

**TOSHIBA**

72.5 to 1,100kV

# High Voltage Gas Insulated Switchgear

High Voltage Gas-Insulated Switchgear



# TOSHIBA SF6 GAS INSULATED SWITCHGEAR

## INTRODUCTION

Toshiba gas insulated switchgear (GIS) is accepted world wide as state-of-the-art equipment with many superior features.

Since the delivery of the first units in 1969, Toshiba has supplied GIS, globally more than 1,000 GIS stations with over 5,000 units covering voltages from 72.5kV to 1,100 kV and subject to various environmental conditions.

All these installations continue to provide trouble free, reliable service in network operation.

Toshiba has developed UHV GIS rated 1,100 kV, the highest voltage in the world.

## MAIN FEATURES

### ●Compactness/Outdoor compatibility

Toshiba GIS makes it possible to provide a substation in densely populated areas, mountainous terrain, underground etc. for both outdoor and indoor use in accordance with client's requirements.

The adoption of GIS leads to an effective use of a limited space.

### ●Protection against pollution

Since all live parts of GIS are contained in a metal enclosure, they are fully protected against environmental effects, such as salt deposits in coastal regions, sand storms, humidity in the atmosphere, etc.; insulator cleaning is eliminated and, thus, high reliability is achieved.

### ●Safe operation and easy maintenance

Live parts (e.g. buses and connections) are within earthed enclosures and are inaccessible: this gives maximum safety to the operators and reduced maintenance.

### ●Aesthetic compatibility

GIS meets with recent requirements for aesthetic compatibility with surroundings. Today, environmental protection is one of the major concerns among utilities.

Adoption of GIS offers an excellent solution.



●**High quality raw materials**

Only raw materials of the best commercial practice and reliably available to Japanese Standards (JIS) are used in our manufacture. Japanese Standards are equivalent to international standards in all important performance requirements and characteristics.

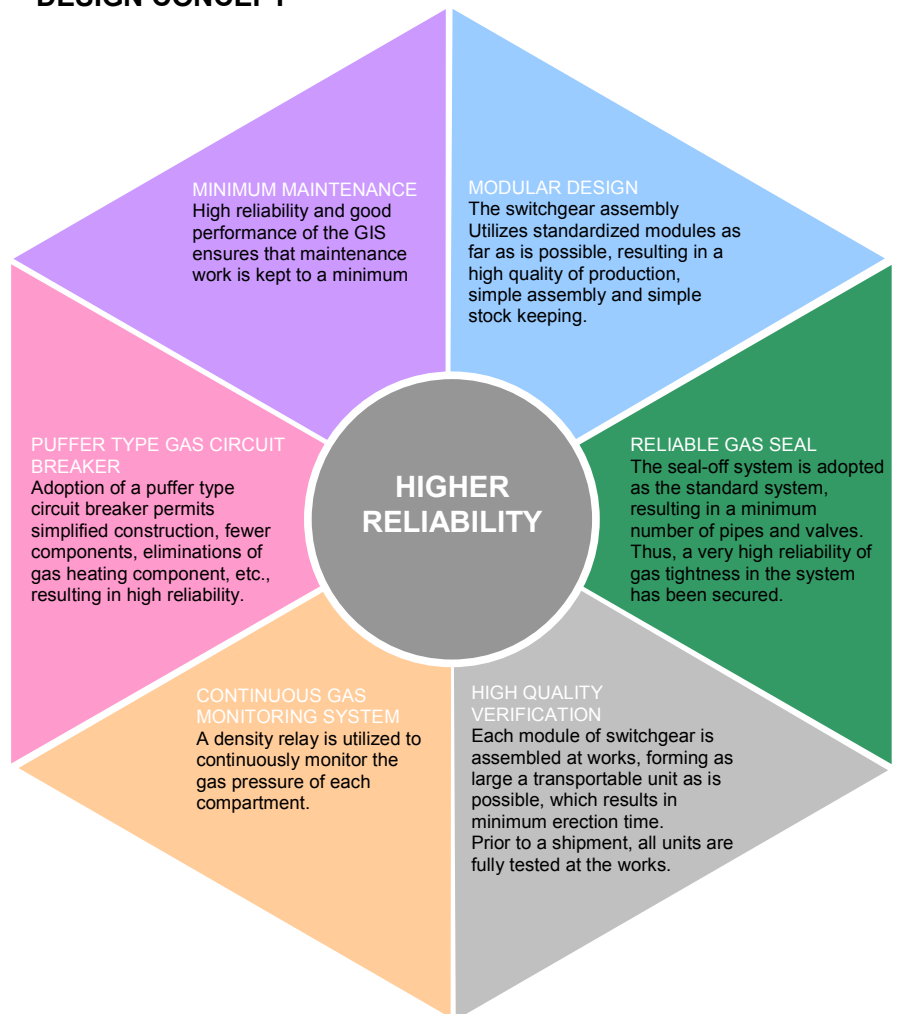
●**Safe and Reliable Pressure Vessel**

The pressure vessels are designed, fabricated, and tested in accordance with the Japanese pressure vessel code.



