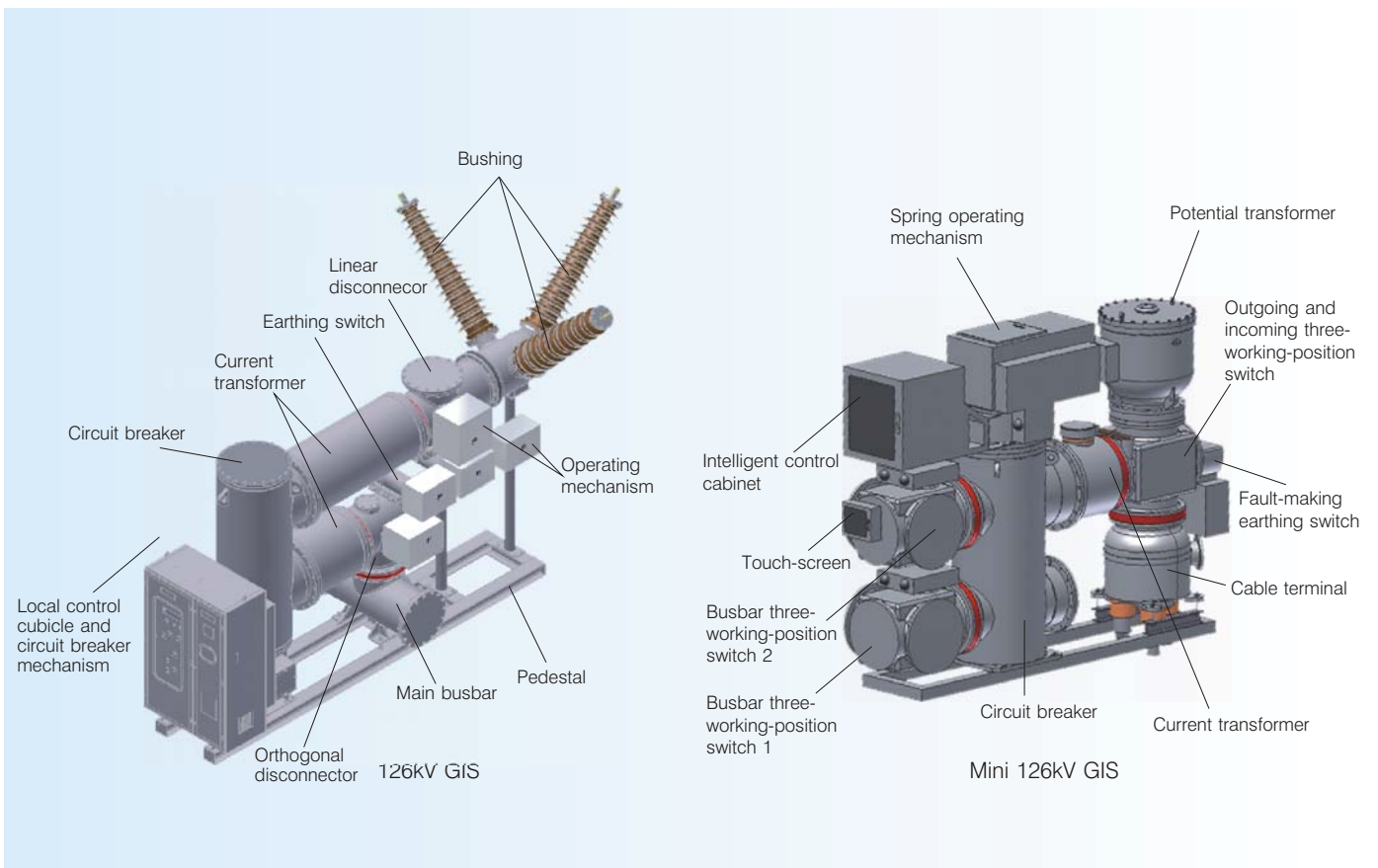
GIS can be used in the special power stations or the following areas besides open substation as:

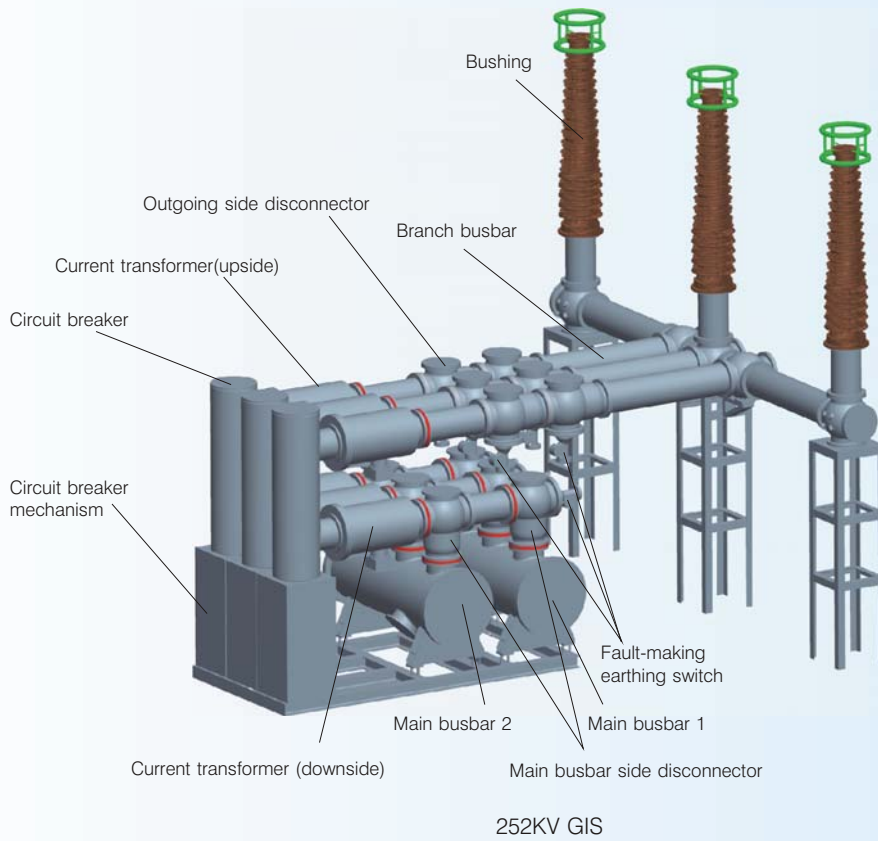
- Substation in city: suitable for cities with large population.
- Contaminated region: suitable for pollution or corruptive area, such as seaside, mining area and chemical plant.
- Hydropower station: suitable for underground substation.
- GIS greatly enhances performance and reliability and save space as well.

1.3 Main Feature

- High insulation reliability.
- High breaking capacity.
- Oilless, gasless and low noise operation.
- Maximally meet the requests of customer.
- Strong anti-seismic capacity.
- Less maintenance or free maintenance.
- Featured products with new design.
- The conduct adopts the thermal insert connection box. The patent number is 200520042177.4.
- The conduct adopts watchband type button contact connection, patent number of which is: 200520041720.9. Special shaft seal equipment, patent number of which is: 200520041721. Reliable guide means, patent number of which is: 200520042176.X.

1.4 GIS 3D Technical Diagram





2. Sales Reference

With its outstanding performance and quality, GIS provided by CHINT T&D has been widely adopted by utilities, industrial end users, contracting & engineering companies both domestically and abroad.



Kiev Boryspil International Airport-126kV GIS
 The Ukrainian Kiev Boryspil International Airport Project is one of the important projects from the 2012 European Cup.

ENE (State Grid of Angola)-126kV GIS

The 126kV GIS products offered by CHINT T&D to the State Grid of Angola are for the high-voltage power transmission project 2B substation of the Reconstruction and Residential Development Project.



Inner Mongolia Electric Power Group -126kV, 252kV GIS

Inner Mongolia Electric Power Group is one of the top electric grid companies in China, with which CHINT T&D has a sound partnership. CHINT T&D 126kV, 252kV GIS has consecutively serviced in several 110kV transmission line projects, 110kV substation projects and 220kV substation projects of the company.

Hunan Huaihua Electric Power Group-126kV, 252kV GIS

Hunan Huaihua Electric Power Group is the biggest electricity network in Hunan province of China. CHINT T&D 126kV, 252kV GIS operated in the 220kV substation of a temple in Huaihua City.





2008 “5.12” WenChuan Earthquake Electricity Relief Project-126kV GIS

CHINT T&D donated abundant HV electrical equipments to the disaster areas of WenChuan Earthquake, including 126 kV GIS products, for repairing and reconstruction of the local infrastructure facilities.

Sinopec (China Petroleum & Chemical Corporation)-126kV GIS

Sinopec (China Petroleum & Chemical Corporation) is one of the largest petroleum companies in China as well as in the world, and CHINT T&D 126 kV GIS served to the rehabilitation of North power grids project of one of its subsidiary, Shengli Oilfield Company.



More>>>

- China Huaneng Group (for wind power)252kV GIS
- China Heilongjiang Longmei Mining Holding Group-252kV GIS
- Qinghai-Tibet Railway-126kV GIS
- Xinyu Iron & Steel Corporation-126kV GIS
- Tianjin Binhai Electric Power Company-126kV GIS
- China Hubei Electric Power Company-Mini 126kV GIS
- Sichuan Coal Industry Group-Mini 126kV GIS
- COSCO SHIPYARD Group-Mini 126kV GIS
-

3. Workshop



• (A) (B) (C) Overview of workshops



CHINT T&D is equipped with manufacturing facilities of 900,000m² in total and the workshops of the HV Breakers (including GIS) covers nearly 10,000m² under conditions of completely closed, constant temperature and humidity, and dust-free standard.



D



E

- D GIS workshop
- E GIS Assembly workshop

- Airshower room
- CB assembly

- Bushing assembly



4. Manufacturing and Testing Facility

CHINT T&D always takes technical innovation and partner' satisfaction as our top priority to supply improved solutions continuously, with five percent of annual sales revenue as R&D investment.

4.1 Manufacturing Facility

To improve the production capacities and capabilities, CHINT T&D is equipped with first-class manufacturing facilities from home and abroad.

4.1.1 Insulation Casting Process

Insulation casting process is one of the key processes of GIS production, and is also an important measurement to GIS manufacturing capacity and level. CHINT T&D has established a first-class insulation casting production line to guarantee high-quality GIS products.



Compact Vacuum Casting Equipment



Curing furnace for manufacturing of basin-type insulator



Testing transformer



Production scene of casting workshop

4.1.2 Shell Manufacturing Process

Shell manufacturing process is one of the most important processes of GIS production. CHINT T&D established a shell production line with investment of around 15 million USD, which met the shell requirements of 126kV and 252kV GIS production.



Fully Hydraulic Four Roller Bending Machine



Automatic Aluminum Vertical Welding Machine



Semi-finished circuit breaker enclosure



Desktop CNC boring and milling machining center

4.1.3 Surface Treatment Process

CHINT T&D established the largest and most advanced surface-processing center in Asia in power transmission & distribution industry, with an advancing zero-emission sewage treatment station and fully automated production lines of silver plating, zinc plating, chrome plating and oxidation.



Plating workshop



Production scene of plating workshop



Silver plating production line of copper and aluminum



Sewage treatment system

4.1.4 Mechanical Process

In the HV breaker industry, mechanical processing plays a decisive role in the processing quality and level of the core components of HV breakers, such as the interrupter room.

We applies to the latest achievements of the machining technology and reach 100% self-production of the key components of aluminum and copper of HV breakers.



Wire cutting



Mechanical process workshop

4.1.5 Assembly Process

The assembly workshop was designed according to cleanliness 100,000 with equipments as blast drying oven electric, hydraulic lift trucks, SF6 gas filling devices, vacuum devices and so on.



Preparation for assembly



Storage control

Shell assembly

4.2 Testing Facility

CHINT T&D is facilitated with first-class testing labs and a QC inspection team with 30 professional testing staff. Close relationships with top Chinese and overseas testing institutions and labs, such as KEMA.



750kV Power frequency withstand voltage test transformer



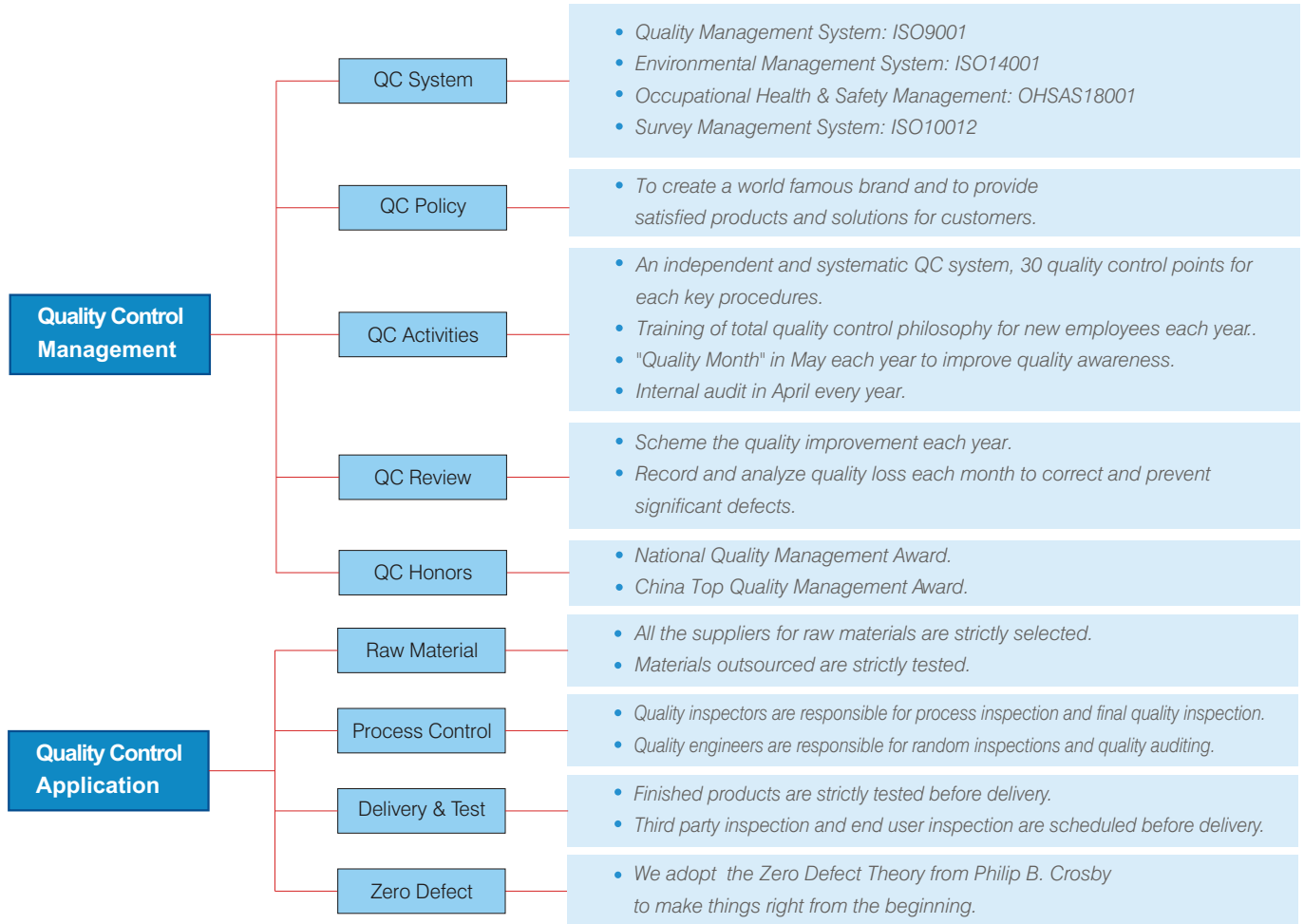
Testing equipments



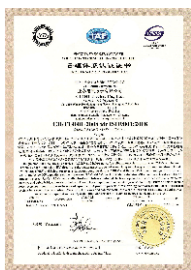
275kV Power frequency withstand voltage test transformer

5. Quality Management, Certification and Sales Service

5.1 Quality Management



QC System Certification



6. Transportation, Installation, Commissioning and Maintenance

6.1 Transportation

In order to ensure safety during transportation and minimize the installation workload at the scene, the product will be transported in transport-friendly unit forms.

