Read more

RELIABLE POWER GENERATION

Sustainable generator circuit-breaker systems

Improving power plant efficiency and availability

Start

SIEMENS

A comprehensive portfolio: vacuum generator switchgear solutions

Our generator switchgear solutions with vacuum switching technology are the result of more than 30 years of continuous development, fulfilling the highest technological and quality requirements. They offer numerous advantages regardless of the type of power plant.

Our portfolio of high-current generator switchgear systems for applications up to 450 MW (570 MVA) provides optimized customer solutions to the challenges of a constantly evolving market for power generation. Under the high thermal and mechanical stress of generator switching applications, generator switchgear solutions with vacuum switching technology serve as an important operational equipment for the protection of transformers and generators.

The use of maintenance-free vacuum switching technology ensures minimum maintenance costs. Technical expertise gained in many years of experience, ongoing quality controls, and type tests for our switchgear solutions and components also stand for a high level of operational reliability. Our customers profit from highly reduced operational expenditures and tremendously increased SF_6-free asset availability.

Benefits:

- Sustainable vacuum technology, SF_6-free for a better CO_2 footprint
- Maintenance-free – up to 75% OPEX savings
- Flexible arrangement – bolt-on solution to replace legacy GCB
- Efficient – type-tested up to 130 percent asymmetry at 110 kA
- Reliable vacuum interrupter – MTTF exceeding 83,000 years

Generator circuit-breakers (GCB)

No sustainability issues whatsoever

With our completely F-gas free generator circuit-breakers, you can dramatically improve your environmental footprint compared to SF_6. And because our GCBs do not contain F-gases, they do not fall under the scope of F-gas regulations.

Protecting people and the environment

Our passion for technologies drives our efforts to set standards and create added value over the long term – for our customers, for society, and for each individual.

Part of this effort is a transparent environmental documentation regarding the reduction of CO_2 emissions, environmentally friendly materials, and the optimized service lifespan of products, solutions, and systems from Siemens.

Sustainability in practice

We focus on low-emission production, and consistently optimize our resource consumption, including energy, materials, locations, and products. And we strive for greenhouse gas-free operation of our products, as with our generator circuit-breakers, and a built-in circular economy, with defined return schemes and recycling loops.

Reducing energy consumption and CO_2 emissions as well as achieving eco-transparency are challenges that companies are facing today. We practice eco-transparency in our own locations, and use innovative technologies, solutions and products to optimize our environmetal performance.

Our customers thus also benefit from our experience in all aspects of sustainability, from operation and low maintenance to simple end-of-life treatment.