1,100kV GIS

**DESIGN CONCEPT**



# TOSHIBA SF6 GAS INSULATED SWITCHGEAR

## QUALITY CONTROL

Our superior quality control system assures high product reliability.

●**OIS09001 /EN ISO9001/ ANSI/ASQC Q9001/JIS 29901**

A third party inspector has certified that the Toshiba's quality management system conforms to stringent specifications of ISO9001/EN ISO9001/ANSI/ASQC 09001 /J IS 29001.

This will continue to be assured by continual assessment and reviews.

●**High Voltage & High Power Testing Laboratories**

Our laboratories are equipped with two short-circuit generators (7,400MVA and 3,600MVA at three-phase power), AC testing transformer for 2,300kV, Impulse generator for 6,000kV and DC voltage generator for 2,000kV together with other facilities.

These provide superior quality verification and effective assistance in research and development at the highest power levels.

In principle, all kind of electrical type tests can be carried out our testing laboratories.

These testing laboratories quality systems have been officially accredited for the first time in Japan according to ISO / IEC GUIDE 25 by JAB (The Japan Accreditation Board for Conformity Assessment) in 1999.



ISO/IEC GUIDE 25 Certificate by JAB



ISO9001 certificate



Short circuit generator



2,300kV AC Testing transformer



6,000kV Impulse generator

●High precision assembly shop

Various dedicated assembly shops are provided for GIS manufacture, fully equipped for the precision assembly methods used.



Painting machine



Flange welding machine



Automatic machining center



Parts marshalling before assembling

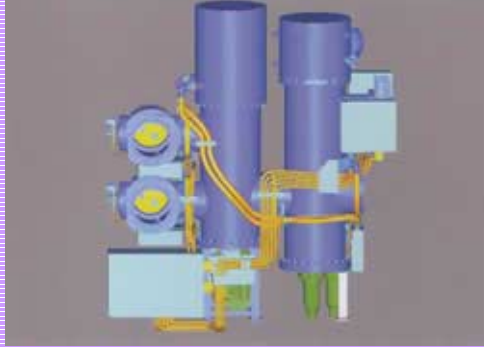


Dust proof room

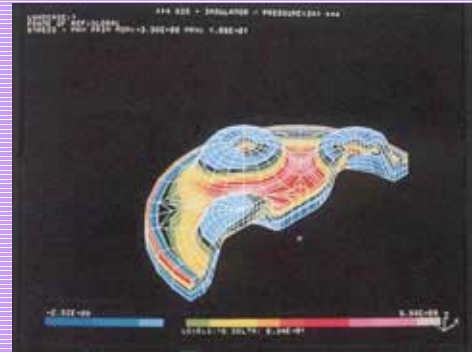
# TOSHIBA SF6 GAS INSULATED SWITCHGEAR

## •Computer Integrated Manufacture (CIM)

Our GIS works has the process control system which links its production resources with its engineering base, thereby creating a sophisticated CIM which enables Toshiba to accurately meet the needs of the market, and to offer highly reliable GIS to our customers.



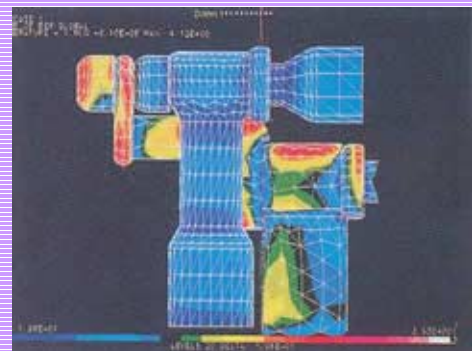
Layout design using GIS solid model



Analysis of three phases  
Insulating spacer, using  
Computer Aided Engineering  
(CAE)



Three-dimensional GIS model



Analysis of three-dimensional  
Electric field using CAE

## CUSTOMER SUPPORT AND OVERSEAS ACTIVITIES

Toshiba GIS has been delivered to many countries around the world, and is now contributing to each country's industrial development. Toshiba are also actively pursuing various forms of overseas activities, including technical collaboration/joint research with overseas companies, on-site installation and commissioning of our products, training of overseas personnel and procurement of products from companies abroad. In these and many other ways, we are fulfilling, and will continue to fulfill, our responsibility as citizens of the global community.



Instructional facility



GIS training of overseas customer at Hamakawasaki works

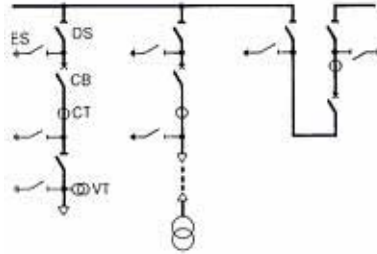
# TOSHIBA SF6 GAS INSULATED SWITCHGEAR

## SINGLE LINE DIAGRAM

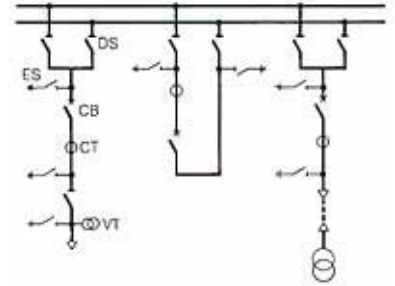
The switchgear of each rated voltage is designed to comprise standardized modules, so that various configurations can be built up by the arrangement of these modules.

