

Three-phase Encapsulated Type  
**SF<sub>6</sub> Gas Insulated Switchgear**  
Type SDH714 for 72.5 to 145 kV



**SDH714**

**For 72.5 to 145 kV**



# Small Space Requirement, High Reliability and Safety — 72.5 to 145kV GIS, SDH714

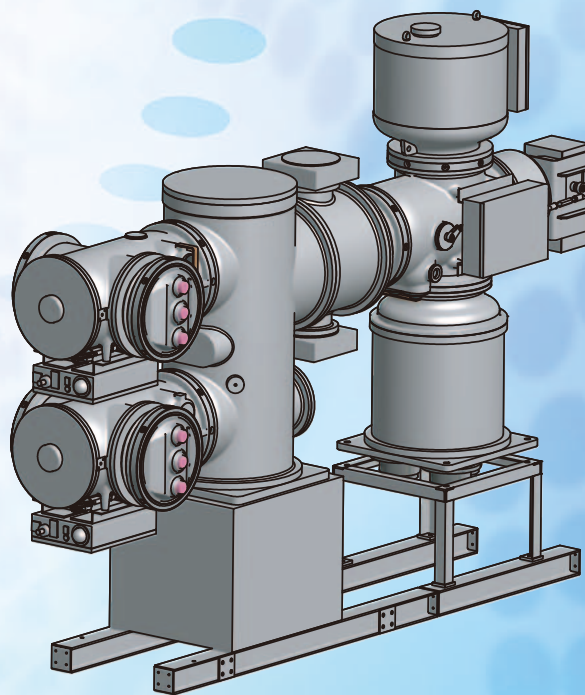
The number of application for SF<sub>6</sub> gas insulated switchgear has been tremendously growing all over the world, because it has many advantageous features as below:

- Small space requirement
- High reliability
- Safety
- Good harmony with environment
- Long maintenance interval
- Short erection period at site

Fuji started the development of SF<sub>6</sub> gas insulated switchgear (GIS) in the 1960's.

The first 72.5 kV GIS, which was of the phase segregated type, was put into operation in 1970. Since then Fuji has also developed three-phase encapsulated type GIS and supplied the first 72.5 kV three-phase encapsulated GIS in 1975. The three-phase encapsulated GIS for 72.5 to 145 kV as of now, type SDH was developed in 2001, and have been supplied all over the world. Based on these experiences with high and long term technology, Fuji has successfully developed an updated version of the type SDH, namely, SDH714.

The 72.5 kV and above GIS is being manufactured in our substation equipment factory located in Chiba prefecture, Japan. The substation equipment factory has been recognized to be in accordance with the requirements of the quality standards ISO 9001.





# Characteristic Features

**Compact design** makes for minimum space requirements and transportation by container service. Therefore, the costs of foundations, buildings and transportation can be minimized.

**The fully earthed enclosure** protects operators not to touch live parts directly, prevents from radio interference, and realizes no atmospheric pollution. Aluminum alloy enclosure is used to reduce weight and power dissipation.

**The modular design principle applied** realizes the standardization of components and parts. This makes possible the large quantity production way which increases the reliability of components and parts with their easy stock control.

