

# 123/145kV SF<sub>6</sub> GAS INSULATED SWITCHGEAR

*Three-Phase Common Enclosure  
Gas Insulated Switch Gear with Spring Operated GCB*



## *Original technology, now further improved*

In 1975, Hitachi set the global standard for high-voltage GIS with an 84kV three-phase common-enclosure GIS, and 40 years of field data has proven the design meets a wide range of technical requirements. The design has since been modified based on customer feedback from around the world and the technology refined through intense research and development.

## *Outstanding features of Hitachi GIS*

**Compact:** Reducing the foot print has been one of Hitachi's main goals in addressing customer feedback. The newly designed three-phase common-enclosure GIS requires half the space of conventional models.

**Reliable:** The reliability of Hitachi GIS has been proven with more than 40 years of experience and 9,000 bays in service. Top-quality, long-life seals and pinhole-free steel enclosures keep the interior properly pressurized. In the unlikely event of a total pressure loss, the SF<sub>6</sub> gas will continue to effectively insulate the switchgear at nominal system voltage.

**High Quality:** All Hitachi GIS are fully assembled in our factories. Prior to shipping, every unit undergoes stringent mechanical and electrical testing ensuring proper performance at the customer's site.

**Easy Maintenance:** Hand holes provide ready access to circuit breaker contacts and other key GIS components for ease of inspection, maintenance, and replacement. There is no need to disassemble the circuit breaker, or to employ special tools or a mobile crane.

**Environmental Adaptability:** The switchgear's robust design, durable materials, heavy-duty construction and low profile make it suitable for installation in all locations.

**Reduced Installation Time:** Hitachi GIS are shipped to the site in as few pieces as possible minimizing the number of on-site connections required and significantly reducing installation time and cost.

**Easy Extension:** Feeders are easy to add with minimal outage time.

**Three-Phase Common-Enclosure Design Concept:** Three-phase common-enclosure designs offer two main advantages: compact size and fewer parts. With less real estate and with fewer parts required, significant cost savings and greater reliability are realized.

By applying its years of experience with isolated-phase common-enclosure designs, Hitachi has succeeded in developing an ultra-compact 123/145kV model.

Developing three-phase common-enclosure switchgear involves three major considerations: coordination of interphase insulation, minimization of interphase electromagnetic stress, and maximization of current capacity.

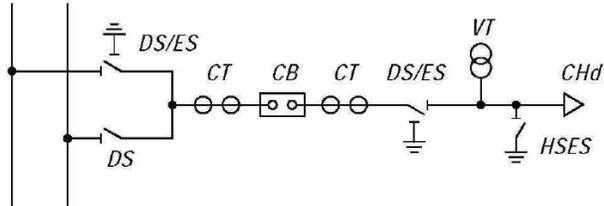
Coordinating insulation between phases requires a thorough EMTP surge analysis for a wide variety of fault scenarios. Through analysis and test, we have learned that an insulation strength ratio of 1.5 phase-to-phase to phase-to-ground will provide the protection required.

Minimizing electromagnetic stress between phases involves spacing conductor supports to suppress harmonics, then evaluating the optimal conductor layout in computer-based simulations based on real-time experiments.