SF_6-free GCB solutions for various applications

We delivered

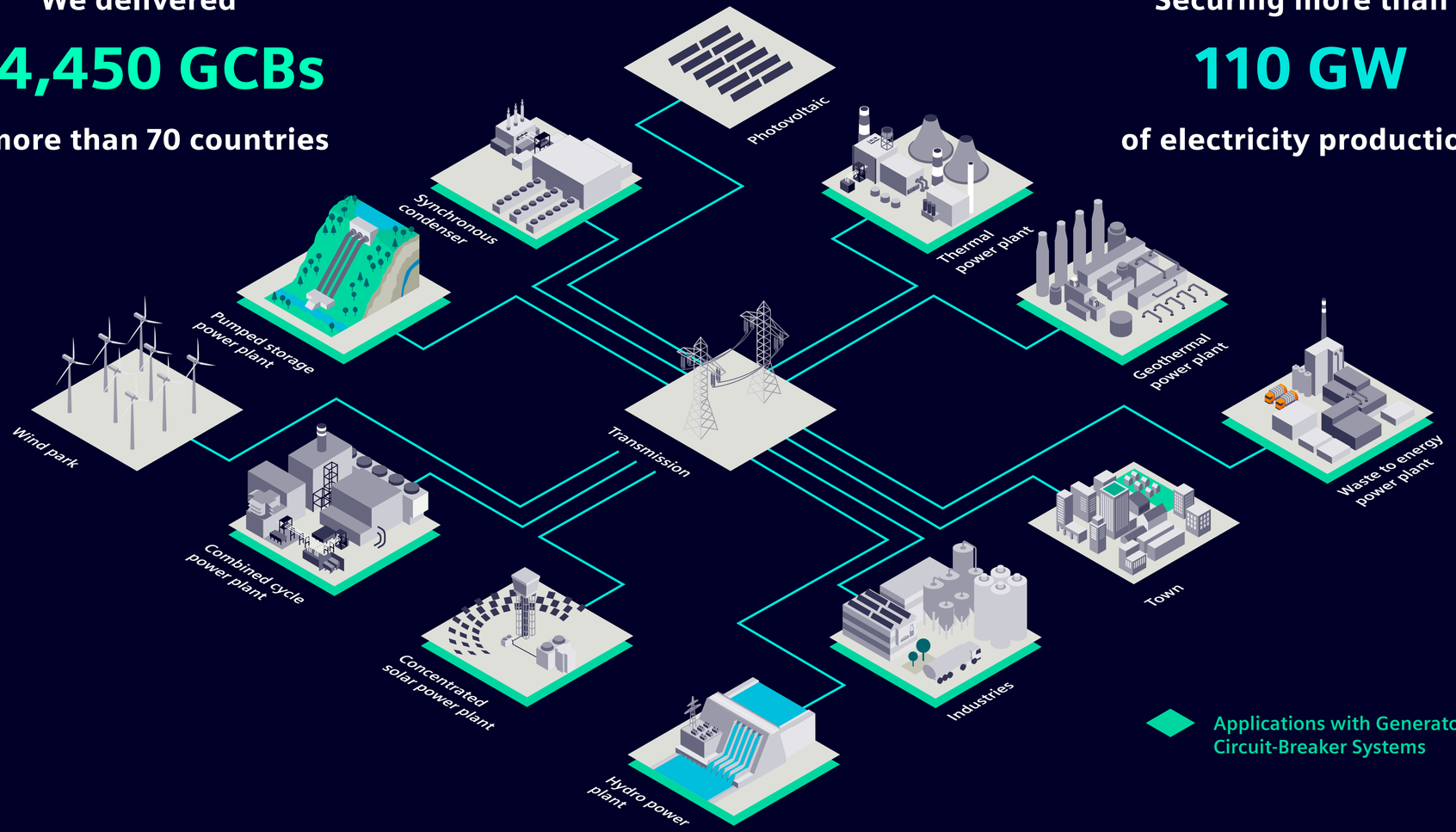
+4,450 GCBs

in more than 70 countries

Securing more than

110 GW

of electricity production



> The level of durability of the vacuum switching technology is something that we attach great importance to.
>
> Ulrich Voigt, Vattenfall

> The legislation around SF_6 is becoming quite tedious and consumes a lot of time.
>
> Jean-Louis Drommi, Hydro Engineering Center, EDF

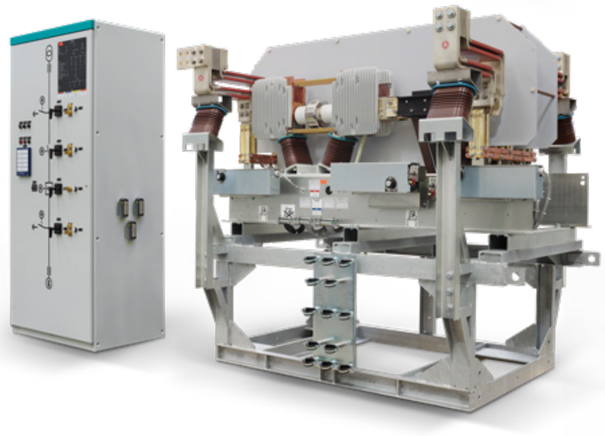
> The electrical life exceeds by far what has been achieved by SF_6 circuit-breakers in the system.
>
> Sebastian Gast, VOITH HYDRO GmbH

Generator circuit-breakers – **the perfect upgrade**

Replacing an aging GCB offers many advantages, starting with an SF_6-free operation and – thanks to vacuum technology – no further maintenance costs, which amount to an OPEX decrease of up to 75 percent. Our plug-and-work designs match legacy GCBs footprints, interfaces, and performances to make finding the perfect replacement for your existing GCB much easier.