**Unified SF<sub>6</sub> gas pressure throughout the switchgear** makes simplified gas maintenance work.

## Technical Data

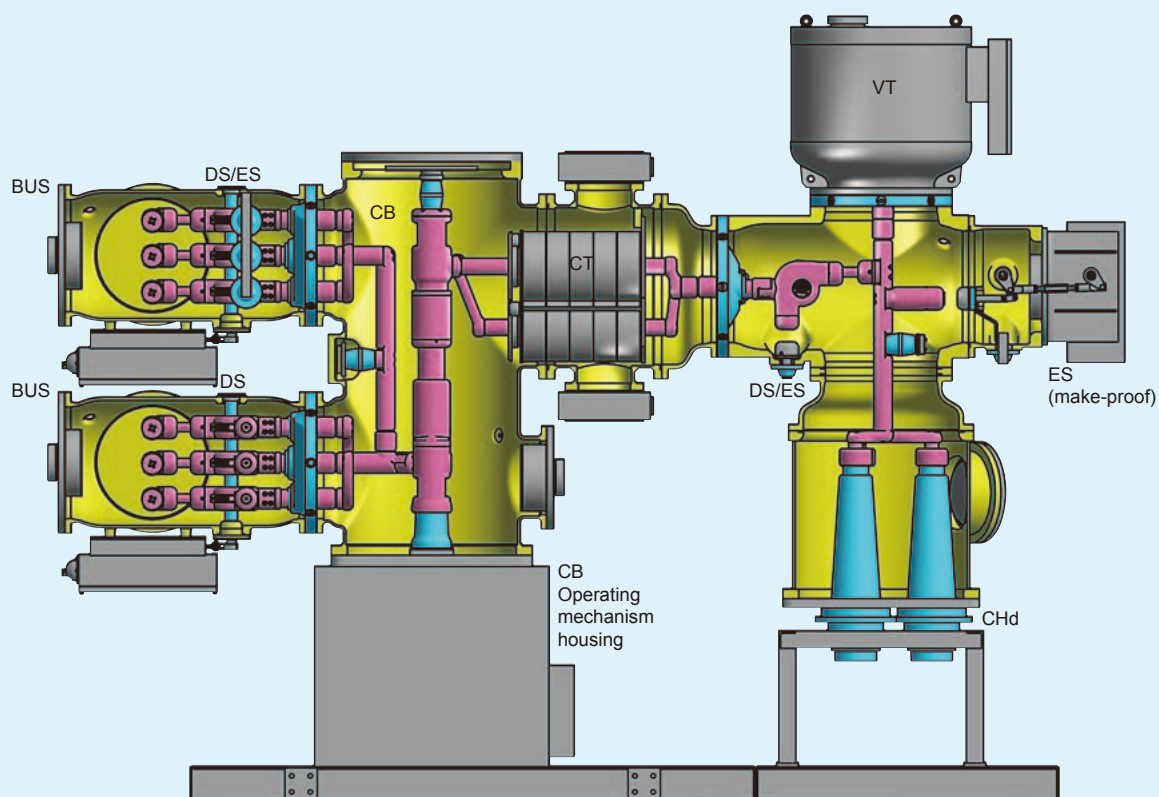
Rated voltage		[kV]	72.5	123	145
Rated power frequency withstand voltage	[kV]	Common values	140	230	275
		Across the isolating distance	160	265	315
Rated lightning impulse withstand voltage	[kV]	Common values	325	550	650
		Across the isolating distance	375	630	750
Rated normal current	[A]	Busbar	up to 3150		
		Others	up to 3150		
Rated short-circuit breaking current		[kA]	up to 40		
Rated short-time withstand current (3 s)		[kA]	up to 40		
Rated peak withstand current		[kA]	up to 100		
Rated SF <sub>6</sub> gas pressure, gauge (at 20 °C )	[MPa]	Switchgear	0.6		
		Circuit breaker	0.6		
Rated break time of circuit breaker		[cycles]	3		
Rated operating sequence of circuit breaker			O-0.3 s-CO-3 min.-CO, O-3 min.-CO-3 min.-CO,CO-15 s-CO		
Bay width		[mm]	900		
Number of mechanical operations of circuit breaker and disconnecter			Class M2 (10000 operations)		