- All the equipments have been finished debugging in the workshop, and all the gas rooms have been filled with SF₆ gas with pressure of 0.05MPa.
- Connecting parts of the transport-friendly units are sealed with transporting cover and with anti-rust protection.
- The packing way of the products changes according to the manner and duration of transportation and users' storage environment and duration.

6.2 Installation

- Workload, personnel, period for installation at the scene reduced a lot, because the GIS is usually transported three bays in a package.
- Work at the installation scene mainly includes: main bus connection between bays, outgoing line termination connection, secondary circuit cable connection and so on.
- Only a small amount of lifting equipment and special equipment are necessary at the installation scene.
- Simplified installation procedures, detailed installation instructions, face to face guidance by experienced technical personnel from CHINT ensure the GIS installation to be simple and efficient.

6.3 Commissioning

Local tests will be carried out after installation.

On-site testing items including:

- Switching operation test
- Main circuit resistance test
- SF₆ gas tightness test
- SF₆ Gas Moisture Measurement
- Secondary circuit check and electrical interlock test
- Main circuit insulation test
- Auxiliary circuit insulation test

6.4 Maintenance

Excellent performance of the products results in less or free from maintenance during operation.

Maintenance of equipment can be done according to the following principles:

- Switchgear operations reach the number of times provided by the installation instructions.
- Disconnecter operations reach the number of times provided by the installation instructions.
- GIS operate every 25 years a period to have the overhaul.



7. Typical Product and Parameter

Gas Insulated Switchgear (GIS/HGIS) up to 252kV

126kV Gas Insulated Switchgear (GIS)

(66kV,72.5kV Operation Applicable)

1. Standard: IEC 62271-203

2. Technical Parameter

2.1 Ambient Environment Condition

Description	Indoor	Outdoor
Temperature (°C)		-40~+40
Sunshine w/m ² (fine in midday)	-	1000
Wind velocity (m/s)	-	≤34
Relative humidity (daily average value)		≤95%
Relative humidity (monthly average value)		≤90%
Altitude(m)		≤2000 (Customized when > 2000m)

2.2 Main GIS Technical Parameters

Rated voltage		kV	72.5~126
Rate current /Rated current of main busbar		A	2500/3150
Rated frequency		Hz	50
Rated insulation level	Rated power frequency withstands voltage (RMS,1min)	Pole to earth	kV 230
		Open contacts	kV 230+73
	Rated lightning impulse withstands voltage(peak)	Between poles	kV 230+115
		Pole to earth	kV 550
		Open contacts	kV 550+103
		Between poles	kV 550+275
SF ₆ zero gauge pressure rated power frequency short time withstand voltage for 5min	Pole to earth	kV $\frac{126}{\sqrt{3}} \times 1.3$	
	Between poles	kV $\frac{126}{\sqrt{3}} \times 1.3 \times 1.5$	
Radio influence level(at 1.1 times rated pole voltage)		μV	≤500
Partial discharge (whole bay)		pC	<10
Rated SF ₆ pressure (20°C, surface pressure)	Circuit breaker gas room	Rated pressure	MPa 0.60
		Alarm pressure	MPa 0.55
	Other gas rooms	Blocking pressure	MPa 0.50
		Rated pressure	MPa 0.40
		Alarm pressure	Mpa 0.30/0.35 (PT)
SF ₆ annual leakage rate		%	≤0.5
Protection level of auxilliary circuit and moving part		-	IP5X, IP5XW

2.3 Main Technical Parameters of Circuit Breaker

Rated short circuit breaking current(RMS)		kA	40
Rated operating sequence		-	O- 0.3s-CO-180s-CO
Full breaking time		ms	≤60
Open time		ms	30.0±5.0
Close time		ms	≤100
On-off time		ms	50~70
Mechanical life		Time	10000

2.4 Main Technical Parameters of Disconnecter

Rated voltage		kV	126
Control voltage of electromotion operate mechanism		V	DC220, DC110
Rated control voltage of auxilliary circuit		V	DC 220/110, AC 220
Motor-driven operation mechanism	Rated closing time	s	≤ 6.0
	Rated opening time	s	≤ 6.0



2.5 Main Technical Parameters of Earthing Switch

Rated voltage	kV	126
Rated short time withstands current(RMS)	kA	40
Rated peak withstands current(peak)	kA	100
Rated short circuit continuous time	s	3
Rated insulation level	Rated power frequency withstands voltage(RMS,1min)to earth	kV 230
	Rated lightening impulse withstands voltage(peak)to earth	kV 550
Rated short circuit making current of fault making earthing switch	kA	100
Rated control voltage of spring mechanism (with NGES1- II)	V	DC110, DC220
Rated control voltage of electrical mechanism (with NGES1- I)	V	DC110, DC220
Earthing switch NGES1- I for repair	Rated closing time	s ≤6.0
	Rated opening time	s ≤6.0
Fault making earthing switch NGES1- II	Rated closing time	s ≤6.0
	Rated opening time	s ≤6.0
Rated control voltage of auxiliary circuit	V	DC 220/110, AC 220

2.6 Main Technical Parameters of Current Transformer

Rated current	Rated primary current	A	300, 400, 600, 750, 1000 1200, 1500, 2000, 2500
	Rated secondary current	A	1, 5
Rated power frequency withstands voltage of secondary circuit for 1min	kV	3	
Degree of accuracy	Measuring level	-	0.2, 0.5, 1
	Protective level	-	5P, 10P
Rated output (COS φ =0.8)	Measuring level	VA	10, 20, 30
	Protective level	VA	10, 20, 30

2.7 Main Technical Parameters of Voltage Transformer

Rated voltage	Rated primary voltage (primary winding)	kV	110√3	
	Rated secondary voltage (primary winding)	V	100√3	
	Spare winding voltage	V	100	
Insulation level	Rated lightening impulse withstands voltage(peak)	kV	550	
	Rated power frequency withstands voltage of primary winding for 1min	kV	230	
	Rated power frequency withstands voltage of secondary winding and spare winding for 1min	kV	3	
Degree of accuracy	Measuring level	Three-pole	-	0.2, 0.5
		Single pole	-	0.2, 0.5 1
	Protective level	-	3P	
Rated output	Measuring level	Three-pole	VA	150 150
		Single pole	VA	300 400
	Protective level	VA	300	
limited output	Three-pole	VA	350	
	Single pole	VA	300	

2.8 Main Technical Parameters of Busbar

Rated current	A	2000, 3150
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2.9 Main Technical Parameters of Metal Oxide Surge Arrester

System rated voltage	kV	126
Rated voltage of arrester	kV	100
Continuous operation voltage of arrester	kV	78
Nominal discharge current (8/20 μ s)	kA	10
Residual voltage of steep wave impulse current	kV	≤291
Residual voltage of lightning impulse current 8/20 μ s	kV	≤260
Residual voltage of operation impulse current	kV	≤221
Reference voltage of DC 1mA	kV	≥145
Impulse withstands current of rectangular current 2ms	A	600/800
SF ₆ zero gauge pressure, power frequency withstands voltage	kV	$1.3 \times \frac{126}{\sqrt{3}}$
Rated withstand voltage of inside insulation	Rated power frequency withstands voltage for 1min	kV 230
	Rated lightning impulse withstands voltage(peak)	kV 550

2.10 Main Technical Parameters of Air-SF₆ Bushing

Rated current	A	2000, 2500				
Rated insulation level	Rated power frequency withstands voltage for 1min	To earth	Dry	kV	230	
			Wet	kV	230	
		Between poles		Dry	kV	230+115
				Wet	kV	230+115
	Rated lightning impulse withstands voltage(peak)	To earth		kV	550	
		Between poles		kV	550+275	
Radio influence level	μ V	Under 1.1 times rated pole voltage, the radio influence level is not more than 500				

2.11 Main Technical Parameters of Local Control Cubicle

Rated operation voltage(secondary element)	V	DC: 48, 110, 220	AC: 220, 380, 660
Rated operation current(secondary element)	A	DC: ≤5.5	AC: 0.5~10
Rated frequency of AC power source	Hz	50	
Rated power frequency withstands voltage of secondary circuit insulation level for 1min	kV	2	

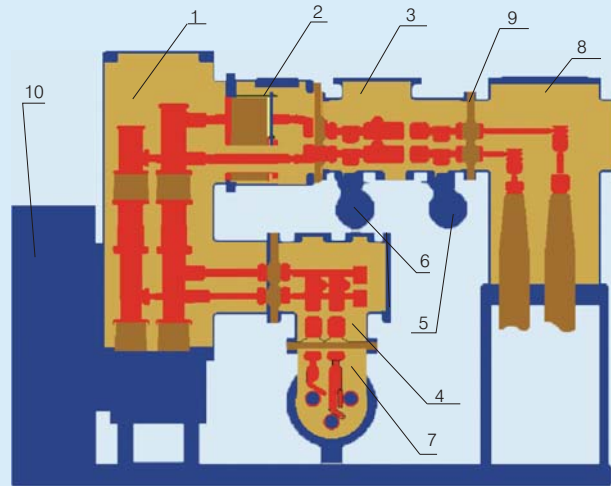
2.12 Outline Dimension and Weight (standard double bus bay)

Width	mm	1200
Length	mm	3390
High	mm	3100
Weight	kg	5500
Weight of SF ₆ gas	kg	120

3. Structure

Modular design makes the structure varied as per different bay arrangements.

Fig.1 Sectional diagram of one bay



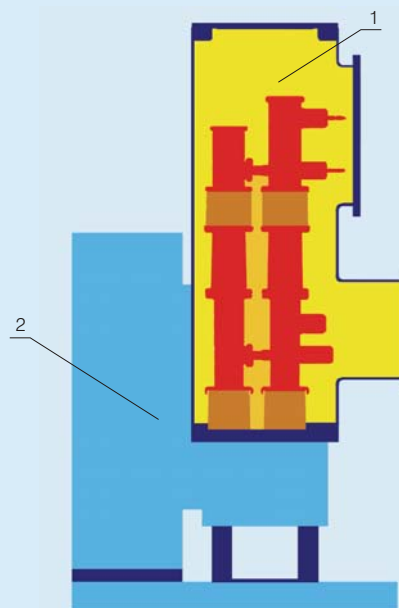
- 1. Circuit breaker
- 2. Current transformer
- 3. Disconnector(line type)
- 4. Disconnector (right angle type)
- 5. Fault making earthing switch
- 6. Earthing switch for repairing
- 7. Main bus
- 8. Cable Sealing End (CSE) box
- 9. Basin-type insulator
- 10. Local control panel (LCP) and circuit breaker mechanism box

4. Standard Module

4.1 Circuit breaker NGCB1- I

Circuit breaker is the core component of GIS. It is composed of two parts: 1) Interrupter unit.
2) Spring operating mechanism.

Fig.2 Sectional diagram of circuit breaker



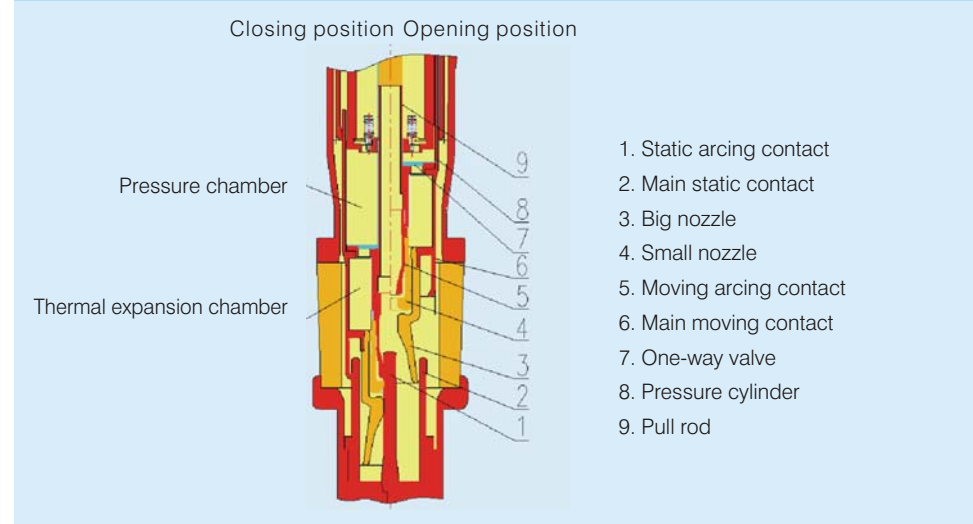
- 1. Interrupter unit
- 2. Spring operating mechanism

4.1.1 Interrupter Unit

The structure of the Interrupter unit is three poles in one shell type.

The arc-extinguishing chamber operates on the self-compression principle. As low drive energy is needed, spring mechanism with minimum operating force could be selected.

Fig.3 Principle diagram of interrupter unit



4.1.2 Spring Operating Mechanism

Spring stored energy operation mechanism provides energy to opening or closing operation of circuit breaker. The mechanism is sealed in mechanism box.

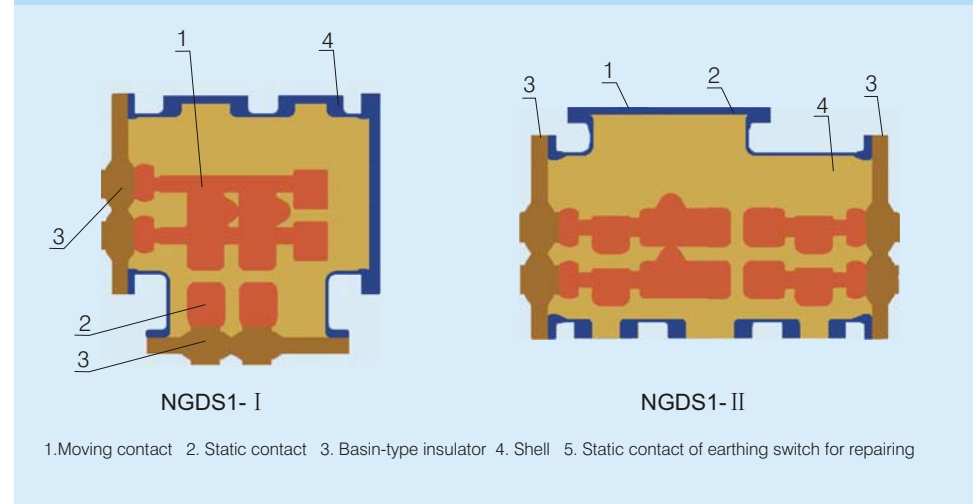
Features:

- Compact designed.
- The circuit breaker can accomplish 3000 times machinical operation.
- No noise operation.