- Single busbar system
- Double busbar system
- Single bus with bypass busbar system
- Double busbar system with bypass DS
- 1-1/2 CB system
- Ring busbar system
- Main and transfer busbar system

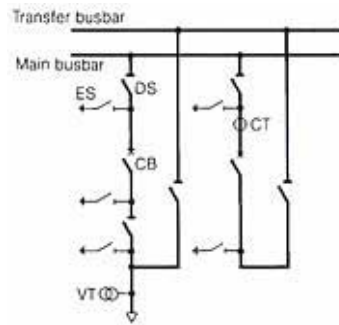
Single busbar system



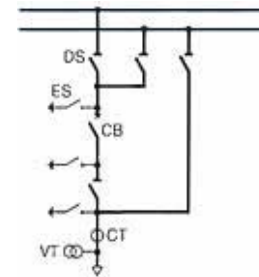
Double busbar system



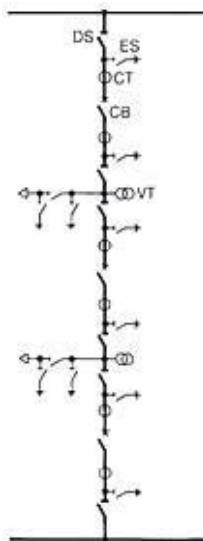
Single bus with bypass busbar system



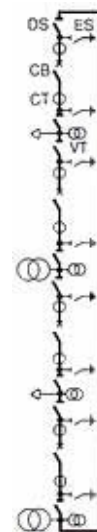
Double bus system with bypass DS



1-1/2 CB system



Ring busbar system



The above illustrations are typical arrangements.

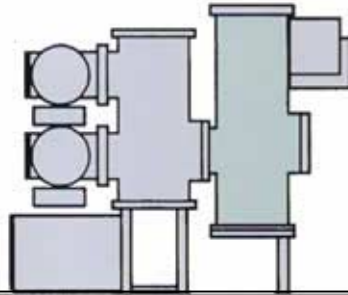
## COMPATIBILITY WITH VARIOUS TYPES OF TERMINATION

Various types of termination at the GIS are available to meet the client's specification.

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### •Power cable connection

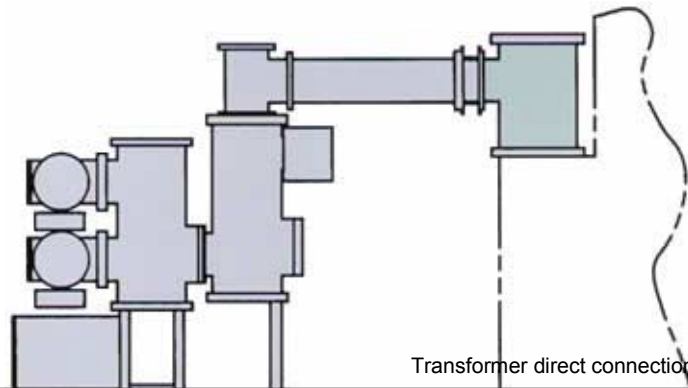
A cable connection assembly in accordance with IEC standard 859 is recommended.



Typical cable connection (145kV GIS)

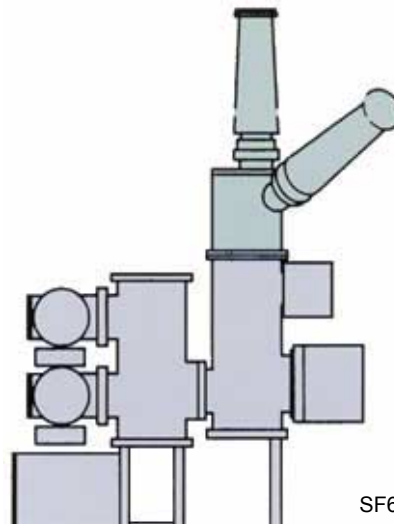
### •Transformer connection

Direct connection to transformers by means of a gas-insulated busbar (GIB) is one of the simple and safe solutions.



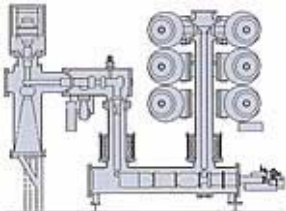
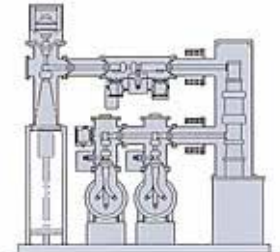
Transformer direct connection (145kV GIS)

### •Open-Air connection



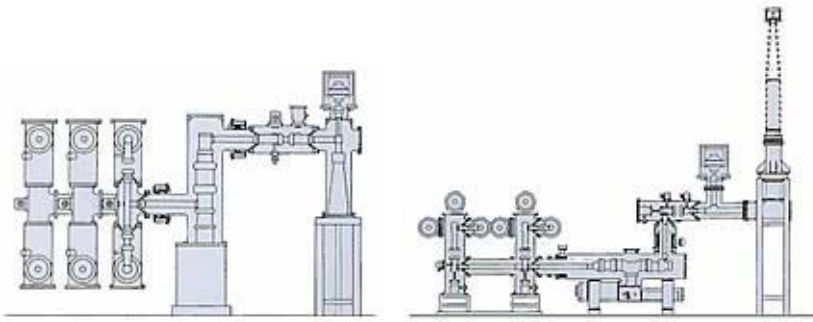
SF6-Air bushing connection (145kV GIS)

