SIEMENS

GAS-INSULATED, ARC-RESISTANT SWITCHGEAR

For critical power applications

That offers reduced maintenance, enhanced operator safety, compact footprint, and is environmentally independent

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Medium-voltage switchgear in substations and secondary distribution systems that serve data centers are often based on designs influenced by the conventional electrical distribution topology. But data centers have unique performance requirements and have needs that differ from those of utilities and less critical industrial applications.

Engineers can chose currently from two solutions when designing their medium-voltage system: air-insulated switchgear and gas-insulated switchgear. And although, many may instinctively lean towards air-insulated solutions, which Siemens offers as an arc-resistant switchgear type to the market, Siemens also provides safe, reliable, gas-insulated switchgear technology that can be used in various application fields where the benefits of gas-insulated switchgear outweigh conventional air-insulated switchgear.

In 1982, Siemens introduced its medium-voltage, gas-insulated, arc-resistant switchgear with vacuum circuit breakers for arc quenching and SF_6 for insulation (refer to TechTopics No. 53 - use of SF6 gas in medium-voltage switchgear).

The fundamental purpose for the development was to offer compact and reliable switchgear with improved operator safety and reduced maintenance.

The combination of gas insulation and vacuum switching provides features, such as personnel safety, enhanced reliability, availability, environment independence, and reduced maintenance, thus representing an optimal solution for critical power requirements when reliability is paramount.

All of the above wrapped in a compact footprint that has on average over a 50% space savings for systems up to 15 kV and over a 75% space savings for systems up to 38 kV compared to traditional air-insulated switchgear.

Gas-insulated switchgear offers the following benefits:

Reduced maintenance -
10-year inspection interval

Reliability and availability -
unique isolated-phase design that eliminates the potential for phase-to-phase faults

Personal safety -
arc-resistant switchgear tested to ANSI / IEEE C37.20-7 standard

Compact design - up to 75% smaller footprint compared to air-insulated technology.

Figure 1: Type 8DA10 medium-voltage, arc-resistant, gas-insulated switchgear

Down-time can cost millions of dollars each day according to industry estimates. Even planned maintenance can curtail data center operations or require costly workarounds.

Comparing the historic causes of failures in typical air-insulated switchgear to gas-insulated switchgear, according to independent IEEE Gold Book, gas-insulated switchgear is more reliable compared to air-insulated switchgear.

Medium-voltage gas-insulated switchgear can also have built-in contingencies to address any weaknesses in the network that is fed by another substation.

For example, to achieve the highest level of reliability, a data center substation must be designed to accept utility power from at least two sources. If one line suffers a power outage, the remaining line is able to continue providing all the power required keeping the data center running; **this requires complicated interlocking and automatic switching, which in addition to the gas-insulated switchgear's built-in interlocking features, is provided by Siemens' protection and control combined with Siemens' gas-insulated switchgear** to help ease of operation.

Further, **an extension of lineup / busbar without interruption of power supply is possible** in an isolated-phase gas-insulated switchgear design, **which helps save money by not having to shutdown the connected load**.

In sum, Siemens' gas-insulated switchgear offers additional benefits for your critical power application that traditional air-insulated switchgear but whichever insulating medium you ultimately choose, Siemens can provide an efficient, reliable, stable, and economical solution.

Medium-voltage, air-insulated switchgear failure cause	Share	Not applicable to medium-voltage, gas-insulated switchgear
Exposure to moisture	30%	Not applicable
Malfunction of protective device	10%	
Exposure to dust or other contaminants	10%	Not applicable
Normal deterioration from age	10%	
Thermocycling	7%	
Mechanical damage from foreign source	7%	Not applicable
Exposure to non-electrical fire	7%	
Others	4%	
Mechanical structure failure	3%	
Shorting by snakes, birds, rodents, etc.	3%	Not applicable
Above normal ambient	3%	
Exposure to chemicals or solvents	3%	Not applicable
Severe weather condition	3%	

Source: IEEE 493 Gold Book, Annex E, table XVIII, page 479

Estimated 50% of failure causes not applicable with MV GIS

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