This includes unique horizontal and vertical installation capabilities for applications up to 15,000 A, and short-circuit ratings up to 110 kA.

Our compact systems (HB3-C and HB1-C) are the perfect solution to modernize your existing installation regarding space or electrical requirements.



HB1-C – the bolt-on solution

HB3-C – the versatile solution

- Practically no maintenance
- No spare part availability problems
- No unscheduled downtime
- No gas handling or monitoring required
- Smaller environmental footprint

Product overview

	HB3-C	HB3	HB1-C	HB1
Rated continuous current (up to)	**15,000 A**	**13,500 A**	**6,700 A**	**5,500 A**
Short-circuit ratings (up to)	**110 kA**	**110 kA**	**72 kA**	**72 kA**
Rated voltage (up to)	**24 kV**	**24 kV**	**24 kV**	**17.5 kV**
				
	the versatile solution	**the encapsulated solution**	**the bolt-on solution**	**the standardized solution**
Application range[1)]	50 MW – 450 MW (up to 570 MVA)	80 MW – 400 MW (up to 510 MVA)	50 MW – 200 MW (up to 250 MVA)	50 MW – 120 MW (up to 150 MVA)
Rated short-time withstand current/duration	up to 110 kA/3 s	up to 110 kA/3 s	up to 72 kA/3 s	up to 72 kA/3 s
Rated peak withstand current	up to 302 kA	up to 302 kA	up to 197 kA	up to 197 kA
Internal arc classification				up to IAC A FLR 63 kA/0.5 s
Degree of protection		up to IP66		up to IP55/IK10
Loss of service continuity category		LSC 1		LSC 1
Standards according to	IEC, IEEE	IEC, IEEE	IEC, IEEE	IEC, IEEE
Installation	• Indoor	• Indoor • Outdoor	• Indoor	• Indoor • Outdoor
Type of connection	• Cable • Segregated and non-segregated phase busbars • Solid-insulated busbars • Isolated phase busbar	• Cable • Solid-insulated busbars • Isolated phase busbar	• Cable • Segregated and non-segregated phase busbars • Solid-insulated busbars	• Cable • Segregated and non-segregated phase busbars • Solid insulated busbar
Direction of connection	front/rear, top/bottom, lateral	lateral	front/rear, top/bottom, lateral	top
Auxiliary feeder				
Exciter feeder, start-up disconnector		■		
Multiple feeder switchgear				
	Learn more	**Learn more**	**Learn more**	**Learn more**

1) with cos phi 0.8 and voltage derating of 10%

Product overview

	VB1	HIGS	GM-SG	NXAIR
				
	the flexible solution	**the integrated solution**	**the draw-out solution**	**the industrial solution**
Rated continuous current (up to)	**6,700 A**	**5,500 A**	**4,000 A**	**4,000 A**
Short-circuit ratings (up to)	**72 kA**	**72 kA**	**63 kA**	**50 kA**
Rated voltage (up to)	**24 kV**	**17.5 kV**	**15 kV**	**17.5 kV**
Application range[1]	50 MW – 200 MW (up to 250 MVA)	25 MW – 120 MW (up to 150 MVA)	10 MW to 80 MW	10 MW – 80 MW (up to 110 MVA)
Rated short-time withstand current/duration	up to 72 kA/1 s	up to 72 kA/1 s	up to 63 kA/3 s	up to 50 kA/3 s
Rated peak withstand current	up to 180 kA	up to 197 kA	up to 173 kA	up to 125 kA
Internal arc classification	up to IAC A FLR 76 kA/0.5 s	up to IAC A FLR 63 kA/0.3 s	up to ANSI/IEEE C37.20.7 63 kA/0.5 s	IAC A FLR 50 kA/1 s
Degree of protection	up to IP55	up to IP56		IP3XD
Loss of service continuity category	LSC1 (LSC2A on request)	LSC 1		LSC 2B
Standards according to	IEC, IEEE	IEC, IEEE	ANSI, IEEE, NEMA	IEC, IEEE
Installation	• Indoor • Outdoor	• Indoor • Outdoor	• Indoor • Outdoor	• Indoor
Type of connection	• Cable • Segregated and non-segregated phase busbars • Solid-insulated busbar • Isolated phase busbar	• Cable • Segregated and non-segregated phase busbars • Solid-insulated busbar	• Cable • Segregated and non-segregated phase busbars	• Cable • Segregated and non-segregated phase busbars
Direction of connection	front/rear, top/bottom, lateral	top/bottom	front/rear, top/bottom	front/rear, top/bottom
Auxiliary feeder	■	■	■	■
Exciter feeder, start-up disconnector	■	■		
Multiple feeder switchgear	■		■	■
	Learn more ›	**Learn more** ›	**Learn more** ›	**Learn more** ›