# Principal technical data

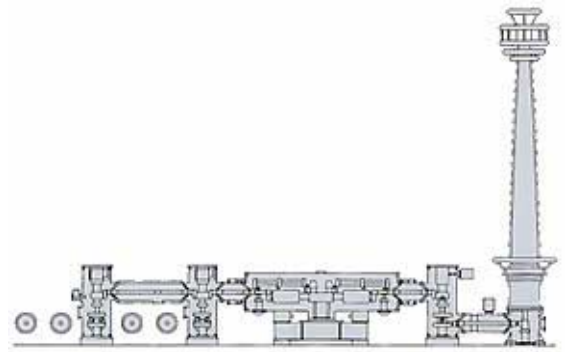
Illustration of typical double busbar feeder		G3A Series	G1B Series	G1C Series
				
The items of principal technical data				
Rated voltage	kV	72.5 to 145	170 to 252	245 to 300
Rated one minute power frequency withstand voltage	kV	275	460	460
Rated lightning impulse withstand voltage	kV	650	1,050	1,050
Rated frequency	Hz	50/60	50/60	50/60
Rated current	A	2,000/3,150	3,150/4,000	3,150/4,000
Rated short-circuit current	kA	20 to 40	40 to 50	40 to 63
Number of breaks per pole		1	1	1
Dimensions per double bus bar bay (Width)	approx. m	0.9	2.0	3.1
Dimensions per double bus bar bay (Height)	approx. m	3.7	3.6	5.1
Dimensions per double bus bar bay (Depth)	approx. m	3.9	5.2	5.2
Weight per double bus bar Bay	approx. t	6	8	15

The above data refer to the standard equipment. Higher values have been realized and are available on request.

### G1D Series



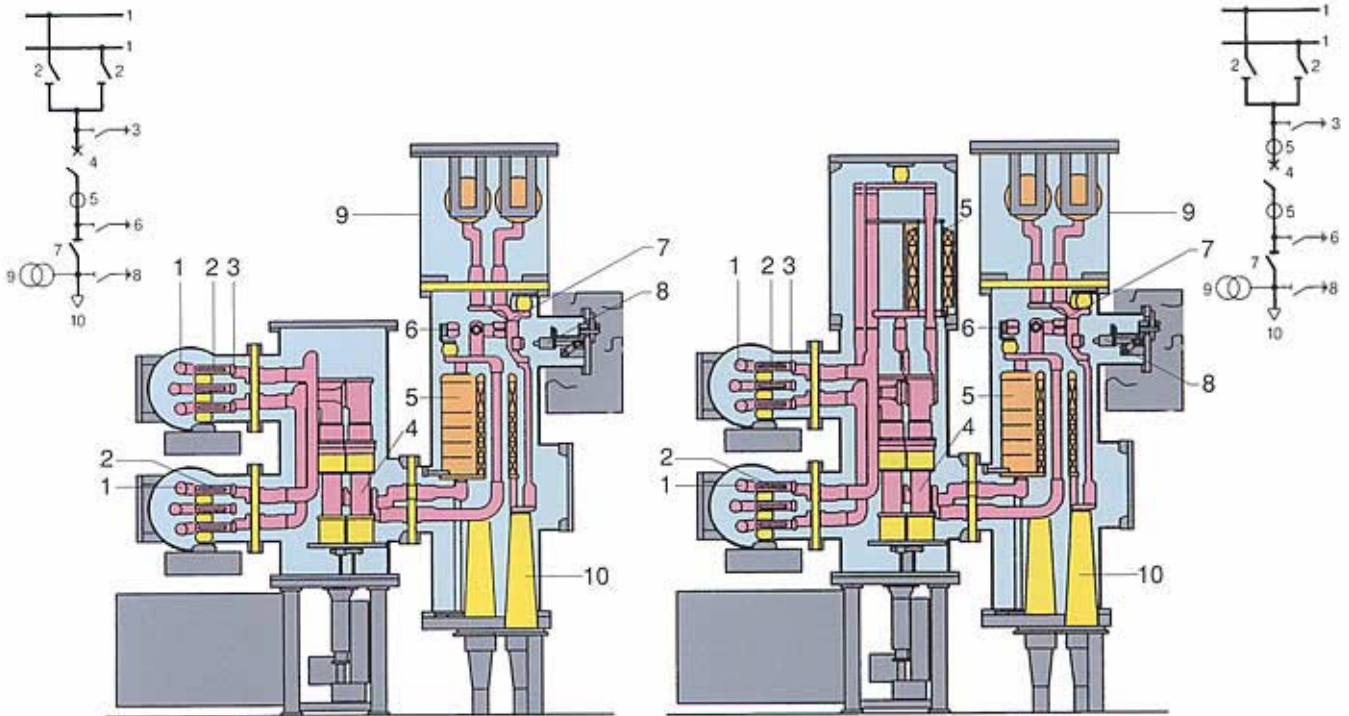
### G1E Series



330 to 420	330 to 550	765 to 800	1,100
630	760	960	1650
1,425	1,550	2,100	2,250
50/60	50/60	50/60	50/60
3,150/4,000	4,000/6,000	5,000/6,000	2,000/8,000
40 to 63	40 to 63	40 to 63	50
1	1 or 2	2 or 4	2
3.6	5.5	6.5	7.5
5.8	6.5	6.5	6.0
8.0	12	20	30
22	30	70	250