4.2 Disconnecter NGDS1- I / II

- Right-angle type NGDS1- I and line type NGDS1- II and available.
- Disconnecter can open or close the bus charging current(capacitive current),low inductive current and bus switching current.
- Three-phase common barrel-type
- Can be operated by three-pole linking electric mechanism or manual operation.

Fig.4 Right-angle type disconnecter switch



Through the shaft seal of air tight, insulating bar, connecting level, transfer the movement of mechanism to moving contact of disconnecting switch, make the moving contact open or close.

The electric mechanism is installed on independent mechanism cabinet. And the mechanism cabinet is also installed position indication device, auxiliary switch and etc.

According to the requirement of operation, the earthing switch can be fault making earthing switch or earthing switch for repair.

4.3 Earthing Switch NGES1- I / II

4.3.1 Earthing switch NGES1- I for repairment and fault making earthing switch NGES1-II available.

4.3.2 The fault making switch can open or close the electrostatic induction current and electromagnetic induction current.

4.3.3 The fault making switch can making short-circuit current.

4.3.4 Three-phase common barrel-type

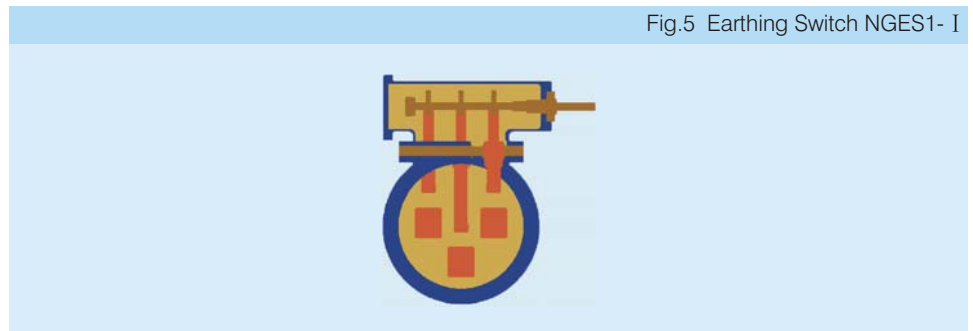
4.3.5 NGES1- I can be operated by three-pole linking of electric mechanism.

4.3.6 NGES1- II can be operated by three-pole linking of electric mechanism or manual operation.

4.3.7 Usages of earthing switch

- Measuring the main circuit of GIS.
- Measuring the mechanical characteristic of circuit breaker.
- Testing the current transformer.
- The high voltage parts of GIS are safe grounding for the security of people and equipments during installing and repairing.

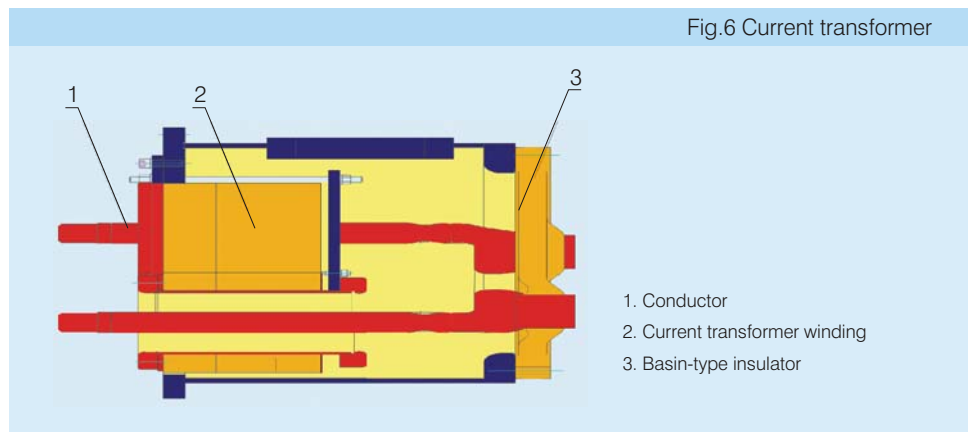
Fig.5 Earthing Switch NGES1- I



4.4 Current Transformer

- Toroidal core.
- Different ratio of transformer, class of accuracy and capacity according to the requirement of main connection of secondary circuit.
- Variety of class of measurement and protective winding available.
- Three-phase common barrel-type.

Fig.6 Current transformer

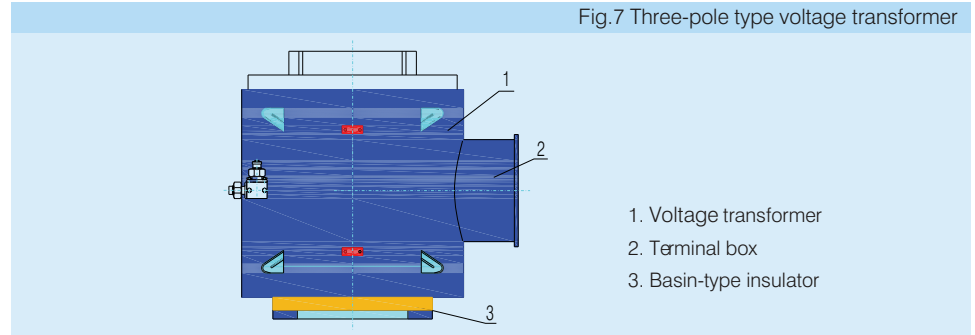


- 1. Conductor
- 2. Current transformer winding
- 3. Basin-type insulator

4.5 Voltage Transformer

- Electromagnetic-type transformer.
- Variety of secondary windings and spare windings available.
- Three-phase common barrel-type and single-pole type.
- Can be installed on any position of GIS.

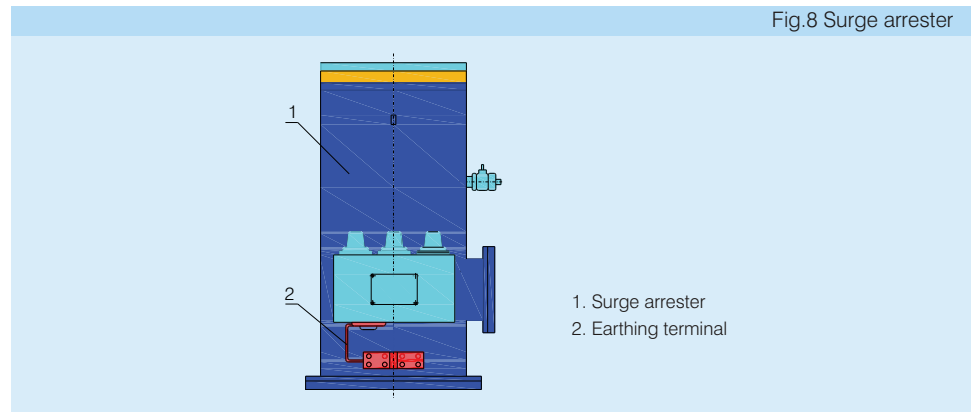
Fig.7 Three-pole type voltage transformer



4.6 Metal Oxide Surge Arrester

- Metal Oxide(MO) resistor wafer.
- Three-pole common barrel type

Fig.8 Surge arrester



4.7 Bus

- Main bus type and branch bus type.
- The main bus is three-pole common barrel type, the branch bus have three-pole common barrel type and single pole type.

4.7.1 Main bus

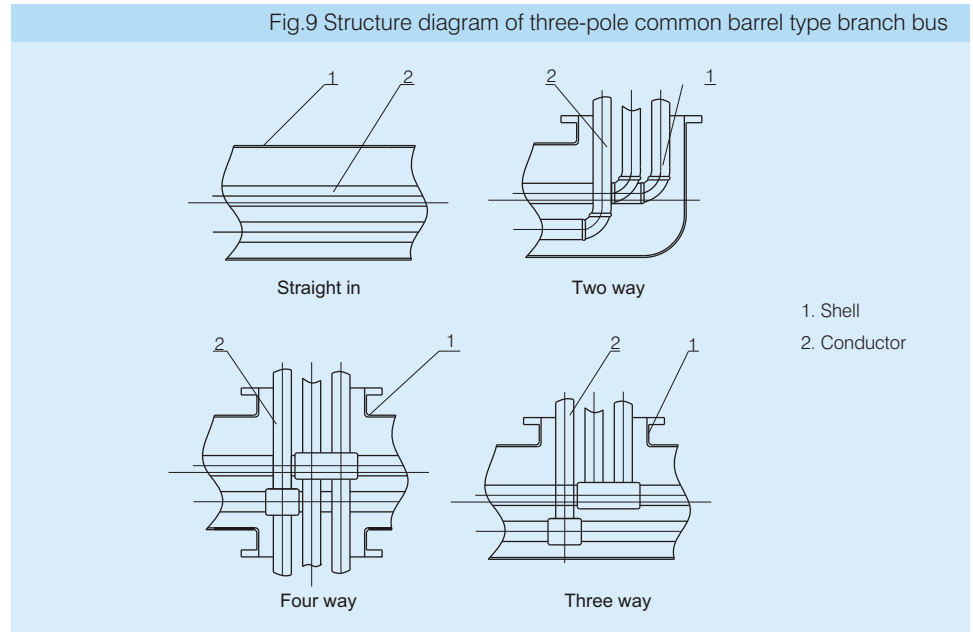
In order to reduce the error of production and installation, install bellows on main bus at suitable position.

4.7.2 Branch bus

Branch bus have three-phase common barrel type and single pole type.

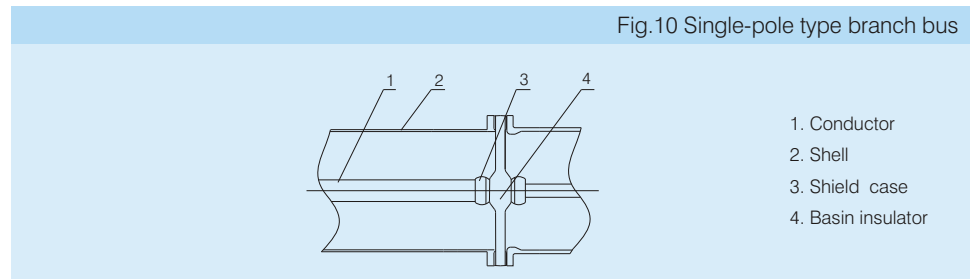
4.7.2.1 Three-pole Common Barrel Type Branch Bus

Fig.9 Structure diagram of three-pole common barrel type branch bus



4.7.2.2 Single-pole Type of Branch Bus

Fig.10 Single-pole type branch bus

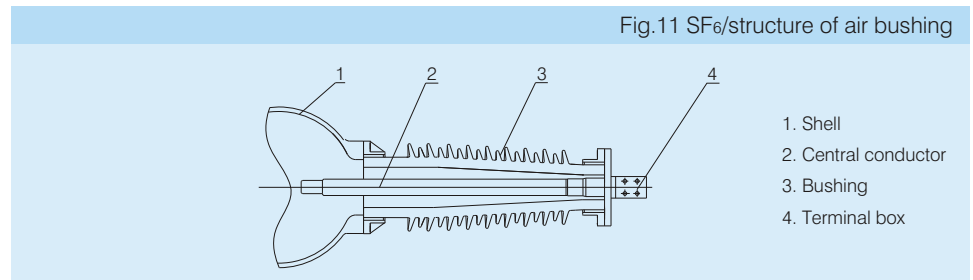


4.8 Incoming and Outgoing Feeder-SF₆ /air Bushing, Cable Sealing End (CSE) Box, SF₆ /oil Bushing Box

4.8.1 SF₆ /air Bushing

When the overhead incoming and outgoing feeder is adopted on GIS, it adopts SF₆ /air bushing.

Fig.11 SF₆/structure of air bushing

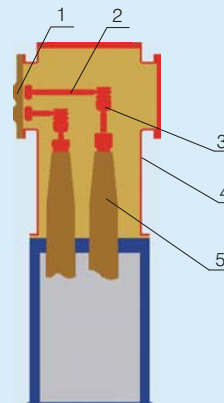


4.8.2 Cable Sealing End (CSE) Box

Through cable sealing end, it can joint all kinds of high voltage cable to GIS. The cable sealing end is epoxy resin or jack-in type.

The design and scope of supply of cable sealing end box comply with the requirements of IEC 62271-305.

Fig.12 Structure of cable terminal box

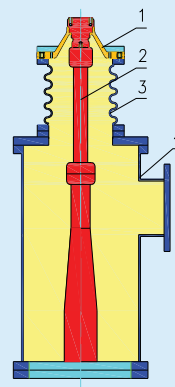


- 1. Basin-type Insulator
- 2. Conductor
- 3. Connecting conductor
- 4. Shell
- 5. Cable terminal

4.8.3 SF₆/oil Bushing Box

- The transformer connects with GIS through SF₆/oil bushing.
- The design and scope of supply of S_f₆/oil bushing comply with the IEC standard 62271-306.
- The structure of SF₆/oil bushing is three-pole split barrel.
- In order to compensate the error, the bellows is usually installed on between bushing shell and GIS shell.

Fig.13 SF₆/Oil Bushing



- 1. Basin-type insulator
- 2. Conductor
- 3. Bellows
- 4. Shell

5. Controlling, Interlocking, Monitoring

5.1 Local Control Cubicle

The circuit breaker, disconnecting switch, control of earthing switch, position indicator and the monitor of SF₆ are all concentrate in local control cabinet of space.

The main function of control cabinet:

- The local operation of circuit breaker, disconnecting switch, earthing switch come true, and operation choice of remote control room comes true.
- Transmite all of the signal to center control room and protective device
- Setting a mimic diagram of primary main wiring, position indcator of circuit breaker, disconnecting switch and earthing switch.
- Setting local operation switch of circuit breaker, disconnecting switch and earthing switch.
- Ligthing alarm annunciator of SF₆, monitor the SF₆ state of every gas room.
- Connect with circuit breaker, disconnecting switch, earthing switch, current transformer and terminal of voltage transformer.

5.2 Interlocking

Electric interlock is set during circuit breaker, disconnecting switch and earthing switch, it can avoid incorrect operation effectively. So people can operate the circuit breaker, disconnecting switch and earthing switch correctly in main control room or local position.

5.3 SF₆ Monitoring

The space of GIS is separated to several unattached gas room by basin insulator, the SF₆ monitor are installed in every gas room. And it also has independent aeration interface. The signal is transmitted to local control cabinet through cable. When the SF₆ in the gas room is abnormal, the alarm signal is sent out. The circuit breaker also has block-signal of SF₆ pressure reduce operation.