Applicable standards : IEC



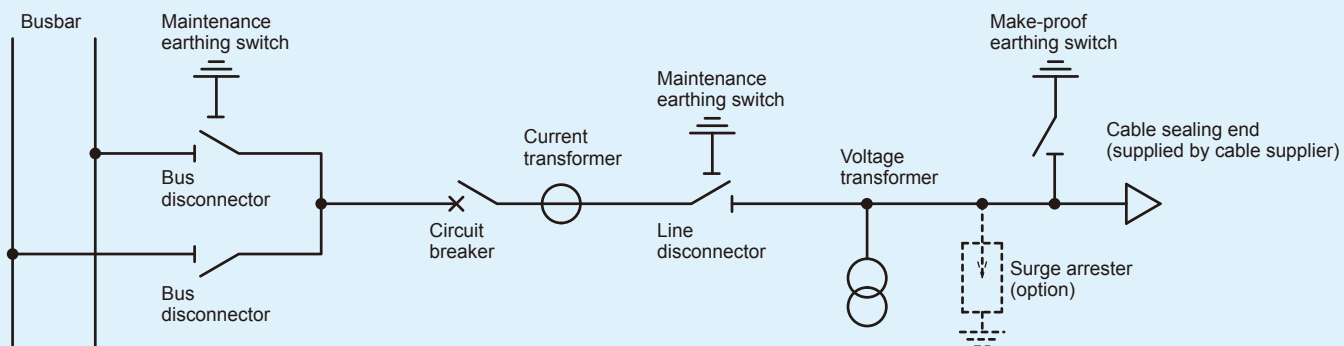
# Typical Section of a Unit

Fig.1 Sectional view of a cable feeder unit with double busbar



- |                           |                          |
|---------------------------|--------------------------|
| CB : Circuit breaker      | VT : Voltage transformer |
| DS : Disconnecting switch | CHd : Cable sealing end  |
| ES : Earthing switch      | BUS : Bus bar            |
| CT : Current transformer  |                          |

Fig.2 Single line diagram of a cable feeder unit with double busbar



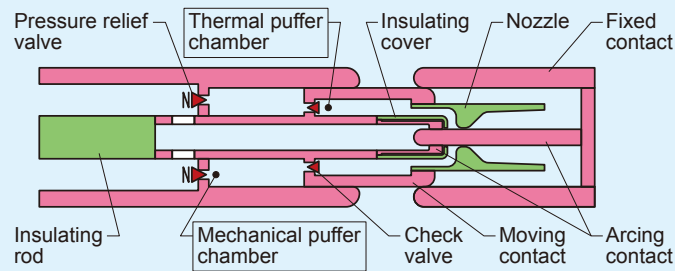


## Circuit Breaker

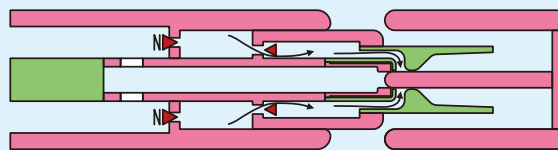
- A motor-charged spring operating mechanism is applied.
- Three interrupters are commonly operated through insulating operating rods and a link mechanism.
- Combination of a thermal puffer chamber and a mechanical puffer chamber can achieve excellent breaking performance from small current to large current with a small operation power.
- Maintenance free up to 2000 times load breaking.
- Mechanically type tested for 10000 operations. (class M2)

Fig.3 Principle of arc quenching

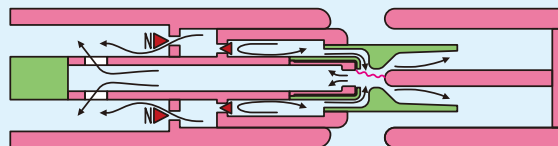
● Closed position



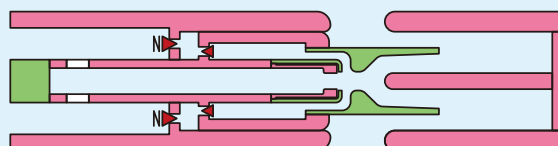
● Opening (Priming)



● Opening (arc quenching)



● Open position



## Busbar

Three phase conductors made of aluminium or copper, depending on the current rating, are supported by gas tight insulators.

## Disconnectors and Earthing Switches

Line disconnector combined with a maintenance earthing switch forms a three-position switch.

Busbar disconnectors are assembled in each busbar compartment. One of them is combined with a maintenance earthing switch and forms a three-position switch. The disconnector has a switching capability of bus-transfer current, small capacitive current as bus charging and small inductive current as transformer magnetizing current, if required.

Earthed side of the earthing switch is brought out from the earthed metal housing and earthed to it through a removable link for primary injection test.

Disconnectors and earthing switches are normally motor or manual-operated.

The make-proof earthing switch is provided with a motor-charged spring operation mechanism.

## Current Transformer

The current transformer is of foil-insulated type with ring core mounted in the CB enclosure. SF<sub>6</sub> gas provides the high-voltage insulation. A separate compartment is available upon request.

## Voltage Transformer

The voltage transformer is of induction type. SF<sub>6</sub> provides the high-voltage insulation.

## Surge Arrester

The surge arrester consists of zinc oxide (ZnO) element with excellent low residual voltage characteristics and long service life.