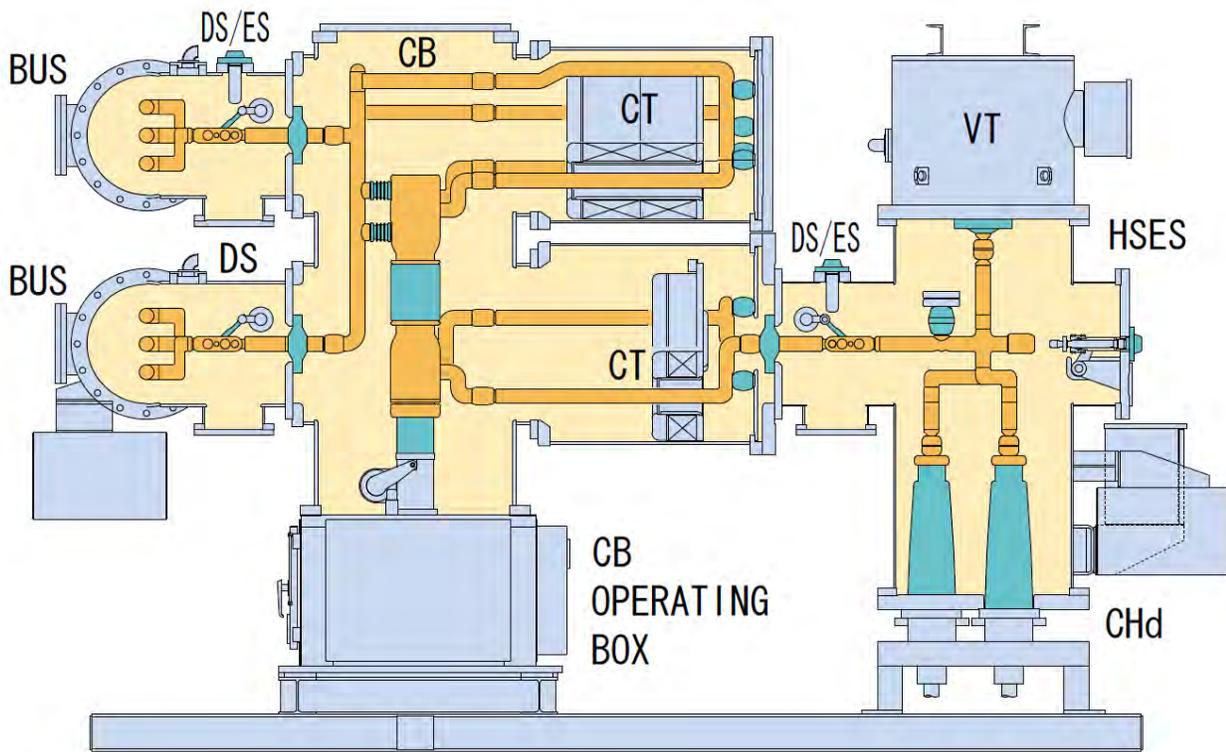
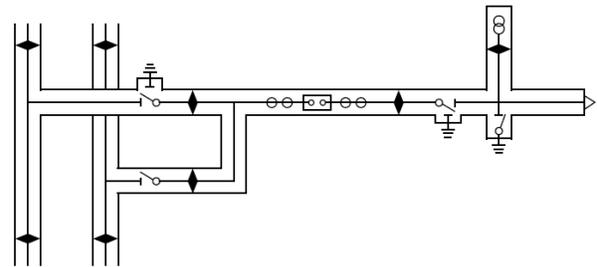
Computer-based analysis plays an indispensable role in resolving these and other design issues. Three-dimensional analysis and a variety of simulation devices ensure reliability throughout the design process.

# Gas Compartment

ONE LINE DIAGRAM



GAS SECTION



CB : CIRCUIT BREAKER  
 DS : DISCONNECTING SWITCH  
 ES : EARTHING SWITCH  
 HSES : HIGH SPEED EARTHING SWITCH

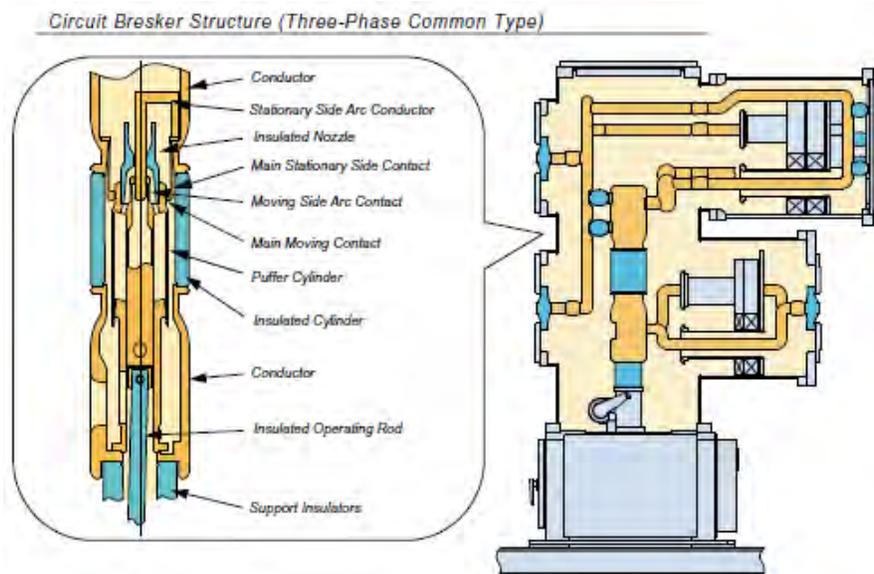
CT : CURRENT TRANSFORMER  
 VT : VOLTAGE TRANSFORMER  
 CHd : CABLE SEALING END  
 BUS : BUS BAR

# Circuit Breakers

Circuit breakers are the key modular component of GIS.