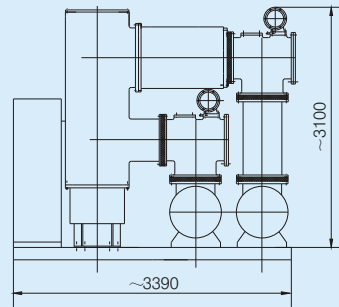
6. Typical Bay Layout

6.1 Typical Bus Connections

- Single bus connection(subsection, non-subsection)
- Double bus connection(subsection, non-subsection)
- Inside bridge connection
- Outside bridge connection
- Line-transformer group connection

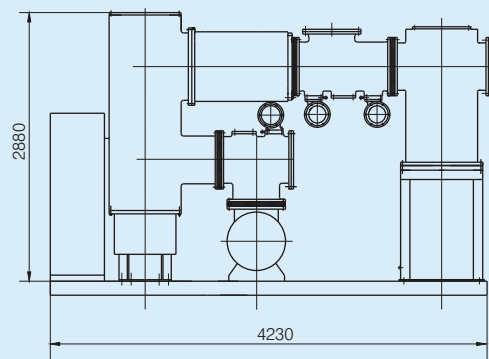
6.2 Typical Layout Diagrams of Bus Connections

Fig.14 Sectional diagram of double bus bay



The weight of bay is about 5.5 T.

Fig.15 Sectional diagram of cable incoming and outgoing feeder bay



The weight of bay is about 6.0T

Fig.16 Sectional diagram of overhead incoming and outgoing feeder bay

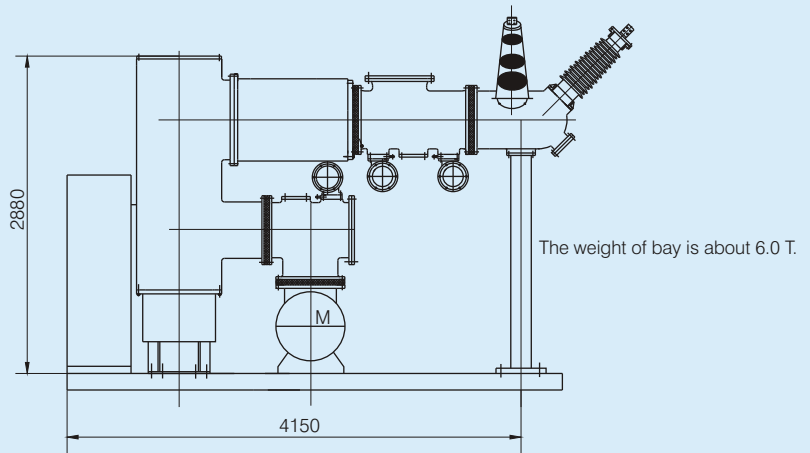


Fig.17 Layout diagram of double bus connection

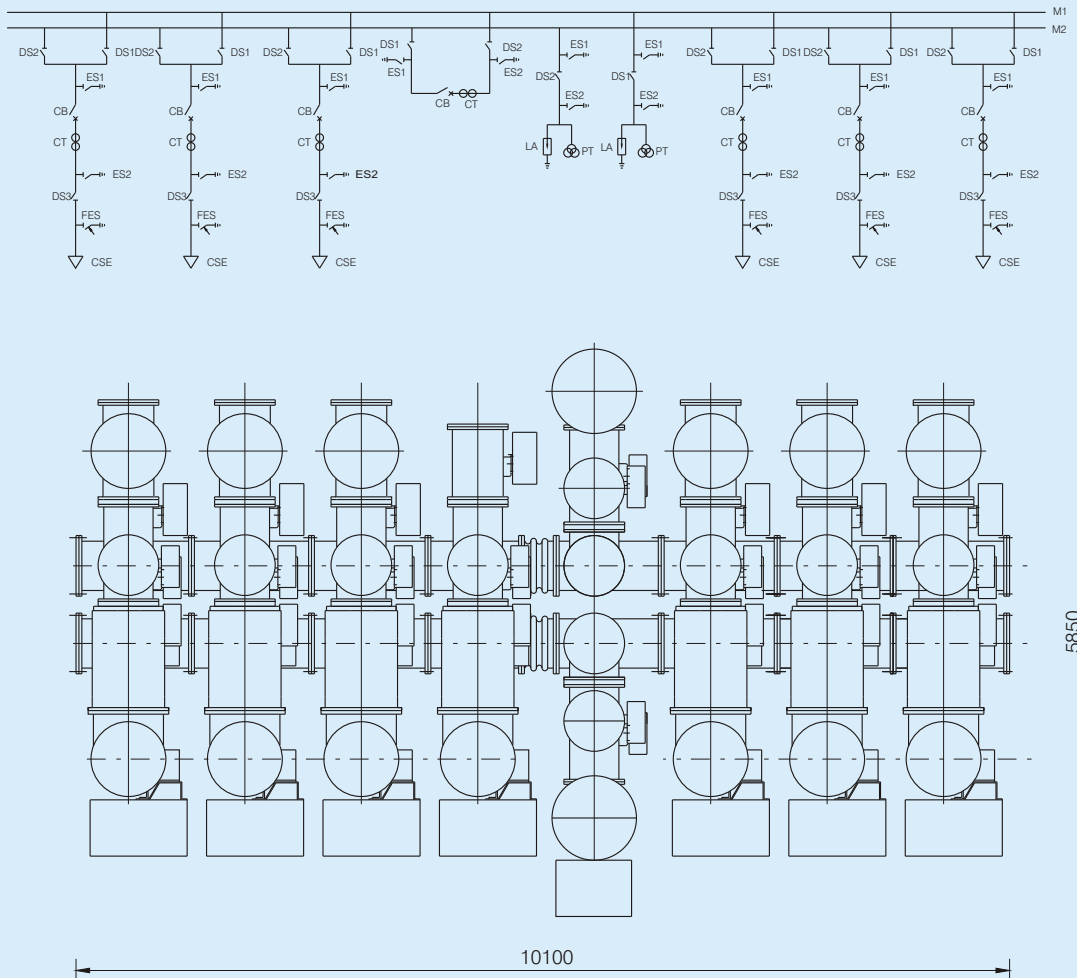


Fig.18 Layout diagram of single bus connection

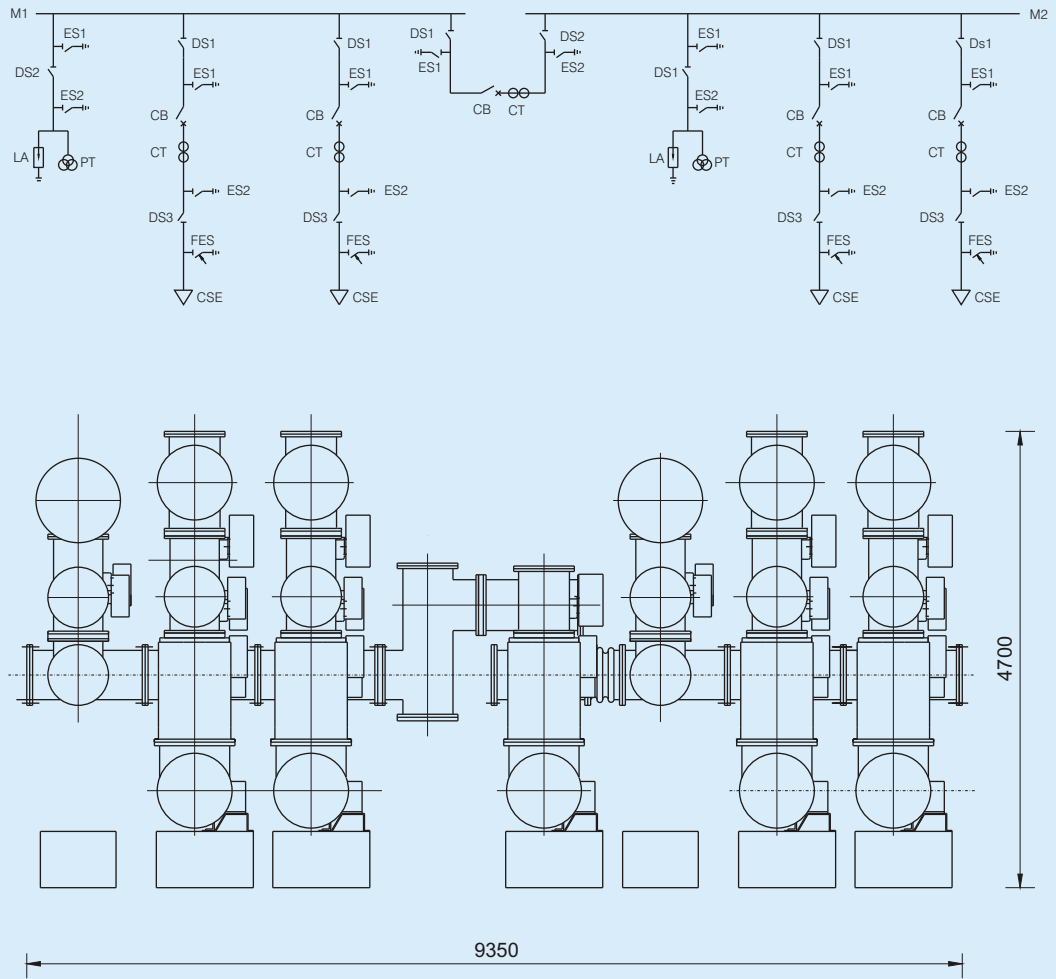
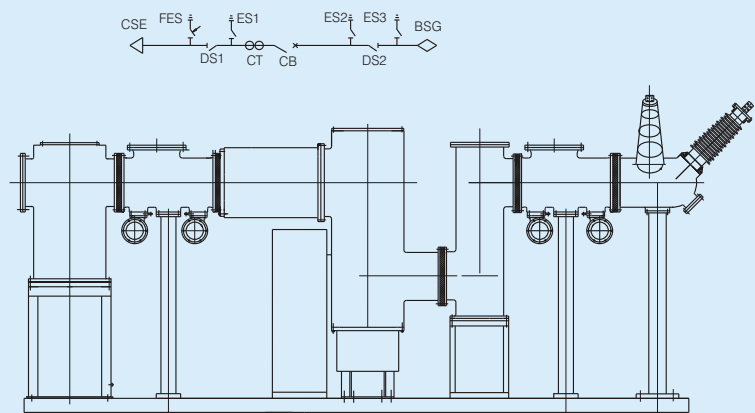


Fig.19 Layout diagram of circuit-connector of transformer group



252kV Gas Insulated Switchgear (GIS/HGIS) (170kV Operation Applicable)



1. Standard: IEC 62271-203

2. Technical Parameter

2.1 Ambient Environment Condition

Description	Unit	Parameter
Installation		Indoor or outdoor
Temperature (°C)	°C	-40~+40
Sunshine (outdoor)	W/m ²	1000
Relative humidity	Daily average value	≤95
	Monthly average value	≤90
Max wind velocity(outdoor)	m/s	34
Saturated steam pressure	Daily average value	≤2.2
	Monthly average value	≤1.8
Seismic capacity	horizontal acceleration	0.3
	vertical acceleration	0.15
Altitude	m	≤1000 (Customized when >1000m)

2.2 Main GIS Technical Parameters

Description	Unit	Parameter
Rated voltage	kV	252
Rated frequency	Hz	50
Rated current	A	2000~4000
Rated short-time withstands current ,3s	kA	40/50
Rated peak withstands current(peak)	kA	100/125
Rated short time power frequency withstands voltage, 1min	kV	395/460
Rated lightning impulse withstands voltage(peak)	kV	950/1050
Power frequency withstands voltage under zero gauge pressure, 5min	kV	189
Rated SF ₆ pressure (20°C)	Circuit breaker gas room	0.60
	Other gas room	0.40
SF ₆ annual leakage rate	%	≤0.5
Protect degree of auxiliary circuit and moving part	-	IP4XW/IP5XW

2.3 Main Technical Parameters of Circuit Breaker

Description	Unit	Parameter
Rated short-circuit breaking current	kA	40/50
Rated short-circuit making current(peak)	kA	100/125
First phase breaking factor		1.5
Rated short time power frequency withstand voltage, 1min	Open contacts	460+145
	To earth	460
Rated lighting impulse withstand voltage(peak)	Open contacts	1050+206
	To earth	1050
Power frequency withstand voltage under zero gauge pressure, 5min	Open contacts To earth	189
Rated operating sequence		O-0.3s-CO-180s-CO
Entire breaking time	ms	≤60.0
Closing time	ms	≤110
Opening time	ms	≤30
Operation mechanism	-	Spring / hydraulic spring
Rated voltage of control circuit	V	DC110/220
Rated voltage of auxiliary circuit	V	DC220, AC220/380

2.4 Main Technical Parameters of Disconnecter

Description	Unit	Parameter
Rated power frequency withstands voltage, 1min	Open contacts	460+145
	To earth	460
Rated lightening impulse withstands voltage(peak)	Open contacts	1050+206
	To earth	1050
Power frequency withstand voltage under zero gauge pressure, 5min	Open contacts To earth	kV 189
Closing time	s	<4
Opening time	s	<4
Operation mechanism	-	Electromotion or electromotion spring
Rated voltage of control circuit	V	DC110/220
Rated voltage of auxiliary circuit	V	DC220, AC220/380

2.5 Main Technical Parameters of Earthing Switch for Repairing

Description	Unit	Parameter
Closing time	s	<4
Opening time	s	<4
Operation mechanism		Electromotion
Rated voltage of control circuit	V	DC110/220
Rated voltage of auxiliary circuit	V	DC220, AC220/380

2.6 Main Technical Parameters of Fault Making Erathing Switch

Description	Unit	Parameter
Rated short-circuit making current(peak)	kA	125
Closing time	s	<4
Opening time	s	<4
Operation mechanism		electromotion spring
Rated voltage of control circuit	V	DC110/220
Rated voltage of auxiliary circuit	V	DC220, AC220/380

2.7 Main Technical Parameters of Bus

Description	Unit	Parameter
Rated current	kA	2000~4000
Type of casing		main busbar three-pole common box/ tapped bus three-pole split box

2.8 Main Technical Parameters of Current Transformer

Description	Unit	Parameter
Rated current	Primary current	300, 400, 600, 800, 1250, 2000, 2500, 3000
	Secondary current	1, 5
Rated power frequency withstands voltage, 1min, to earth	kV	460
Rated lightening impulse withstands voltage(peak)	kV	1050
Power frequency withstands voltage under zero gauge pressure, 5min, to earth	kV	189
Secondary winding rated short-time power frequency withstands voltage, 1min	kV	3
Capacity	VA	10, 15, 20, 25, 30
Degree of accuracy	Degree of measure	0.2S, 0.2, 0.5, 1
	Protect of measure	5P, 10P
Accuracy limit factor		10, 20, 30

* Note: Customized products are available per your requirements.

2.9 Main Technical Parameters of Voltage Transformer

Description	Unit	Parameter
Rated primary voltage	kV	220/ $\sqrt{3}$
Rated secondary voltage	V	100/ $\sqrt{3}$
Rated voltage of spare winding	V	100
Rated power frequency withstands voltage, 1 min	Primary winding	460
	Secondary winding, spare winding	3
Rated lightning impulse withstands voltage(peak)	kV	1050
Power frequency withstands voltage under zero gauge pressure, 5min, to earth	kV	189
Degree of accuracy	Secondary winding I	- 0.2
	Secondary winding II	- 0.5
	Spare winding	- 3P
Rated output	Secondary winding I	150
	Secondary winding II	VA 150
	Spare winding	300

* Note: Customized products are available per your requirements.