# GIS for 72.5 to 145kV-up to 40kA

## G3A Series



- |                                |                                |                        |                     |
|--------------------------------|--------------------------------|------------------------|---------------------|
| 1: Busbar                      | 5: Current transformer         | 9: Voltage transformer | SF <sub>6</sub> gas |
| 2: Busbar disconnector         | 6: Maintenance earthing switch | 10: Cable sealing end  | Insulators          |
| 3: Maintenance earthing switch | 7: Disconnector                |                        | Live parts          |
| 4: Circuit breakers            | 8: High speed earthing switch  |                        | CT/PT               |
|                                |                                |                        | Earthed parts       |
|                                |                                |                        |                     |

**145kV GIS Sectional view of a bay with double busbar system**



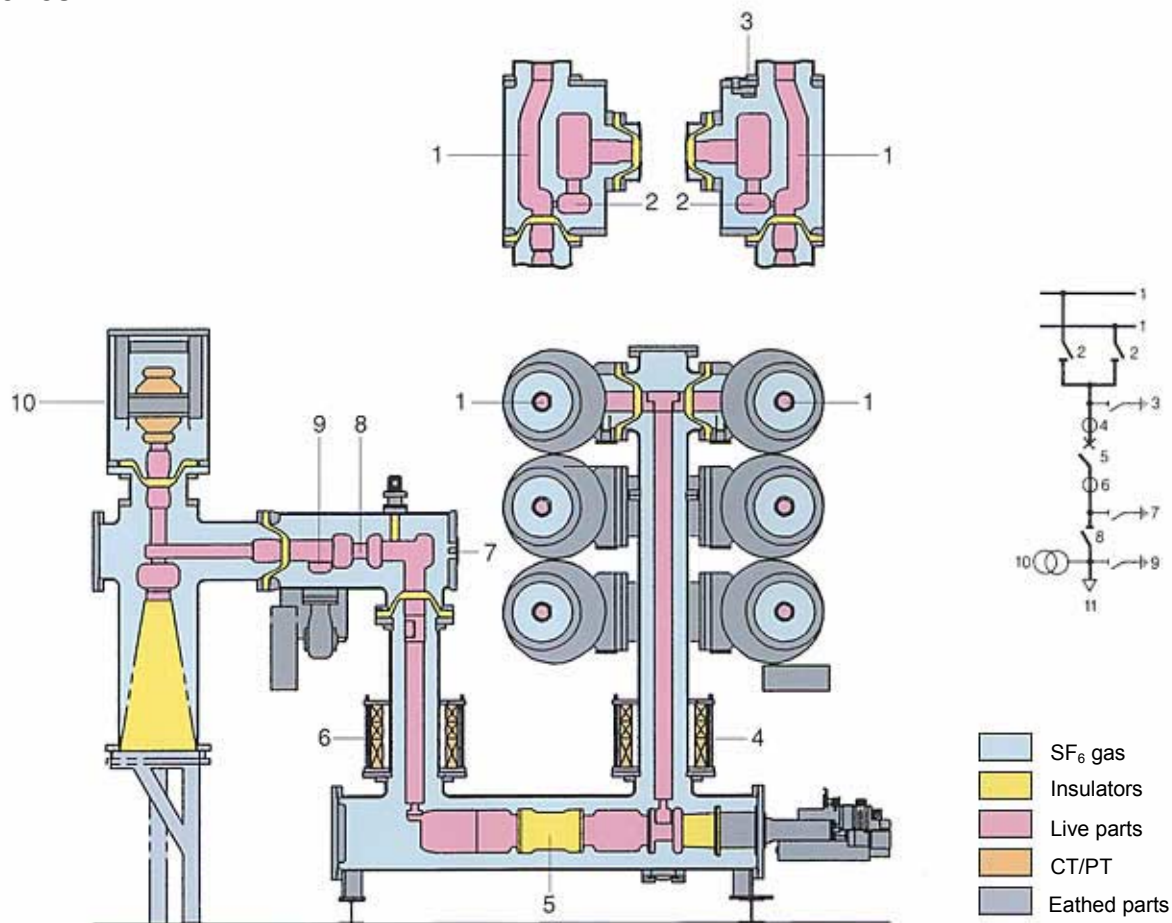
145kV GIS



138kV GIS

# GIS for 170 to 252kV-up to 50kA

## G1B Series



- 1: Busbar
- 2: Busbar disconnector
- 3: Maintenance earthing switch
- 4: Current transformer
- 5: Circuit breaker
- 6: Current transformer
- 7: Maintenance earthing switch
- 8: Disconnector
- 9: High speed earthing switch
- 10: Voltage transformer
- 11: Cable sealing end