1) with cos phi 0.8 and voltage derating of 10%

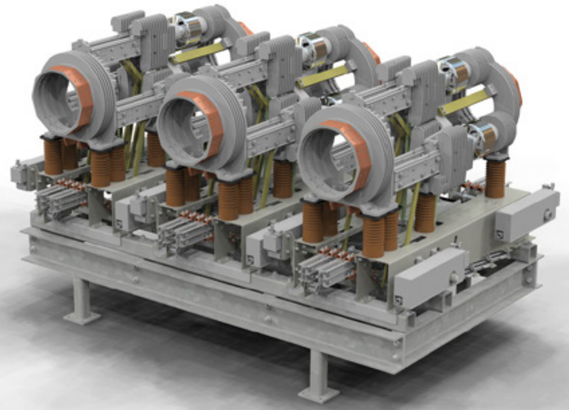
HB3-C:
the versatile solution

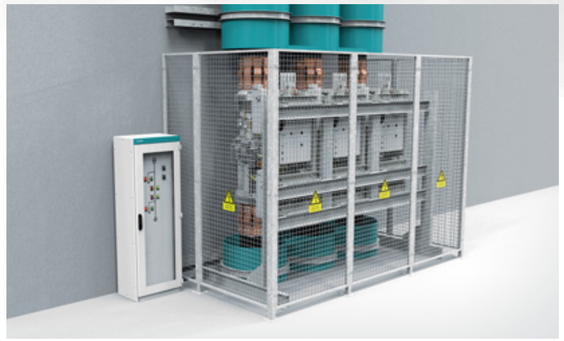
Most versatile, and ideal for retrofit applications

The HB3-Compact is a unique generator circuit-breaker solution for the most challenging constraints, offering one of the highest levels of customization: It can be mounted either vertically or horizontally, its phase-to-phase spacing and phase height axis can be adjusted to match perfectly the existing busbar connection points.

Optionally, the circuit-breaker can be fitted with integrated line disconnector and earthing switch on the generator side and/or on the transformer side.

The switchgear is type-tested in accordance with the IEC 62271-200 and IEC/IEEE 62271-37-013 standards.





HB3-C in vertical configuration

Technical data

Rated voltage U_r	up to 24 kV
Rated continuous current I_r	up to 15,000 A
Rated short-circuit breaking current I_{sc}	up to 110 kA

Features and benefits:

- Suitable for power plants up to 450 MW/570 MVA
- Unique horizontal and vertical installation capabilities
- Common or individual supporting frame design
- Optional integrated line and earth disconnectors
- Saves up to 75% of your OPEX by using vacuum technology
- Spring-operated mechanism for the GCB, with a service life of up to 20,000 CO cycles

Learn more ↗

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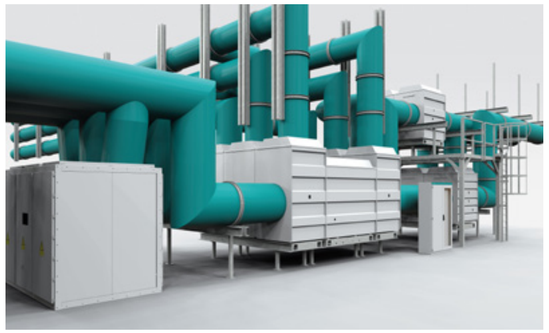
HB3:
the encapsulated solution