2.10 Main Technical Parameters of Surge Arrester

Description	Unit	Parameter
Max system operation voltage	kV	252
Rated voltage	kV	200
Continue operation voltage	kV	156
Nominal discharge current (8/20 μ s)	kA	10
Reference voltage of DC 1mA (20°C)	kV	≥ 290
Residual voltage of lightning impulse current (peak, 8/20 μ s)	kV	≤ 520
Residual voltage of steep wave impulse current (peak, 1/5 μ s)	kV	≤ 582
Residual voltage of operation impulse current (peak, 30/60 μ s)	kV	≤ 442
Impulse withstands current of rectangular current 2ms	A	800
Rated power frequency withstands voltage 1min	kV	460
Rated lighting impulse withstands voltage(peak)	kV	1050
SF ₆ zero gauge pressure ,power frequency withstands voltage	kV	189

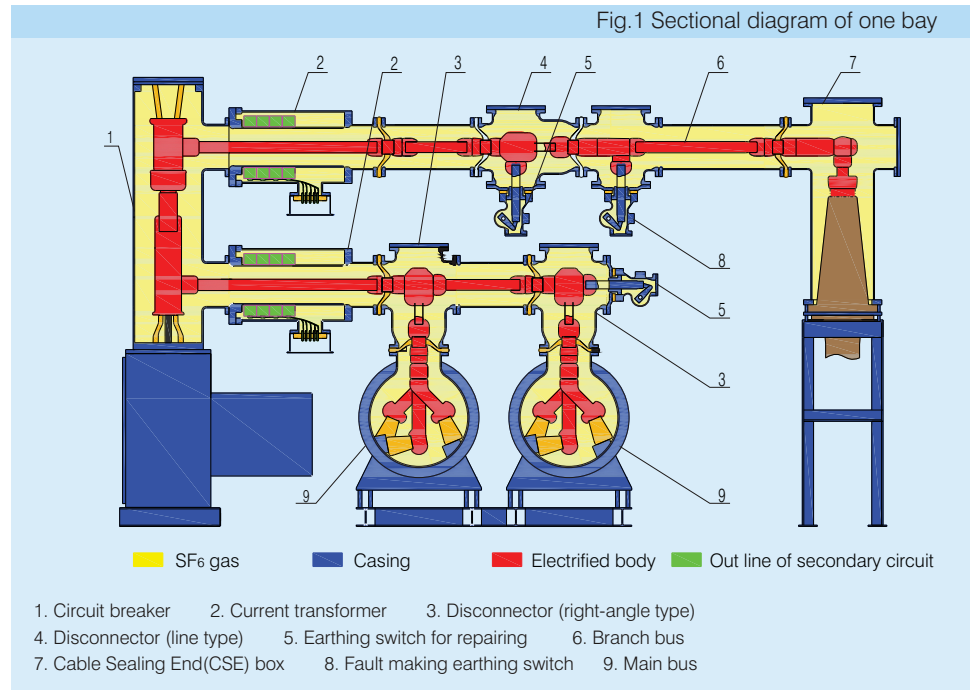
* Note: Customized products are available per your requirements.

2.11 Main Technical Parameters of SF₆-Air Bushing

Description	Unit	Parameter
Rated current	A	2000~4000
Corona level		No visible corona under 1.1 times rated pole voltage
Radio influence level	μ V	≤ 500 Under 1.1 times rated pole voltage
Rated power frequency withstands voltage 1min	Dry	460
	Wet	
Rated lighting impulse withstands voltage(peak)	kV	1050
Power frequency withstands voltage under zero gauge pressure, 5min, to earth	kV	189

3. Structure

Modular design makes the structure varied as per different arrangements.



4. Standard Module

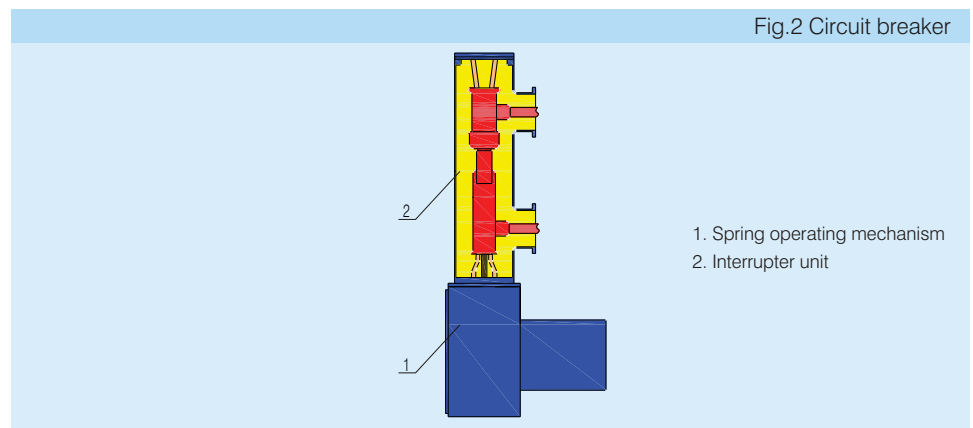
4.1 Circuit Breaker

The circuit breaker is the core component of GIS.

The circuit breaker is composed of two parts: interrupter unit and spring operating mechanism

4.1.1 Interrupter Unit

The interrupter unit is self-extinguishing circuit breaker, during the operation of circuit to arc-quenching. Adopting spring operating mechanism of small operate power because it needs less operating power. The circuit breaker is three pole linking operated by one mechanism.



4.1.2. Operating Mechanism

4.1.2.1 Spring Operating Mechanism

Spring stored energy operation mechanism is provide energy to opening or closing operation of circuit breaker. The mechanism is sealed in mechanism cabinet.

Features:

- Compact designed.
- The circuit breaker can accomplish more than 3000 times opening and closing operation.
- No noise operation.

4.1.2.2 Hydraulic Spring Mechanism

The hydraulic spring mechanism adopts the core from ABB. It has both advantages of spring energy storage and hydraulic mechanism.

The core is installed in a closed box and connected to the interrupter unit through a linking device. IT provides energy to the opening and closing of the circuit breaker.

Feature:

- Modular design and compact structure.
- With measures against slow opening caused by mechanical out of pressure.
- High stability and reliability, long mechanical life.

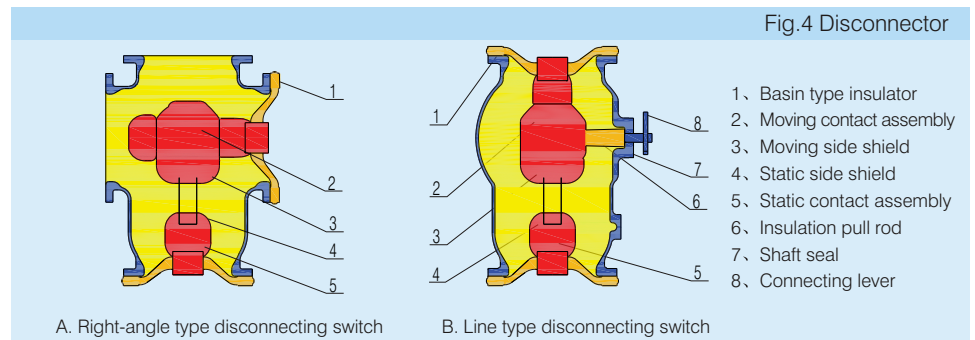
Fig.3 Hydraulic spring mechanism



4.2 Disconnecter

- Right-angle type NGDS2- I and line type NGDS2- II .
- Able to can open or close the bus charging current, low inductive current and bus switching current.
- High insulation level at breaks
- Strongly commonality. All of the spare parts of the two types of disconnecter switch are general service expect type of installation.
- Can be operated by three-pole linking of electric mechanism or manual operation.

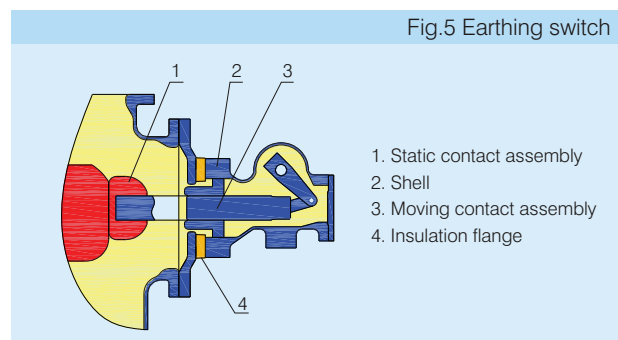
Fig.4 Disconnecter



4.3 Earthing Switch

- NGES2- I for repairing and type NGES2-II fault making earthing switch.
- The fault making earthing switch can make the short-circuit current, it also can open or close the electrostatic induction current and electromagnetic induction current.
- Strongly commonality. Except the different service foundation of two types of earthing switch, they are the same in internal structure, and the spare parts of the two types of earthing switch are general service.
- NGES1- I can be operated by three-pole linking of electric mechanism.
- NGES1-II can be operated by three-pole linking of electric mechanism or manual operation.
- Resistance measurement of GIS main circuit, measurement of mechanical characteristic of circuit breaker and performance test of current transformer is come true through earthing switch.

Fig.5 Earthing switch

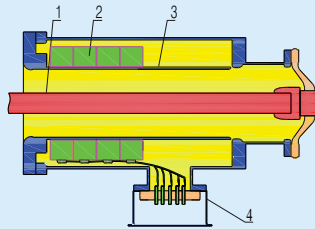


According to the different requirement of arrangement, earthing switch NGES2- I for repair can be installed on disconnecting switch or bus. Fault making earthing switch NGES2- II is usually be installed on incoming and outgoing line. The high potential of GIS are safe grounding through earthing switch for security of people and equipment during installing and repair.

4.4 Current Transformer

- Toroidal core, secondary circuit is epoxide resin packaged.
- Variety quantity of class of measurement and protective winding available.
- According to the requirement of main wiring of secondary circuit, there is different ratio of transformer, class of accuracy and capacity.
- Electromagnetic induction type.

Fig.6 Current transformer



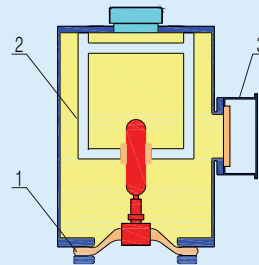
- 1. Primary conductor
- 2. Winding
- 3. Internal shield
- 4. Terminal box

The current transformer can be installed on one side or two sides of circuit breaker, or any position of incoming and outgoing line. The primary winding consists of high voltage conductor. Outgoing feeder of secondary winding is lead-out through sealed terminal which be installed on shell.

4.5 Voltage Transformer

- Electromagnetic-type transformer.
- Variety of secondary windings and spare windings available.
- According to the requirement of customer, secondary winding has different ratio of transformer, class of accuracy and capacity.
- Installed on any position of GIS.

Fig.7 Voltage transformer



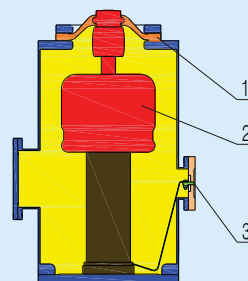
- 1. Basin type insulator
- 2. Voltage current
- 3. Terminal box

Voltage transformer has a independent gas room of SF6. It can be installed vertically, upward and downward.

4.6 Metal Oxide Surge Arrester

- Adopt metal oxide resistor wafer.
- Installed on any position of GIS.

Fig.8 Metal oxide surge arrester



- 1. Basin type insulator
- 2. Core of surge arrester
- 3. Outgoing feeder of low voltage

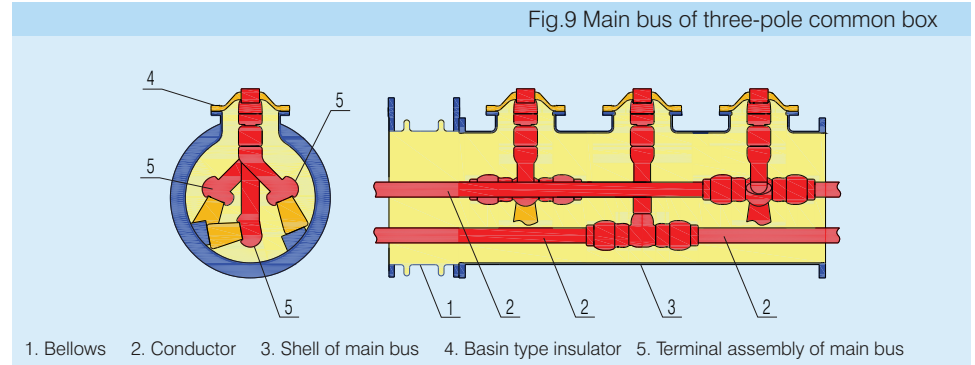
As the overvoltage protective device, surge arrester is installed on incoming side or any position of GIS. The surge arrester is a independent gas room. The core of surge arrester consist of metal oxide resistor wafer which has obvious nonlinearity of current and voltage, connect with GIS through gas insulator. The equipment is installed on casing of surge arrester for monitor and control.

4.7 Bus

4.7.1 Main bus type and branch bus type.

4.7.2 The main bus is three-pole common box type NGBUS2- I ,and the branch bus is three-pole split box type NGBUS2- II .

4.7.2.1 Main bus of three-pole common box type NGBUS2- I .

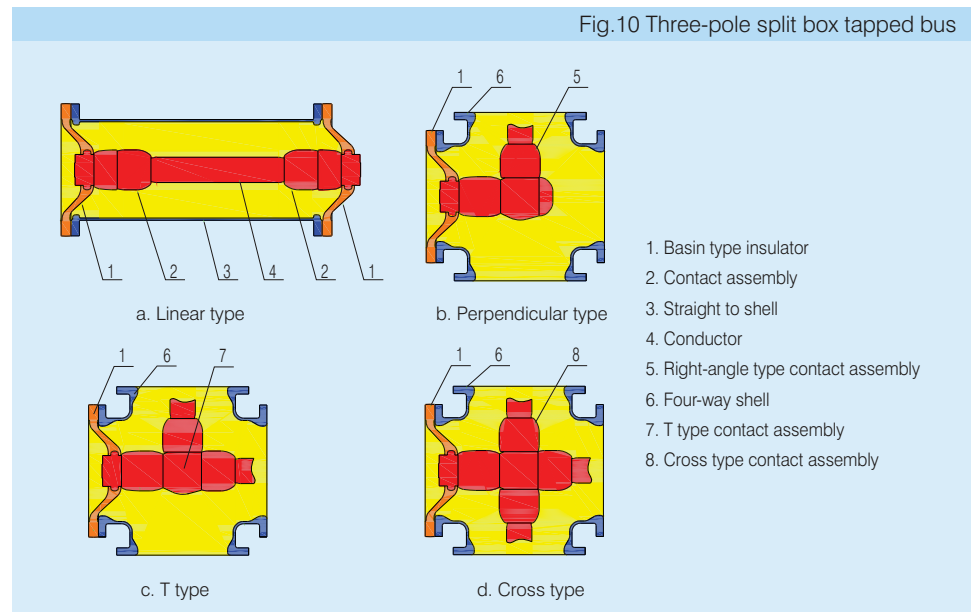


The main bus connect with next main bus of module or space through connecting joint. In order to reduce the error of produce and installation, install bellows on main bus at suitable position.