### 245 kV GIS Sectional view of a bay with double busbar system



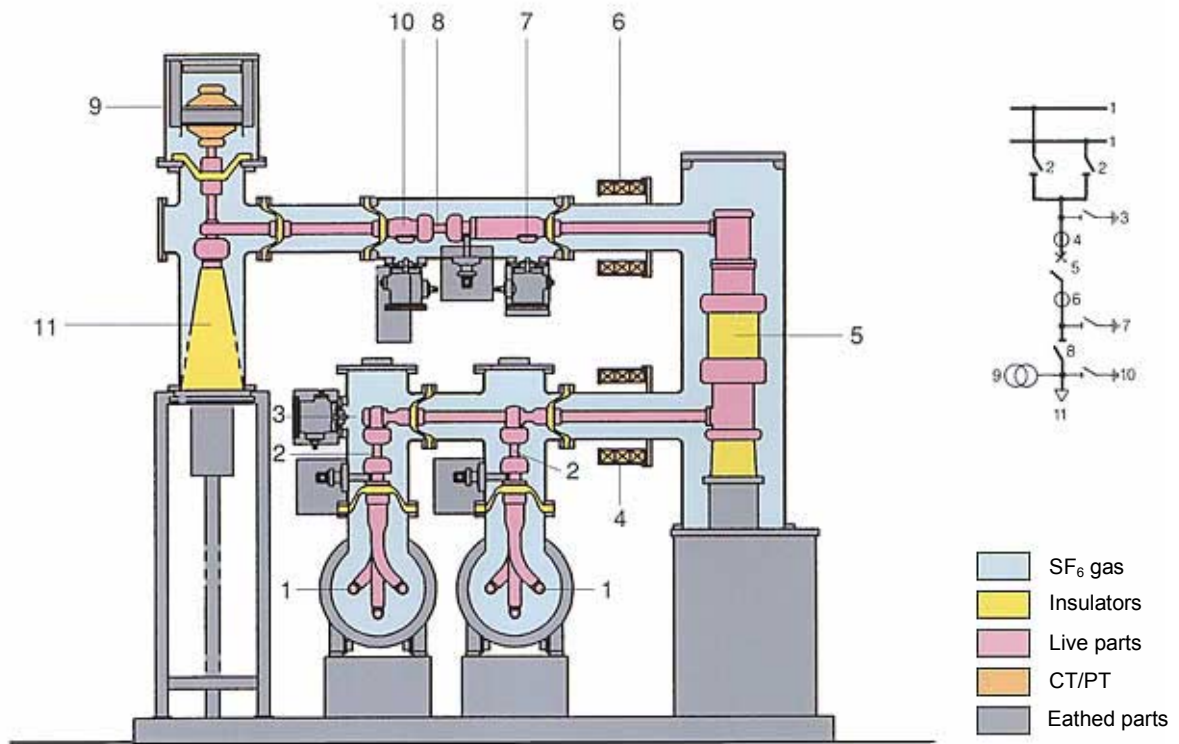
245kVGIS



245kV GIS

# GIS for 245 to 300kV-up to 63kA

## G1C Series



- |                                |                                |                                |
|--------------------------------|--------------------------------|--------------------------------|
| 1: Busbar                      | 5: Circuit breaker             | 9: Voltage transformer         |
| 2: Busbar disconnector         | 6: Current transformer         | 10: High speed earthing switch |
| 3: Maintenance earthing switch | 7: Maintenance earthing switch | 11: Cable sealing end          |
| 4: Current transformer         | 8: Disconnector                |                                |