Fig.4 Line disconnector and earthing switch

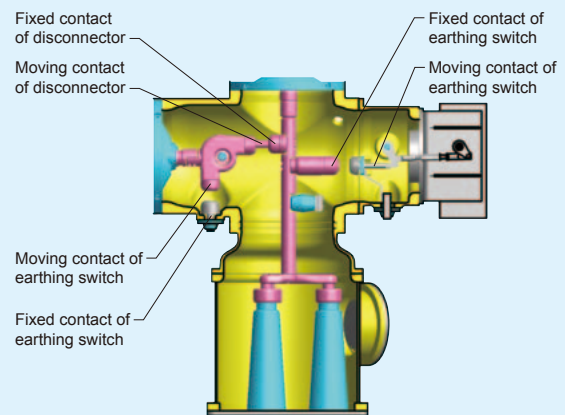
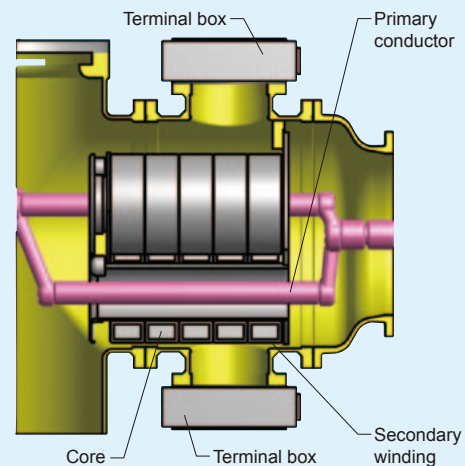


Fig.5 Current transformer



## SF<sub>6</sub> Gas System

Rated SF<sub>6</sub> gas pressure is unified at 0.6 MPa (gauge) for all compartments.

SF<sub>6</sub> gas pressure changes depending on the ambient temperature as shown in Fig.6.

The monitoring of SF<sub>6</sub> gas is carried out by means of temperature compensated pressure switches in the manner as tabled below.

[at 20 °C ]			
Components	Rated SF <sub>6</sub> gas pressure [MPa]	Low alarm pressure [MPa]	Operation lockout pressure [MPa]
Circuit breakers	0.6	0.55	0.5
Disconnectors and earthing switches	0.6	0.55	Note 1
Other components	0.6	0.55	—

Note 1 : Operation lockout at 0.5 MPa (at 20 °C ) is upon request.

Fig.6 Pressure-temperature characteristic curve of SF<sub>6</sub> gas

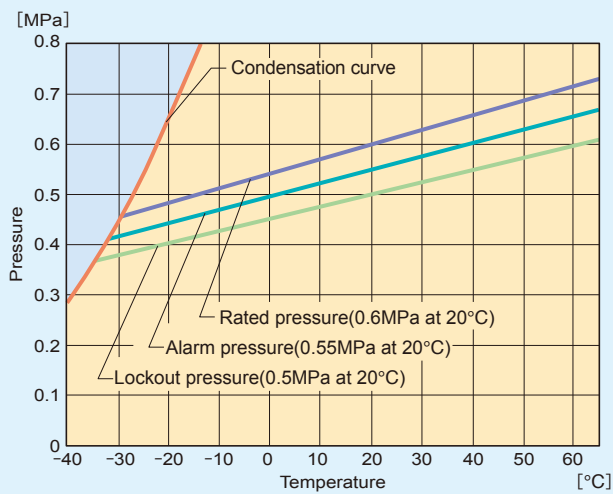


Fig.7 shows the typical gas zones and gas monitoring system. The SF<sub>6</sub> gas filled disconnector / (earthing switch) / busbar compartment is sealed off from the adjacent unit by gas tight and arc-proof insulators.