Hitachi circuit breakers feature:

1. The synchronized axial blast pure puffer method which significantly boosts circuit breaking performance.
2. Hand holes to provide ready access to the interrupter contacts for inspection and replacement.
3. Double trip coils to ensure reliable circuit breaking performance.
4. A highly reliable, maintenance free spring operating mechanism.



## Applications

- Cable Connection
- Bushing Connection
- Direct Connection with Power Transformers

## Isolators (Disconnecting Switches)

The isolators are motor operated and feature three-phase gang operation. The basic design supports only no-load switching operation, but capabilities for interrupting capacitive charging current,

transformer magnetization current, and loop current may be added. A mechanical indicator fixed to the operating shaft inside the operating mechanism box provides a visual means of checking isolator position.

## Earthing Switches (Grounding Switches)

Earthing switches are operated by motor spring and feature three-phase gang operation. They may be attached to the GIS at any position. There are two different types of earthing switches, each with its own particular function: the maintenance earthing switch, and the high-speed earthing switch, for insertion into a circuit that has been accidentally energized. Both designs are fully capable of

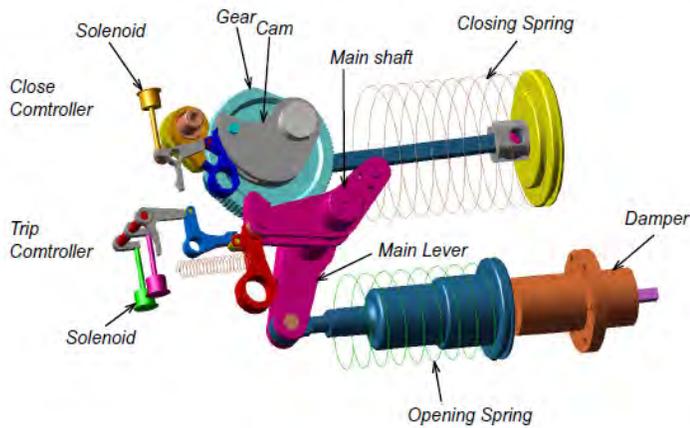
resisting short-circuit faults at their fully engaged positions. The earthing switches can be used as primary injection terminals for checking voltages and currents. It is therefore possible to check the current transformer's ratio and contact resistance without evacuating the SF<sub>6</sub> gas. A mechanical indicator fixed to the operating shaft inside the operating mechanism provides a visual means of checking isolator position.

# Spring Mechanism for Circuit Breaker

## FEATURES

- Simplified driving mechanism and drastically reduced number of parts by adoption of solenoid, resulting in higher reliability and less maintenance.
- Easy manual operation is available for emergency and maintenance purposes.
- Locking device is provided to prevent manual closing operation with breaker closed.
- Very compact and lightweight.

### OPERATING MECHANISM

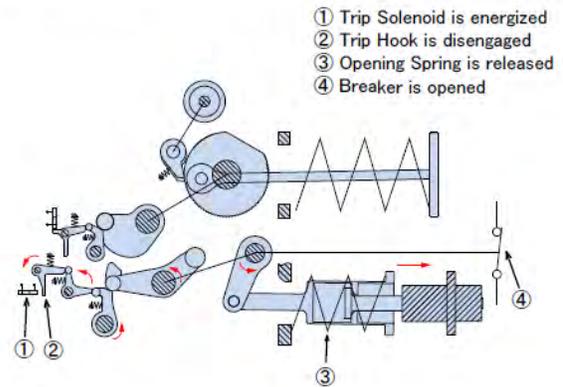


(3D-View)