4.7.2.2 Three-pole split box type tapped bus NGBUS2- II .

The tapped bus connect the discrete elements of GIS, connect the spaces.

- a). Linear type b). Perpendicular type c). T type d). Cross type

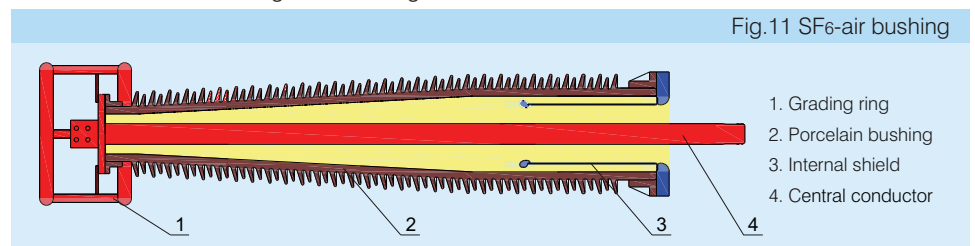


4.8 Terminal Component

The GIS connects with the overhead line, transformer, reactor or cable through following component:SF₆-air bushing, cable terminal box and transformer terminal box (SF₆ oil bushing).

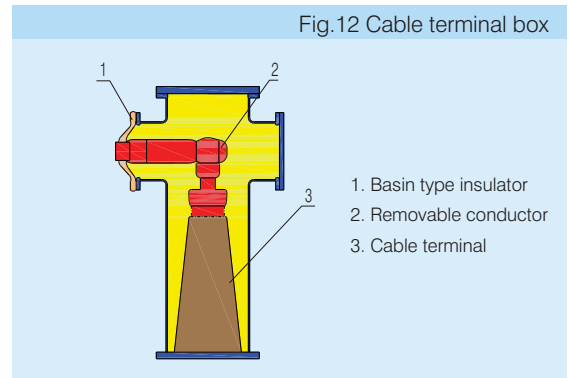
4.8.1 SF₆-air Bushing

GIS connects with open equipment or overhead line through SF₆-air bushing. It has considered the air insulation distance and pollution degree that design of length of bushing, umbrella type and creepage distance, and it is suitable for different area. The insulation distance of three-pole bushing had been considered during the the design.



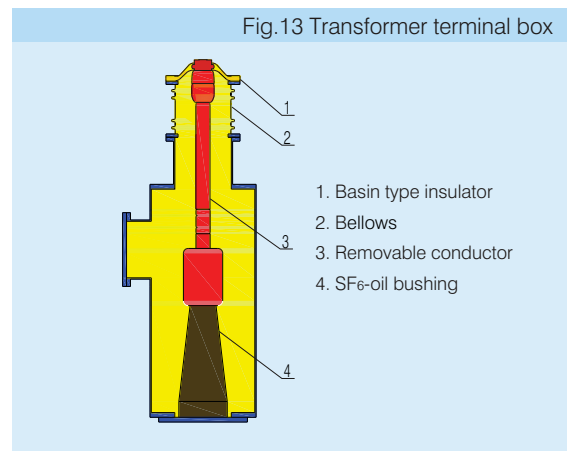
4.8.2 Cable Sealing End(CSE) Box

Through cable terminal box, it can joint all kinds of high voltage cable to GIS. The design and scope of supply of cable terminal box comply with the requirements of IEC62271-305. The connection conduct between GIS and cable terminal is removable, GIS and cable can do test separately.



4.8.3 Transformer Termination Box (SF₆-oil Bushing)

The transformer terminal box connects the oil insulation transformer or reactor. The design and scope of supply of transformer terminal box tallies with the requirements of IEC 62271-306. The connection conduct between GIS and cable terminal is removable, GIS and cable can do test separately. In order to compensate the error, the bellows is usually installed on between transformer terminal box and GIS.



5. Controlling, Interlocking, Monitoring

5.1 Local Control Cubicle

The circuit breaker, disconnecting switch, control of earthing switch, position indicator and the monitor of SF₆ are all concentrate in local control cabinet of space.

The main function of control cabinet:

- The local operation of circuit breaker, disconnecting switch, earthing switch come true, and operation choice of remote control room comes true.
- Transmite all of the signal to center control room and protective device
- Setting a mimic diagram of primary main wiring, position indicator of circuit breaker, disconnecting switch and earthing switch.
- Setting local operation switch of circuit breaker, disconnecting switch and earthing switch.
- Ligthing alarm annunciator of SF₆, monitor the SF₆ state of every gas room.
- Connect with circuit breaker, disconnecting switch, earthing switch, current transformer and terminal of voltage transformer.

5.2 Interlocking

Electric interlock is set during circuit breaker, disconnecting switch and earthing switch, it can avoid incorrect operation effectively. So people can operate the circuit breaker, disconnecting switch and earthing switch correctly in main control room or local position.

5.3 SF₆ monitoring

The space of GIS is separated to several unattached gas room by basin insulator, the SF₆ monitor are installed in every gas room. And it also has independent aeration interface. The signal is transmitted to local control cabinet through cable. When the SF₆ in the gas room is abnormal, the alarm signal is sent out. The circuit breaker also has block-signal of SF₆ pressure reduce operation.

6. Typical Bay Layout

6.1 Typical Bus Connections

- Single bus connection(subsection, non-subsection)
- Double bus connection(subsection, non-subsection)
- Line-transformer group connection
- One and a half connection

6.2 Typical Layout Diagrams of Bus Connections

Fig.14 Sectional diagram of cable incoming and outgoing feeder bay of double bus

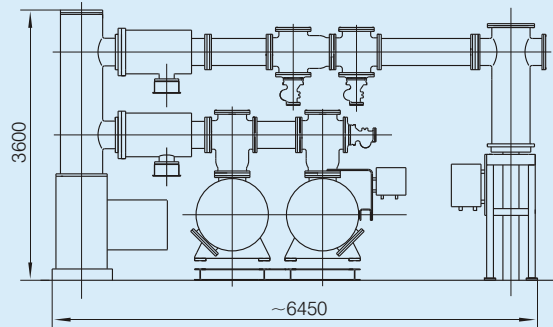


Fig.15 Sectional diagram of overhead incoming and outgoing feeder bay of double bus

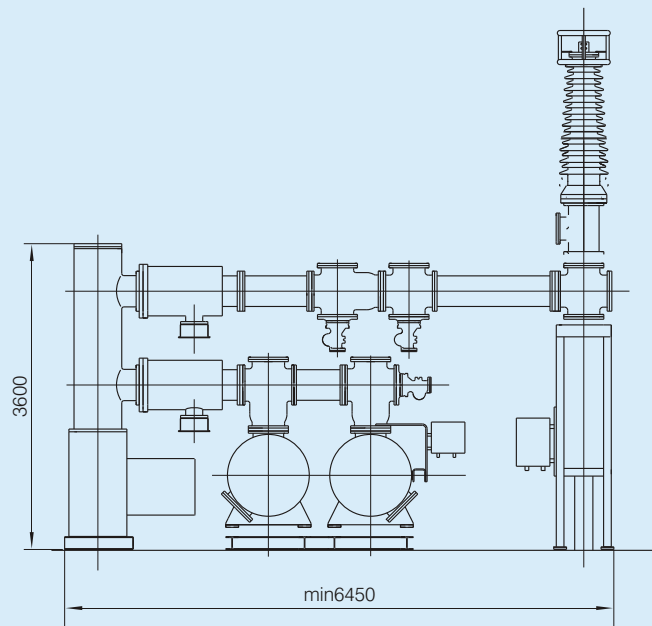


Fig.16 Sectional diagram of bus bay

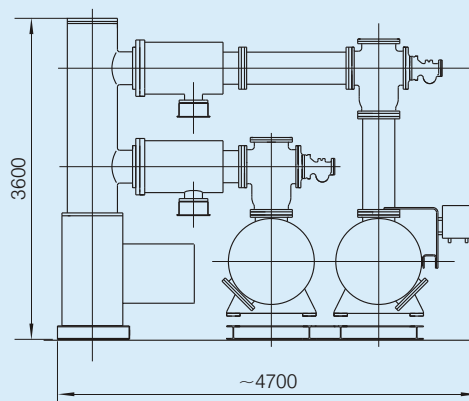


Fig.17 Sectional diagram of measurement and protection bay

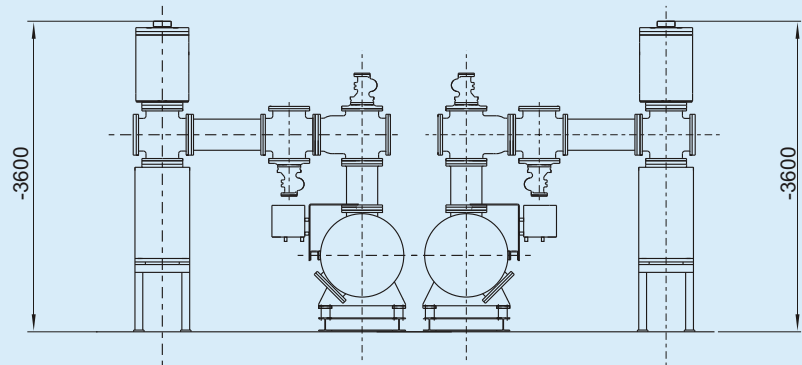


Fig.18 Layout diagram of single bus primary main connection

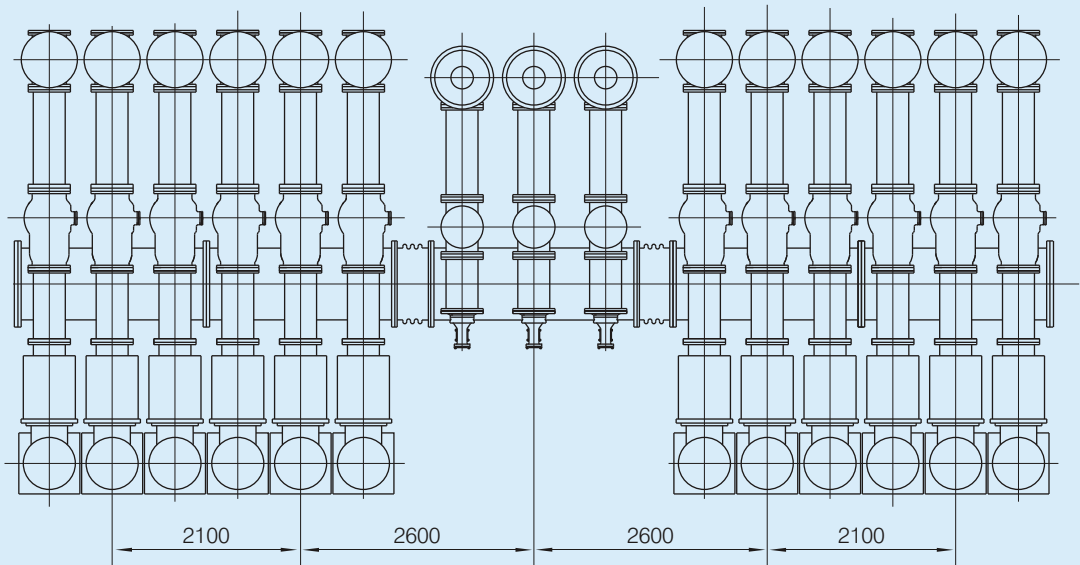
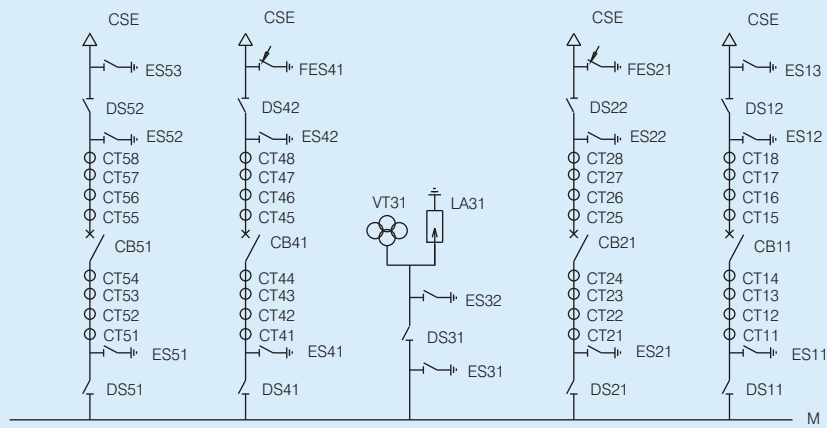