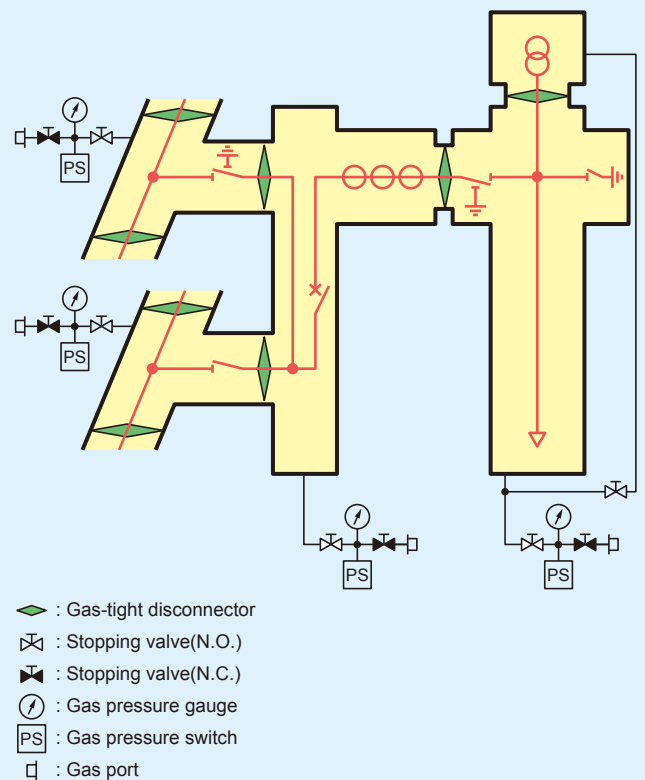
A similar insulator seals off this compartment from the circuit breaker.

All gas zones are monitored by gas density relays.

The switchgear has a very low gas leakage rate.

Guaranteed gas loss is less than 0.5 % per annum and type tested for 0.1% per annum.

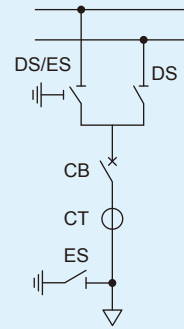
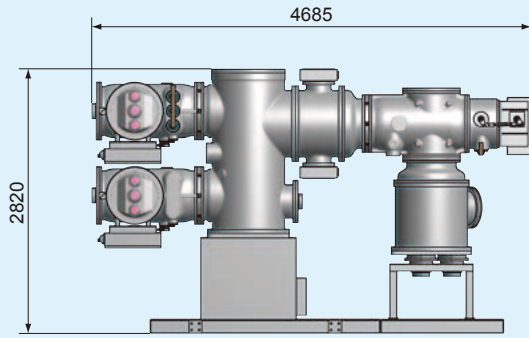
Fig.7 SF<sub>6</sub> gas system



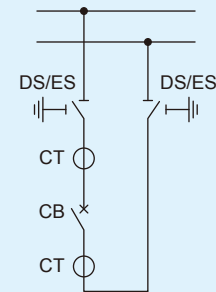
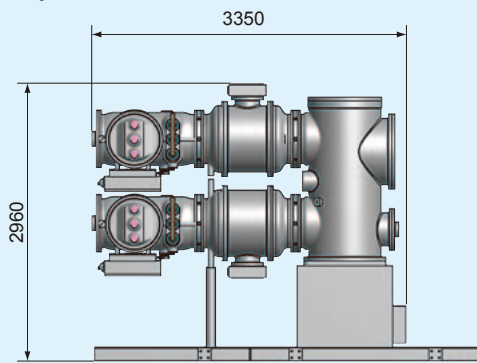
# Typical Arrangement

[Unit : mm]

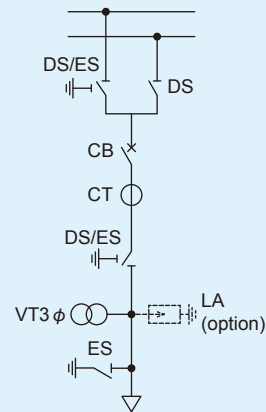
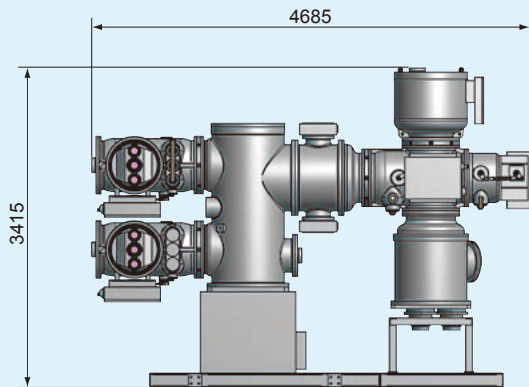
**Fig.8 Cable feeder unit with double busbar (Tr.bay)**



**Fig.9 Bus coupler unit**



**Fig.10 Cable feeder unit with double busbar**



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