**300 kV GIS Sectional view of a bay with double busbar system**



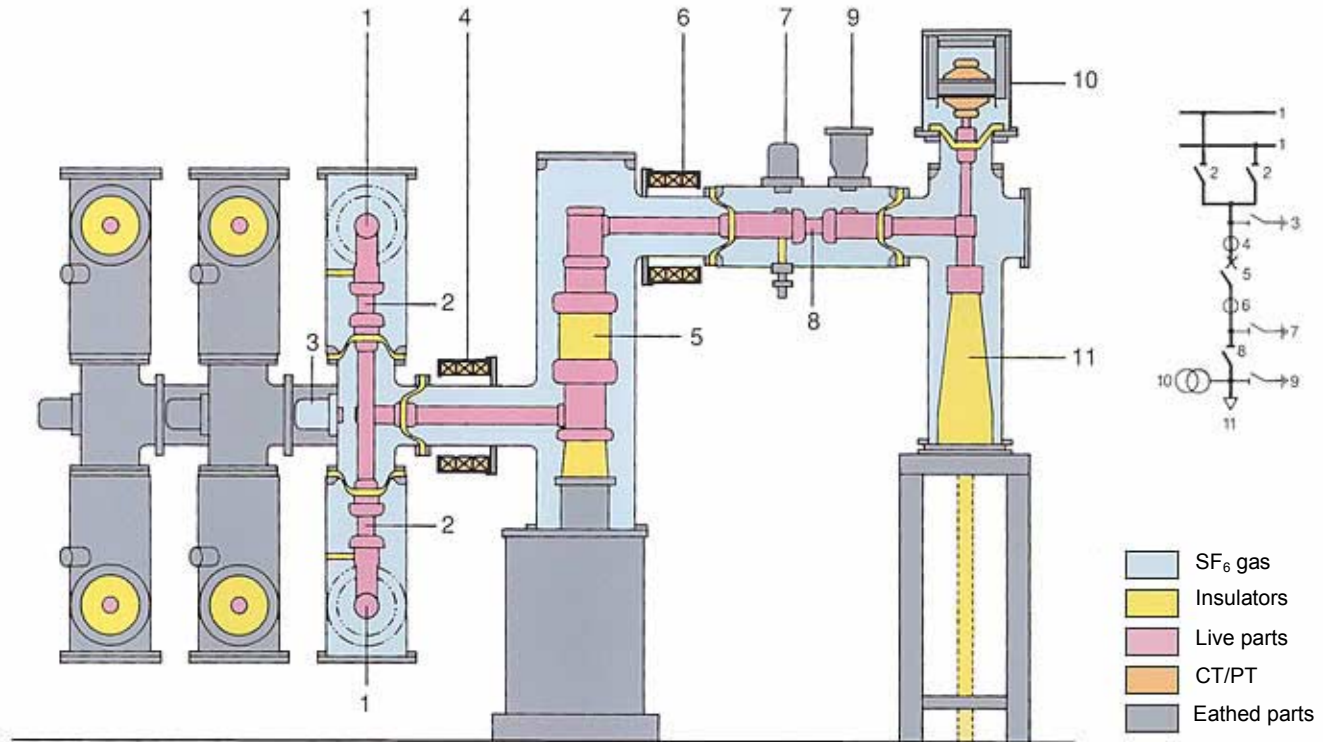
300kV GIS (All three phase encapsulated type)



300kV GIS

# GIS for 330 to 420kV-up to 63kA

## G1D Series



- |                                |                                |                               |
|--------------------------------|--------------------------------|-------------------------------|
| 1: Busbar                      | 5: Circuit breaker             | 9: High speed earthing switch |
| 2: Busbar disconnector         | 6: Current transformer         | 10: Voltage transformer       |
| 3: Maintenance earthing switch | 7: Maintenance earthing switch | 11: Cable sealing end         |
| 4: Current transformer         | 8: Disconnector                |                               |