Fig.19 Layout diagram of double bus primary main connection

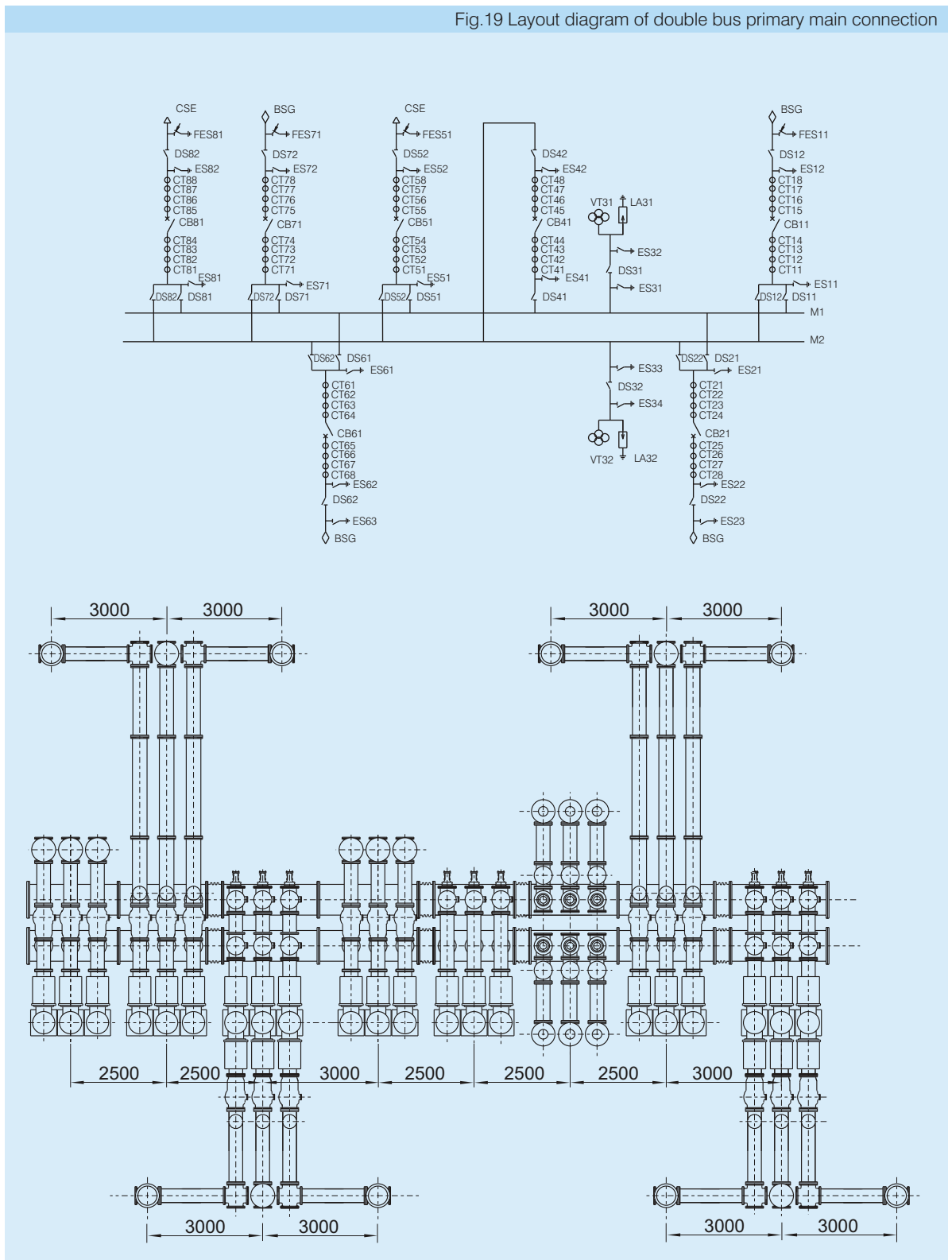


Fig.20 ZHW-252 layout diagram of single bus primary main connection

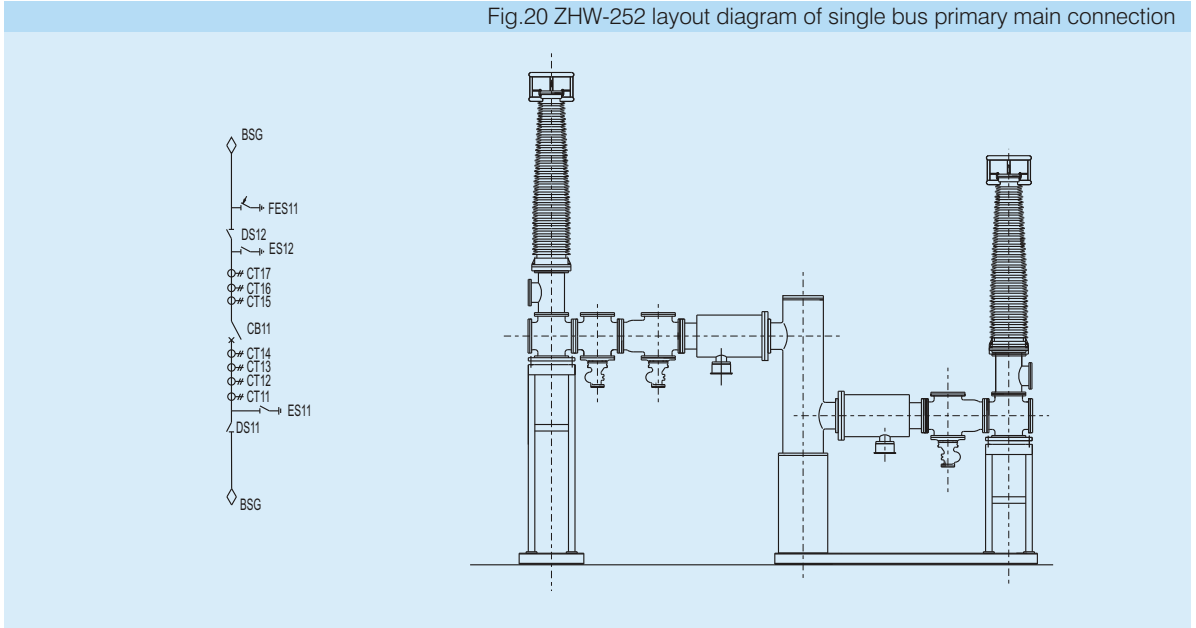
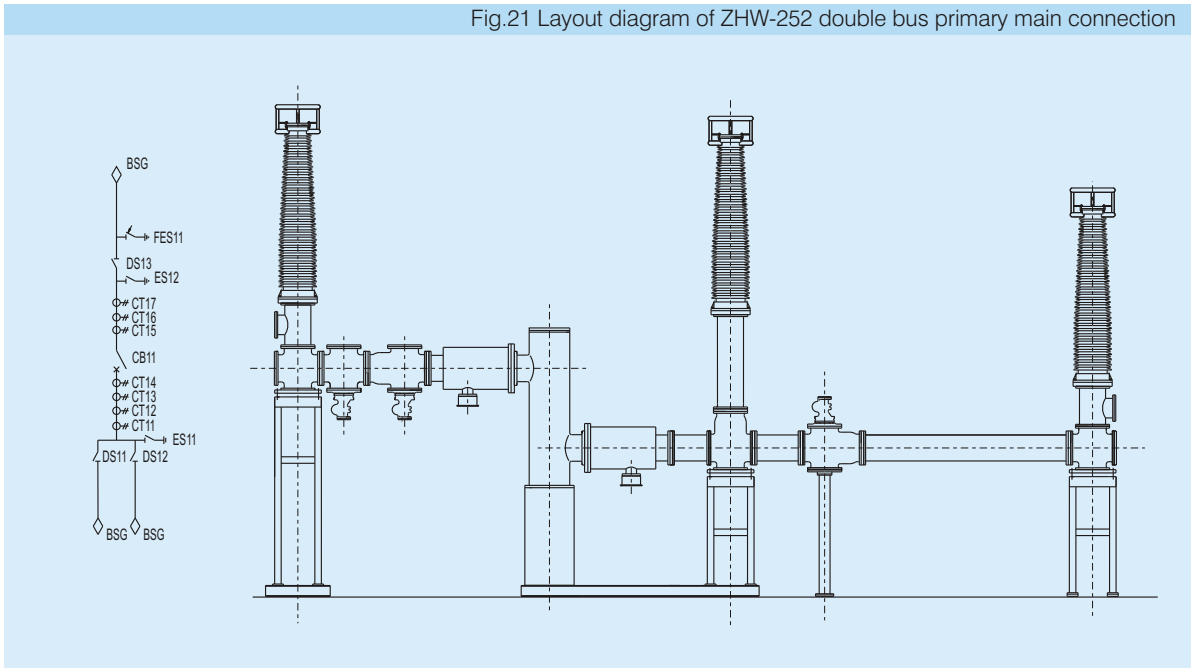


Fig.21 Layout diagram of ZHW-252 double bus primary main connection





Compact Gas Insulated Switchgear (GIS) up to 145kV 126kV,145kV Compact Gas Insulated Switchgear (GIS)

1. Standard: IEC 62271-203

2. Typical Feature

2.1 Great Breaking Character of Circuit Breaker

The circuit breaker adopts the self-extinguishing principle, it can achieve three-pole linking operation by only adopting a spring mechanism with small operating power.

2.2 Compact Design

- Adopt the advanced three-position switch, less parts, simple structure, small space and high reliability.
- Adopt the advanced PLC intelligent control system, reduce the secondary elements, shrink the volume of cabinet greatly.
- The width of the bay is only 0.8m, compact design compared with traditional width of 1.5m.

2.3 High Reliability of Mechanism

The circuit breaker adopts a spring mechanism with small operate power, and the three-position switch adopts electric operating mechanism from Japan.

2.4 Convenient Transportation and Installation

It can be transported as bigger unit and it is easy to install.

2.5 High Reliability and Maintenance

No maintenance under normal condition.

3. Technical Parameter

3.1 126kV Compact Gas Insulated Switchgear (GIS)

3.1.1 Ambient Environment Condition

Description	Indoor	Outdoor
Temperature (°C)	-15~+40	-40~+40
Sunshine w/m ² (fine in midday)	-	1000
Wind velocity (m/s)	-	≤34
Relative humidity (daily average value)		≤95%
Relative humidity (monthly average value)		≤90%
Reek pressure kPa (daily average value)		≤2.2
Reek pressure kPa (monthly average value)		≤1.8
Altitude(m)	≤1000 (customized above 1000m)	
Earthquake condition	Common region	Horizontal acceleration 0.15g, vertical acceleration 0.075g
	Strong shock region	Horizontal acceleration 0.30g, vertical acceleration 0.15g
Outside insulation pollution level	III degree, IV degree	
Bushing thickness of ice (mm)	10, 20	

3.1.2 GIS Technical Parameters

Description		Unit	Parameter
Rated voltage		kV	126
Rated current/main bus rated current		A	2500/3150
Rated frequency		Hz	50
Rated short-time withstand current		kA/s	40/3
Rated peak withstand current(peak)		kA	100
Rated insulation level	Rated power frequency withstand voltage for 1min	To earth/between poles	kV 230
		Open contacts	kV 230+73
	Rated lightning impulse withstand voltage(peak)	To earth/poles to earth	kV 550
		Open contacts	kV 550+103
SF ₆ zero gauge pressure rated power frequency withstand voltage for 1min		To earth	kV $126/\sqrt{3} \times 1.3$
		Between poles	kV $126/\sqrt{3} \times 1.3$
Radio influence level(at 1.1 times rated pole voltage)		μV	≤500
Partial discharge(full bay)		pC	<5
Rated SF ₆ pressure (20°C)	Breaker	Rated voltage	MPa 0.60
		Alarm pressure	MPa 0.55
	Other gas room	Blocking pressure	MPa 0.50
		Rated voltage	MPa 0.50
		Alarm pressure	MPa 0.40
SF ₆ annual leakage rate		%	≤0.5
Short circuit current of fault making earthing switch (peak)		Ka	100(5 times)
Main bus change-over current of three-position switch			30V/1600A/100 times
Rated breaking short circuit current of circuit breaker		Ka	40
Electric life of circuit breaker		Times	20
Mechanical life of circuit breaker, three-position switch and fault making earthing switch		Times	10000

3.2 145kV Compact Gas Insulated Switchgear (GIS)

3.2.1 Ambient Environment Condition

Description	Indoor	Outdoor
Temperature (°C)		-40~+40
Sunshine w/m ² (fine in midday)	-	1000
Wind velocity (m/s)	-	≤34
Relative humidity (daily average value)		≤95%
Relative humidity (monthly average value)		≤90%
Reek pressure kPa (daily average value)		≤2.2
Reek pressure kPa (monthly average value)		≤1.8
Altitude(m)		≤1000 (customized above 1000m)
Earthquake condition	Horizontal acceleration 0.30g, vertical acceleration 0.15g	
Outside insulation pollution level	III degree, IV degree	
Bushing thickness of ice (mm)	10, 20	

3.2.2 GIS Technical Parameters

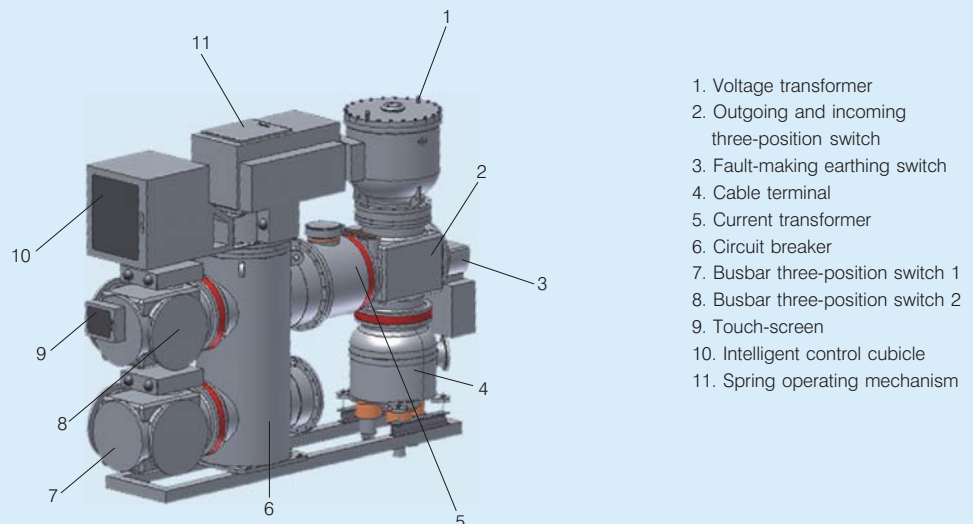
Description		Unit	Parameter	
Rated voltage		kV	145	
Rated current		A	2500, 3150	
Rated frequency		Hz	50	
Rated short-time withstand current		kA/s	40	
Rated peak withstand current(peak)		kA	100	
Rated short circuit duration		S	4	
Rated insulation level	Rated power frequency withstand voltage for 1min	To earth/between poles	kV	275
		Open contacts	kV	275+84
	Rated lightning impulse withstand voltage (peak)	To earth/poles to earth	kV	650
		Open contacts	kV	650+119
SF6 zero gauge pressure rated power frequency withstand voltage for 5mins	To earth	kV	$145/\sqrt{3} \times 1.3$	
	Between poles	kV	$145/\sqrt{3} \times 1.3$	
Radio influence level(at 1.1 times rated pole voltage)		μV	≤ 500	
Partial discharge(full bay)		pC	< 5	
Rated SF6 pressure (20°C)	Circuit breaker	Rated voltage	MPa	0.60
		Alarm pressure	MPa	0.55
		Blocking pressure	MPa	0.50
	Other gas room	Rated voltage	MPa	0.50
		Alarm pressure	MPa	0.45
Moisture content of SF6 gas in gas rooms	Circuit breaker gas room	Acceptance value	PPm(V/V)	150
		Operating value	PPm(V/V)	300
	Other gas rooms	Acceptance value	PPm(V/V)	250
		Operating value	PPm(V/V)	500
SF6 annual leakage rate		%	≤ 0.5	
Protection degree of auxiliary circuit and moving part		-	IP4X/IP5X (Indoor) IP4XW/IP5XW (Outdoor)	

4. Structure

4.1 General Structure

See 126kV,145kV Compact GIS general structure in the following diagram:

Fig.1 3D Structure diagram of 126kV,145kV Compact GIS



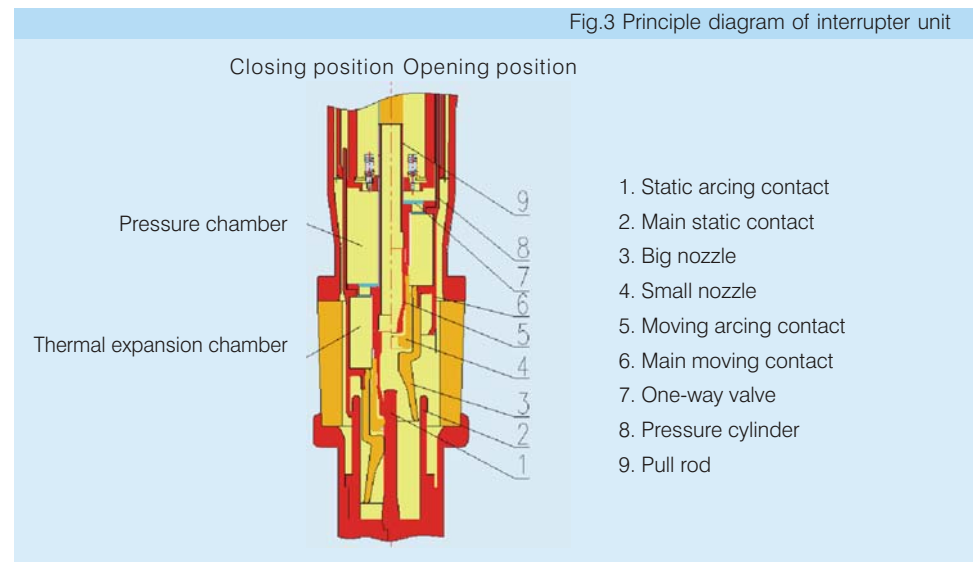
4.2 Circuit Breaker Module

The circuit breaker is of three-pole common box typed structure and consists of two components: Interrupter unit and operating mechanism.