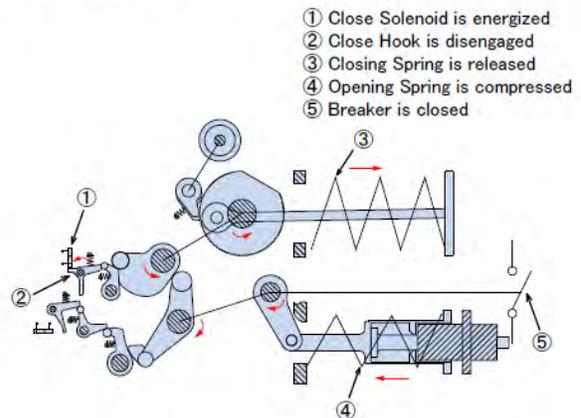


(Side-View)

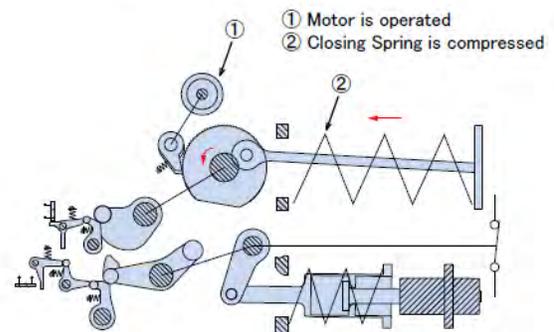
### OPERATING PRINCIPLE



(a) OPENING OPERATION

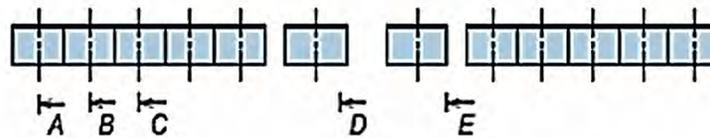
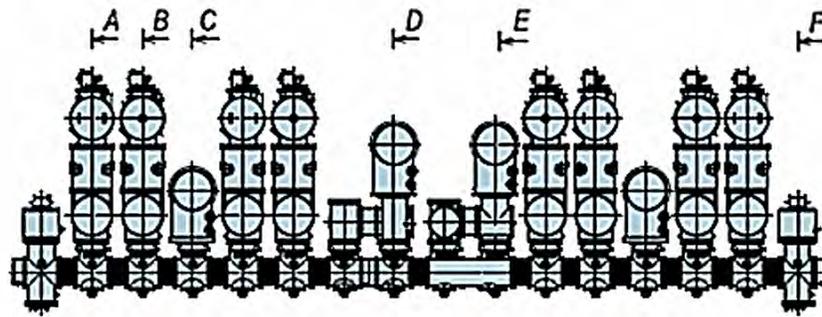
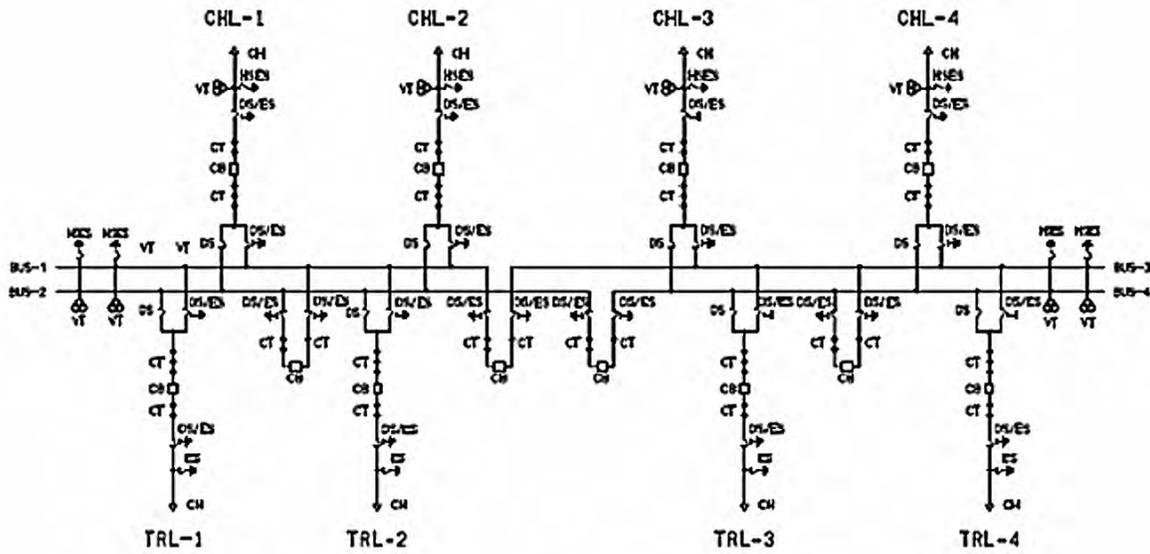