The HB3 is the first generator switchgear worldwide with vacuum generator circuit-breakers for ratings up to 13,500 A, with natural cooling, and a switching capacity of 110 kA. Type-tested according to the IEEE C37.013 standard, it offers maximum operational reliability and a high level of personal safety, as short circuits between phases are excluded due to the single-phase encapsulation.

As a result of the flexibility of the phase spacing and diameters of the single-phase encapsulated IPBs, the HB3 fulfills all requirements for integration into the generator leads. The switchgear can be operated with the overpressure needed for the IPB system. Optionally, the switchgear can be equipped with a start-up disconnector for starting the turbine.

HB3 configured for IPB connection



Fully integrated solution for pumped storage application

Learn more ↗

Technical data

Rated voltage U_r	up to 24 kV
Rated continuous current I_r	up to 13,500 A
Rated short-circuit breaking current I_{sc}	up to 110 kA

Features and benefits:

- Suitable for power plants up to 400 MW/510 MVA
- Maintenance-free vacuum interrupter up to 10,000 CO cycles at full nominal current
- Spring-operated mechanism for the GCB, with a service life of up to 20,000 CO cycles
- Equipped with sealed for life-time vacuum interrupter
- Simplified footprint without dynamic forces during switching operations
- Forklift-ready design
- Degree of protection up to IP66
- Factory-assembled switchgear
- Type-tested in accordance with the IEC 62271-200 and IEC/IEEE 62271-37-013 standards

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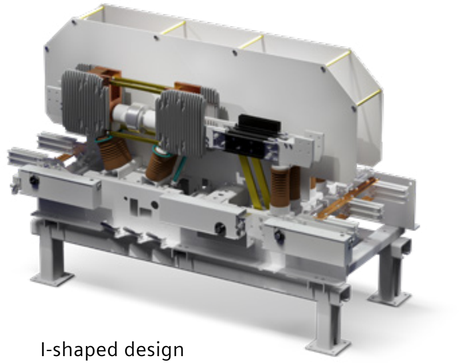
HB1-C:
the bolt-on solution

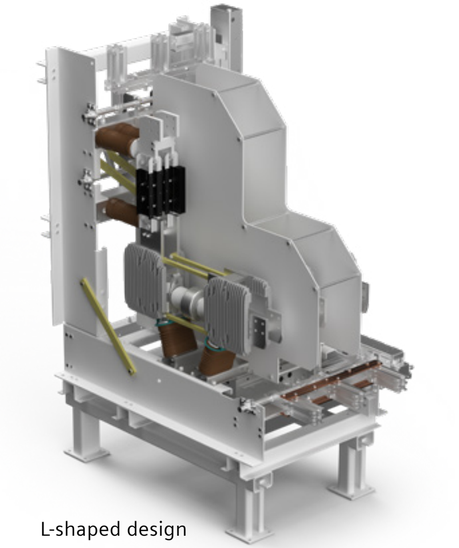
Without enclosure, with integrated main disconnector and earthing switch

The HB1-Compact is the all-around solution for your retrofit applications and new projects. An HB1-C provides a unique generator circuit-breaker module assembly to answer even the most challenging constraints. It offers one of the highest level of customization: The HB1-C can be mounted either vertically or horizontally, its design (I-shape or L-shape) can be adjusted to perfectly match the existing busbar connection points.

Optionally, the generator circuit-breaker and its integrated main disconnector can be fitted with earthing switches on the generator side and/or on the transformer side.