4.2.1 Interrupter Unit

The interrupter unit adopts the principle of self thermal expansion and the compression arc-quenching principle.



4.2.1.1 Interruption of Short-circuit Current

When the circuit breaker opens, the drag rod (9) moves upward, and drives the pressure cylinder (8), the main moving contact (6), the big nozzle (3), the small nozzle (4) and the moving arcing contact (5) which are connected to it to move upward as well. During the breaking operation, the main moving contact (6) and the main static contact (2) open first and the current commutates on the still closed arcing contacts (1) & (5). The operation progresses on and the arcing contacts are separated and then an arc develops between the arcing contacts (1) & (5). As the breaking current during the operation is very big, the arc energy between the arc contacts is relatively very strong. Then the thermal current in the arc area enters the thermal expansion chamber and begins heat exchange, heats up the SF₆ gas and produces thermal expansion, and low-temperature high-pressure gas is produced in the upper zone and the thermal expansion chamber, which makes the pressure in the thermal expansion chamber bigger than that in the pressure cylinder, and this results in the close of the one-way valve (7). The thermal expansion chamber fully takes advantage of the “blocking effect” of the arc, when it comes to zero-current, the high-pressure gas in the thermal expansion chamber flows into the contact gap and extinguishes the arc.

4.2.1.2 Interruption of Load Current

When breaking small current of several thousand Amps, the arc energy is small and the pressure formed in the thermal expansion chamber is low. Meanwhile the drag rod (9) drives the pressure

cylinder (8), the main moving contact (6), the big nozzle (3), the small nozzle (4) and the moving arcing contact (5) move upward, and leads to a pressure rise in the pressure cylinder. Because the pressure in the pressure cylinder is bigger than that in the thermal expansion chamber, the one-way valve (7) opens and the gas flows out and flows into the contact gap by the compressed SF₆ gas and the arc extinguishes when it comes to zero-current.

4.3 Three-position Switch Module (three-phase common box)

Three-position switch includes bus three-position switch and incoming and outgoing feeder three-position switch, they have the common structural features as follows:

- The disconnecter and the earthing switch share a mechanism and a moving contact. Using one electric mechanism can achieve the operation of disconnecter close-disconnector open/earthing switch open-earthing switch close, which achieves less parts, small volume, simple structure and high reliability.
- Adopt three-position switch electric mechanism imported from Japan, which can also be manually operated. It is of compact design, small volume and high reliability.

4.3.1 Bus Three-position Switch

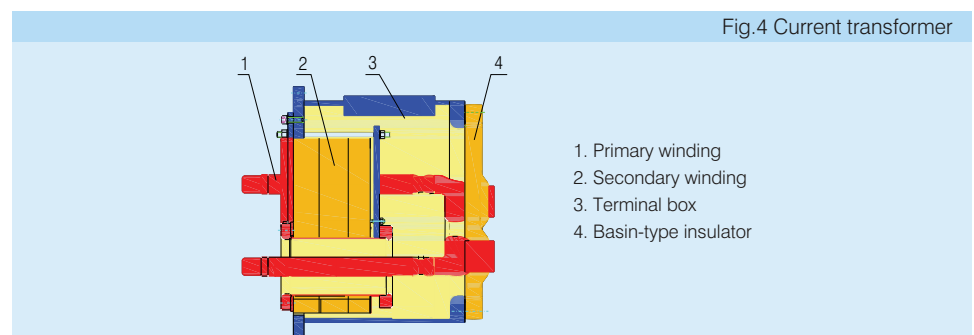
- The disconnecter closes when the moving contact moves towards left and plugs into the static contact of the disconnecter;
the earthing switch closes when the moving contact moves towards right and plugs into the static contact of the earthing switch.
- The conductor connects the static contact of the disconnecter with the middle conductor on the basin-type insulators. It can be used as inside conductor of disconnecter/earthing switch as well as used as a main bus, that's also why the GIS has not a separate main bus unit. This greatly simplifies the structure, saves space and increases product reliability.

4.3.2 Incoming and Outgoing Feeder Three-position Switch

The position in the figure is the middle position of disconnecter open/earthing switch open. The disconnecter closes when the moving contact moves towards right and plugs into the static contact of the disconnecter; the earthing switch closes when the moving contact moves towards left and plugs into the static contact of the earthing switch. It almost has the same structure with the disconnecter, except it has a fault making earthing switch. The static contact of the fault making earthing switch is connected with the conductor, and the moving contact is connected with the enclosure through the insulator as well as connected with the mechanism through four dog bone drive system. The fault making earthing switch has special electric spring operation mechanism with capability of breaking the short circuit current for more than 5 times.

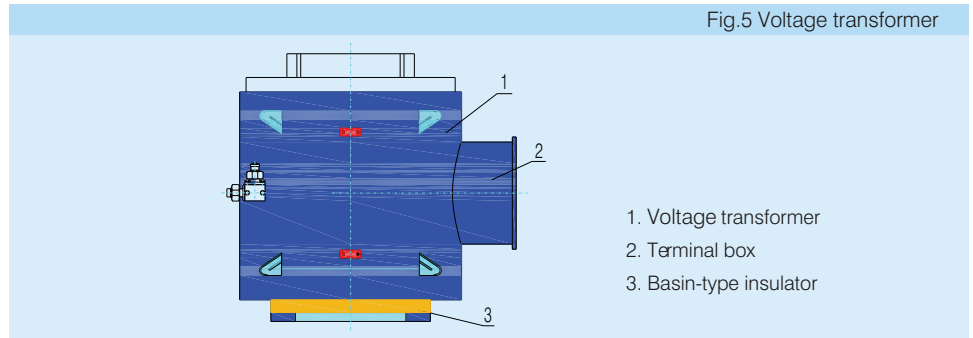
4.4 Current Transformer(CT) Module

- Adopt toroidal core.
- The secondary winding is epoxide resin casing.
- Three-phase common barrel type.
- Various types of class measurement and protective winding with different class precision, rating and capacity are available on customer requirements.
- Primary winding is the main circuit conductor.
- Outgoing feeder of the secondary winding is led out through the terminal box to the control cubicle (PLC).



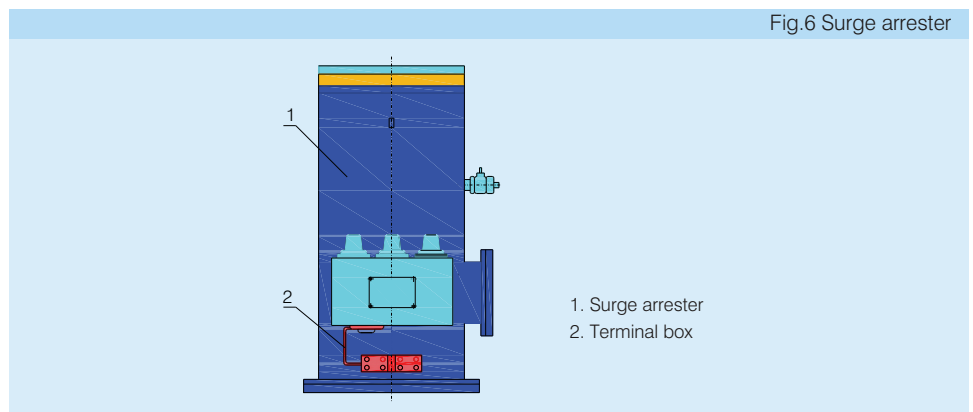
4.5 Voltage Transformer(PT) Module

- Voltage Transformer (also called Potential Transformer) is electromagnetic-type transformer.
- Three-pole common barrel type and single-pole type is available.
- Various types of secondary winding and spare winding available.
- PT can be installed at optional positions in the GIS through basin-type insulator.



4.6 Surge Arrester Module

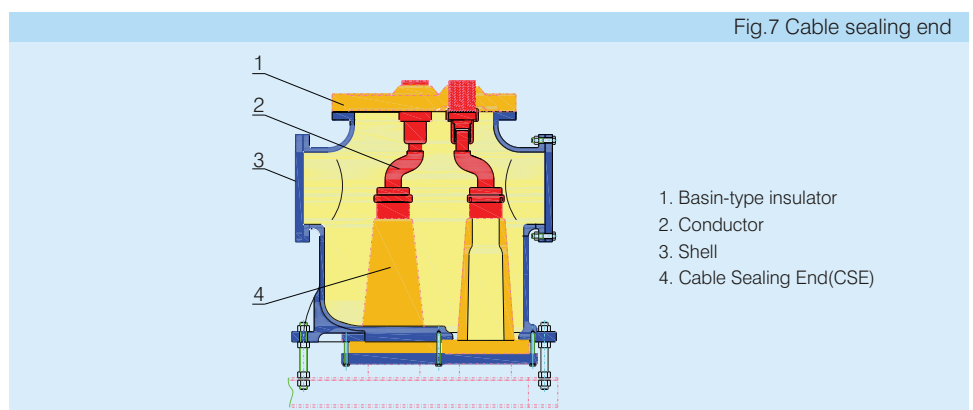
- Metal Oxide (MO) resistor wafer type valve.
- Three-phase common barrel type.
- As the over-voltage protection device, surge arresters are usually installed on the incoming side of a GIS, and are connected with other modules through basin-type insulators.
- Side-mounted and roof-mounted structures available.



4.7 Terminal Module

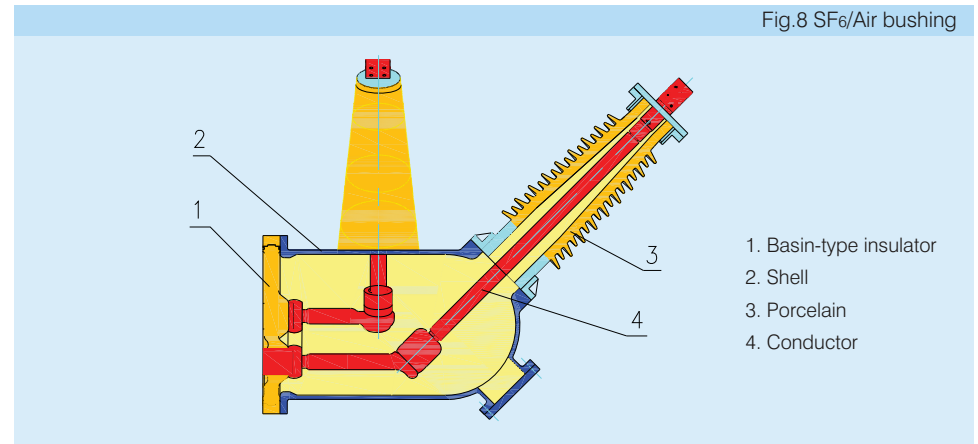
4.7.1 Cable Sealing End(CSE) Module

- Through cable Sealing End(CSE) box, all kinds of high voltage cables can be connected with GIS.
- Epoxy resin or jack-in type available.
- Primary conductor can be removed to separately do high-voltage test of GIS cable.
- Designed in accordance with IEC62271-305 standard.



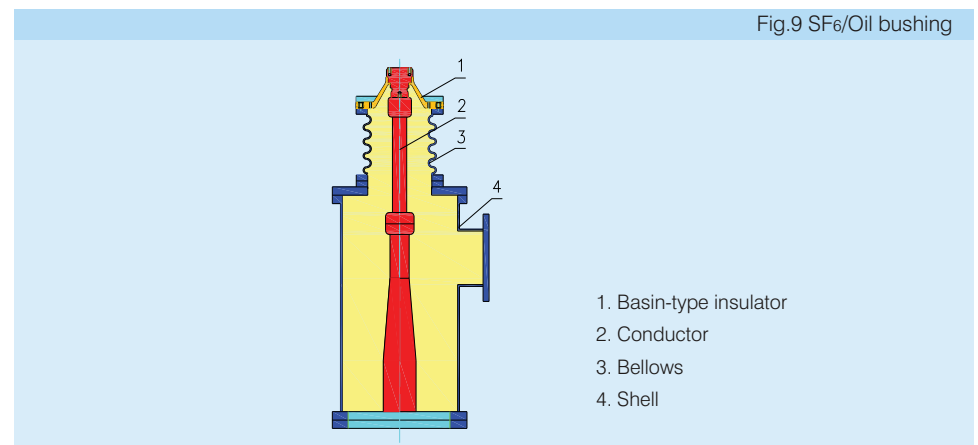
4.7.2 SF6/Air Bushing Module

- When overhead line is used in GIS as the incoming and outgoing feeder, SF₆/air bushing is adopted.
- The structure of SF₆/air bushing is three-pole split phase. The three-phase common barrel type changes to individual pole at the bushing position, then connected to the outside.



4.7.3 SF6/Oil Bushing Module

- The structure of SF₆/oil bushing is three-pole split barrel.
- Transformer is connected with GIS through SF₆/oil bushing.
- Bellows are used to adjust the thermal expansion and contraction and installation errors
- The design and scope of supply of SF₆/oil bushing accord with IEC 62271-306 standard.



4.8 Programmable Logic Controller(PLC)

- Liquid crystal monitor with touch screen is used to facilitate the realization of human-computer dialogue and achieve the remote control of CB, DS, ES, FES including conversion, operation, on load displaying status of location and primary line.
- To achieve automatically block among disconnector, circuit breaker and earthing switch as well as relay-based alarm function through software programming.
- Intelligent on line monitoring system, through which instant monitoring of SF₆ gas pressure value can be achieved.
- Convenient and powerful communication function. PLC communicates with the main control room through data signals communications interface, greatly reduces the cable link with the main control room and makes the whole flow simple and reliable.

Fig.10 Programmable Logic Controller(PLC)



4.9 Maximally Adapt to Users' Requirements

- All the components of GIS, such as disconnecter, circuit breaker, CT and other connected components are of standard modular structure.
- Each component structure is simplified and pruned to meet clients' requirements of arrangement under different conditions.
- GIS can be designed to be more reliable, more compact, more convenient to install and maintain, easier to achieve the expansion of docking and to maximally meet user's needs.

8. Ordering Information

Users shall give the main technical parameters, the main connection diagram and the relevant plant layout. And we will make the best design with most reasonable arrangement of space and covering least area to meet users' requirements.