### 420 kV GIS Sectional view of a bay with double busbar system



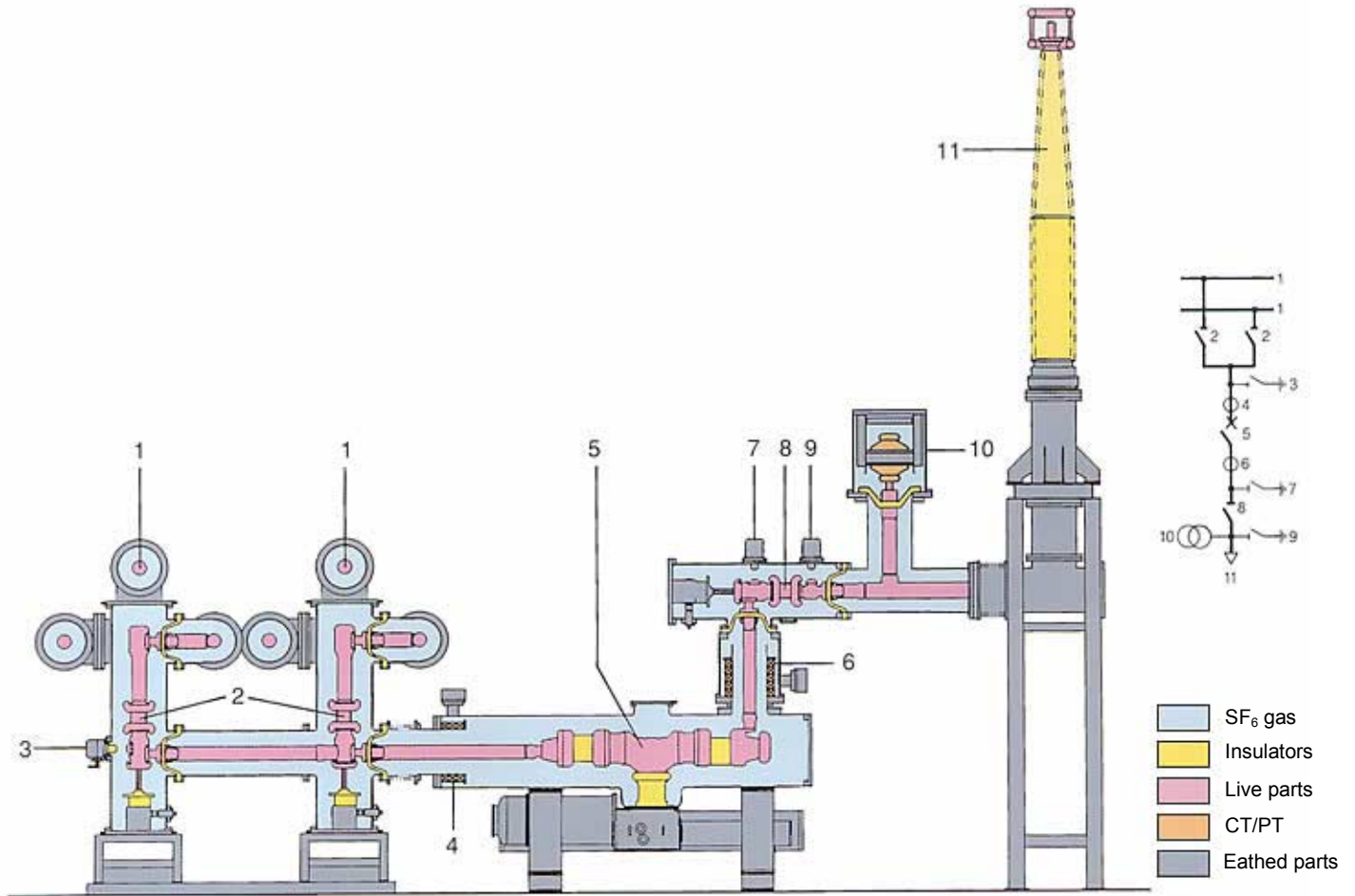
420kV GIS



420 kV GIS

# GIS for 330 to 550kV-up to 63kA

## G1D Series



- 1: Busbar
- 2: Busbar disconnector
- 3: Maintenance earthing switch
- 4: Current transformer

- 5: Circuit breaker
- 6: Current transformer
- 7: Maintenance earthing switch
- 8: Disconnector

- 9: Earthing switch
- 10: Voltage transformer
- 11: Bushing

### 550 kV GIS Sectional view of a bay with double busbar system



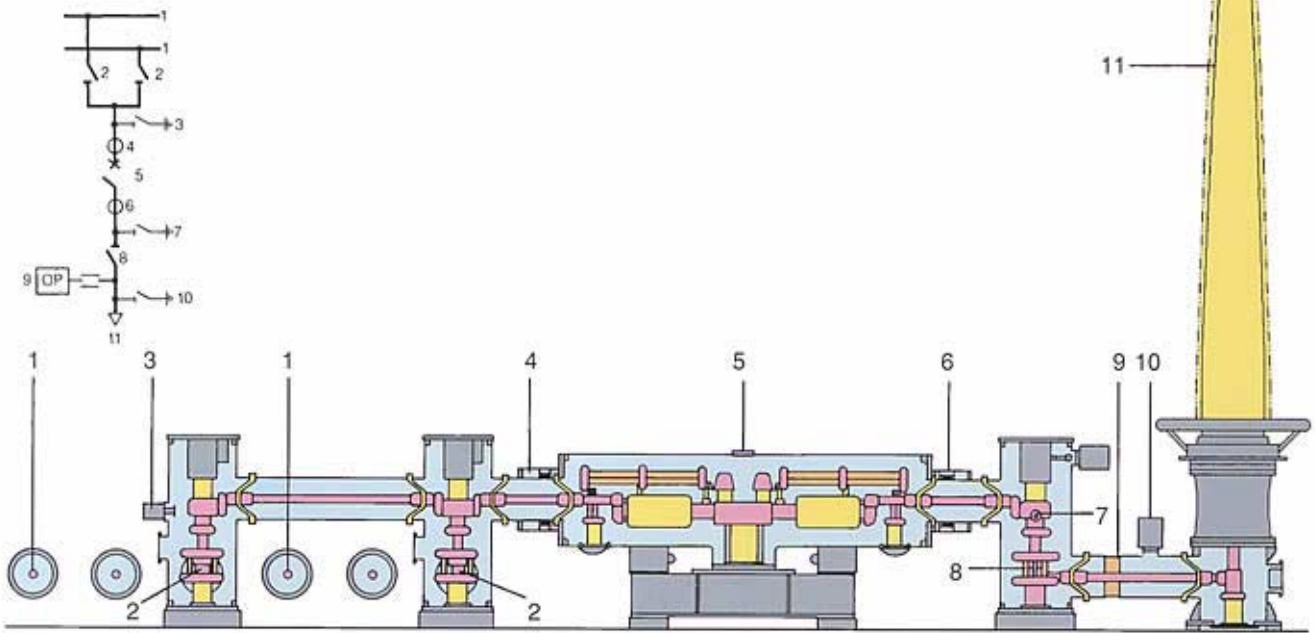
550 kV GIS



1 break GCB for 550 kV GIS in underground substation

# GIS for 765 to 1,100kV-up to 50/63kA

## G1E Series



- 1: Busbar
- 2: Busbar disconnector
- 3: Maintenance earthing switch
- 4: Current transformer

- 5: Circuit breaker
- 6: Current transformer
- 7: Maintenance earthing switch
- 8: Disconnector

- 9: Optical potential device
- 10: Earthing switch
- 11: Bushing

- SF<sub>6</sub> gas
- Insulators
- Live parts
- CT/PT
- Eathed parts

1,100 kV GIS Sectional view of a bay with double busbar system



800kV GIS



1,000kV GIS

## OTHERS



300 kV Hybrid GIS



DC 500kV GIS

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●The data given in this catalogues are subject to change without notice.