I-shaped design
(can also be mounted vertically)



L-shaped design

Technical data

Rated voltage U_r	up to 24 kV
Rated continuous current I_r	up to 6,700 A
Rated short-circuit breaking current I_{sc}	up to 72 kA

Features and benefits:

- Suitable for power plants up to 200 MW/250 MVA
- Unique horizontal and vertical installation capabilities
- Two standard design (I-shape and L-shape) to simplify its installation
- With highly integrated main disconnector
- Saves up to 75% of your OPEX by using vacuum technology
- Optional earthing switches on either side

Learn more ↗

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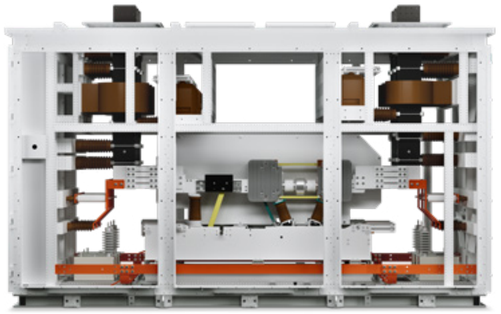
HB1:
the standardized solution

Integrated low-voltage control cubicle

As a compact solution, the HB1 combines all advantages of high end standardization. With its air-insulated, metal-enclosed, and non-phase segregated design, this generator switchgear integrates the latest standardized vacuum generator circuit-breaker (tested as per IEC/IEEE 62271-37-013:2021 and IEC 62271-200:2021) with integrated main disconnector and earthing switch, providing maximum flexibility in connection and accessibility for increased personal safety.

All components and functions are type-tested and routine tested together. It allows the HB1 to deliver a native interlocking system with a high reliability level. The installed HB1-C module can be removed via an external metal frame.



HB1 configured for non-segregated busbar connection

HB1 configured for indoor and outdoor installation

Technical data

Rated voltage U_r	up to 17.5 kV
Rated continuous current I_r	up to 5,500 A
Rated short-circuit breaking current I_{sc}	up to 72 kA

Features and benefits:

- Suitable for power plants up to 120 MW/150 MVA
- For indoor and outdoor installation
- Standard connection from top with cable, SIB, SPB or NSPB
- Compact design
- High personal and operational safety due to internal arc classification

Learn more

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VB1:
the flexible solution

The ideal solution for new and retrofit projects up to 200 MW/250 MVA

The VB1 switchgear features a highly compact and customizable design with space for modular extension. It is especially adapted for power plants operating with multiple generators, or with feeders for auxiliary supply/excitation, or with brake disconnectors. Because of the high requirements in terms of switching capacity, space constraints, and accessibility, this switchgear is frequently used in hydro power plants and retrofit projects.

As a containerized solution, the VB1 switchgear meets the highest requirements even under extreme climatic conditions, e.g. when exposed to corrosive effects like those encountered in the chemical industry. Multiple generator circuit-breakers can be employed in a single switchgear.

VB1 for multiple feeder configuration

VB1 with comprehensive protection of auxiliaries

Learn more ↗

Technical data

Rated voltage U_r	up to 24 kV
Rated continuous current I_r	up to 6,700 A
Rated short-circuit breaking current I_{sc}	up to 72 kA

Features and benefits:

- Highly flexible, expandable modular concept
- Highly compact and customizable design
- Suitable for indoor and outdoor installation
- Suitable for multiple generators and auxiliary feeders
- Operating availability up to LSC 2A
- High personal and operating safety
- Maintenance-free
- Internal arc classification up to IAC A FLR 76 kA / 0.5 s

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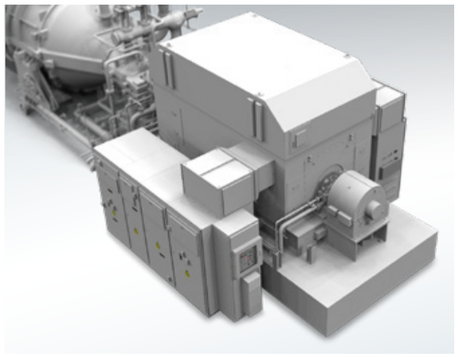
HIGS:
the integrated solution

Interface-saving design
up to 120 MW/150 MVA

The HIGS (highly integrated generator switchgear) is adapted to the requirements of any type of gas and steam turbines.
The switchgear is connected directly to the generator, thus combining the conventional generator terminal box with the functionality of a generator switchgear. It is also possible to implement the neutral connection and an auxiliary feeder.

