



Circuit Breaker Retrofit

For Gas-Insulated Substations

One of the major challenges of aging Gas-Insulated Substations (GIS) is optimizing the cost of asset ownership as maintenance needs increase and technology becomes obsolete. GIS circuit breakers with hydraulic or pneumatic mechanism are exposed to the highest risk of major failure with 32% of major failures linked to a component within the circuit breaker operating mechanism. Operators need solutions that extend the lifetime of the substation while improving asset reliability.

GE Solution

GE's GIS retrofit solutions are designed to replace aging or obsolete circuit breakers manufactured by GE or a 3rd party with a new GE circuit breaker with pure spring mechanism.

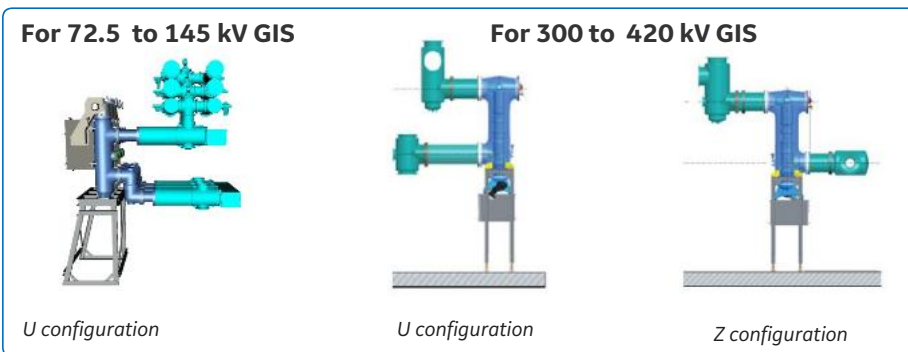
GE's solutions are cost effective and reliable method to modernize and extend the lifetime of the substation by gaining all the advantages of implementing new reliable technology.

The turnkey service solution includes:

- Pre-study to select the correct technical solution for the application
- Adaptation design
- Supply of new components including interface and GE vertical circuit breaker with pure spring mechanism
- Installation, testing and commissioning of the new assets within the substation.

Applications

The GE solution is designed for gas-insulated substations, regardless of the manufacturer or the application and suitable to replace vertical or horizontal GIS circuit breakers. To match the existing configuration and dimensions, phase-distance can be adapted with the interface.



Versatile Solution

- Suitable for all brands of GIS
- Different configurations available to fit with existing architecture
- Compact footprint with vertical arrangement

Reliable Technology

- Up to 42% reduction in unplanned outage risk, due to pure spring operating mechanism
- Up to 22% reduction in outage duration due to “plug and play” solution

Safe and Ecofriendly

- 50% reduction in SF₆ mass
- Reduced risk of leakage by 10 times
- 25% reduction in required material including copper, aluminum and gasket

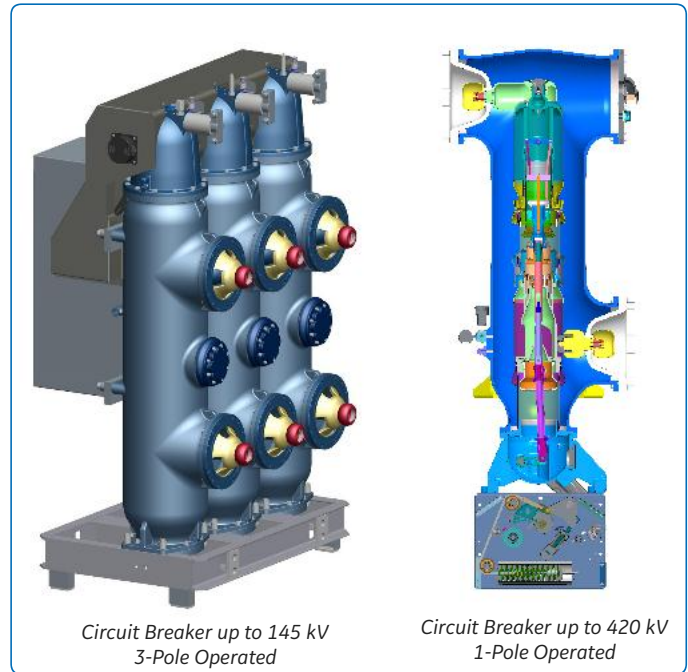
Cost-Effective Solution

- Up to 60% reduction in maintenance costs due to pure spring mechanism compared to pneumatic or hydraulic technology
- Reduced investment cost and outage time compared to a GIS replacement

Technical advantages of The Circuit Breaker with Pure Spring Mechanism

The vertical circuit breakers proposed to retrofit the gas-insulated substation are equipped with the pure spring mechanism used in all GE circuit breakers. This proven technology enables minimized maintenance and improved reliability. Key features include:

- Single-phase enclosure ensures safe operation with all moving parts fully encapsulated
- Gas compartment is up to 50% smaller compared to the previous generation
- Low closing and tripping force is required reducing the need for energy to trigger the switching
- Low static and dynamic forces reduce the mechanical constraints and stress during operation, resulting in increased asset reliability
- Single chamber design lowers the number of moving parts and the energy required
- All models are type tested
- A RPH3 point of wave controller can be added to the solution to synchronize the phases for switching



Main Circuit Breaker Technical Characteristics

Breaker Type	145 kV Vertical	420 kV Vertical
Reference Electro-technical standards	IEC/IEEE	
Rated voltage	145 kV	420 kV
Rated Frequency	50/60 Hz	
Enclosure	Single-Phase	
Short-duration power-frequency, phase-to-earth / across isolation distance	275/315 kV	520/610 kV
Lightning impulse phase-to-earth / across isolation distance	650/750 kVp	1425/1425 (+240) kVp
Rated current	up to 3150 A	up to 5000 A
Rated peak withstand current	100/108 kAp	170 kAp
Rated short-time current (3 s)	40 kA	63 kA
Rated short circuit breaking current	40 kA	63 kA
First-pole-to-clear factor	1.5	1.3-1.5
SF ₆ weight / pole	5.4 kg	50/60 kg
Operating sequence	O – 0.3s – CO – 3 min – CO CO – 15s – CO	
Min. gas operating pressure at 20°C (50Hz)	5.5 bar	5.5 bar
Circuit breaker approx. weight	1500 kg	4230 kg

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Major Failure Risk Data Source: CIGRE 2012-A3.06: Reliability analysis of CB

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Imagination at work