(b) CLOSING OPERATION

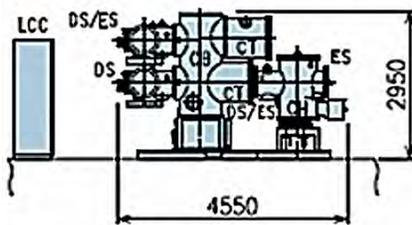


(c) CLOSING SPRING OPERATION

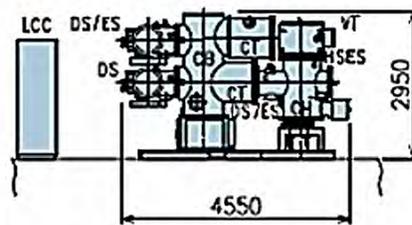
# Sample Layout



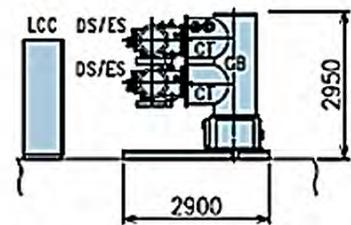
VIEW A-A



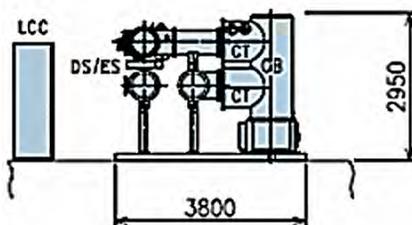
VIEW B-B



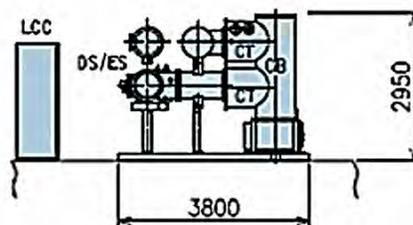
VIEW C-C



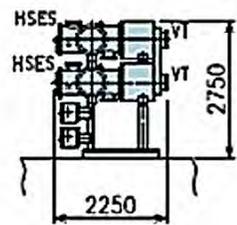
VIEW D-D



VIEW E-E



VIEW F-F



## Rating & Bay Configuration

Equipment	Item	Rating / Specification
		123kV / 145kV
CircuitBreaker (CB)	Type	Gas Circuit Breaker
	Rated Voltage	123kV / 145kV
	Rated Current	1250 / 2000 / 3150A
	Rated Breaking Current	31.5 / 40kA
	Rated Breaking Time	3 Cycles
	Lighting Impulse Withstand Voltage	350kV / 550kV
	Rated Gas Pressure (Gauge)	87.0 psig (0.6MPa)
	CTs	Both Sides of Circuit Breaker
	Method of Operation	Motor – Spring Driven & Manual
DisconnectingSwitch (DS)	Type	3 – Phase Integrated
	Rated Voltage	123kV / 145kV
	Rated Current	1250 / 2000 / 3150A
	Rated Short – Time Current	31.5 / 40kA 3sec
	Method of Operation	Motor – Spring Driven & Manual
Maintenance EarthingSwitch (ES)	Type	3 – Phase Integrated
	Rated Voltage	123kV / 145kV
	Rated Short – Time Current	31.5 / 40kA 3sec
	Method of Operation	Motor & Manual
High – Speed EarthingSwitch (HSES)	Type	3 – Phase Integrated
	Rated Voltage	123kV / 145kV
	Rated Short – Time Current	31.5 / 40kA 3sec
	Method of Operation	Motor – Spring Driven & Manual
Busbar (BUS)	Type	3 – Phase Integrated
	Rated Voltage	123kV / 145kV
	Rated Current	1250 / 2000 / 3150A
	Rated Short – Time Current	31.5 / 40kA 3sec
	Rated Gas Pressure (Gauge)	87.0 psig (0.6MPa)



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