Typical HIGS configuration with protection of auxiliaries



Example of installation with additional neutral box

Learn more ↗

Technical data

Rated voltage U_r	up to 17.5 kV
Rated continuous current I_r	up to 5,500 A
Rated short-circuit breaking current I_{sc}	up to 72 kA

Features and benefits:

- Suitable for power plants up to 120 MW/150 MVA
- Integrated generator terminal box and neutral box with grounding treatment
- Reduction of interfaces and space requirements
- For indoor and outdoor installation
- Factory-tested for easy installation and quick commissioning after delivery
- Most compact solution at its performance level
- IAC certified

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GM-SG:
the draw-out solution

The GM-SG GCB metal-clad switchgear solution is precision built equipment designed to function efficiently under normal operating conditions. It is designed and manufactured to operate within the parameters established in ANSI/IEEE C37 standards for metal-clad switchgear. Performance requirements of these standards have been met or exceeded by these designs. Specific standards which apply include ANSI/IEEE C37.20.2.

GM-SG GCB – the draw-out solution

Learn more ↗

Technical data

Rated voltage U_r	up to 15 kV
Rated continuous current I_r	up to 4,000 A
Rated short-circuit breaking current I_{sc}	up to 63 kA

Features and benefits:

- Up to 50 full-fault interruptions
- Uses the latest developments in vacuum interrupter technology
- Generator circuit breakers tested to IEEE C37.013/C37.013a
- UL or C-UL Listing available
- SIERS integrated electrical-racking system available (optional)

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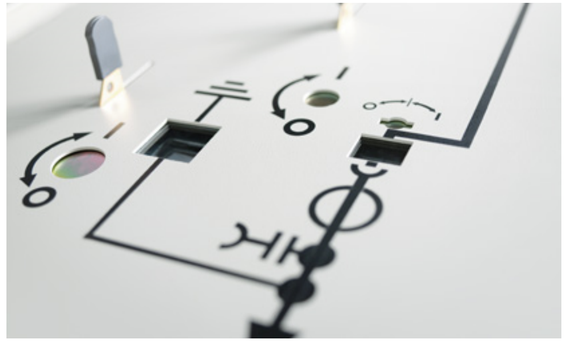
NXAIR:
the industrial solution

Ideal for industrial generator applications up to 80 MW/110 MVA

The NXAIR can also be equipped with generator circuit-breakers tested in accordance with the IEEE C37.013 and IEC/IEEE 62271-37-013 standards. This enables the generator and auxiliary supply application to be combined in a joint switchgear, which reduces space requirements as well as interfaces, and increases profitability.

NXAIR in 8-panel configuration for generator circuit application



Control board of NXAIR

Learn more ↗

Technical data

Rated voltage U_r	up to 17.5 kV
Rated continuous current I_r	up to 4,000 A
Rated short-circuit breaking current I_{sc}	up to 50 kA

Features and benefits:

- Modular and extendable up to 17.5 kV
- Breaking capacity of up to 50 kA
- Suitable for industrial power plants up to 80 MW/110 MVA
- Withdrawable technology
- Maximum personal safety through the internal arc classification IAC A FLR 50 kA, 1 s
- Maximum availability through the loss of service continuity category LSC 2B, and maximum reliability through partition class PM
- Increased profitability through fewer interfaces and less space requirements

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Smart Infrastructure combines the real and digital worlds across energy systems, buildings and industries, enhancing the way people live and work and significantly improving efficiency and sustainability.

We work together with customers and partners to create an ecosystem that both intuitively responds to the needs of people and helps customers achieve their business goals.

It helps our customers to thrive, communities to progress, and supports sustainable development to protect our planet for the next generation.

Creating environments that care.

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Published by
Siemens AG
Smart Infrastructure

Distribution Systems
Mozartstrasse 31c
91052 Erlangen
Germany

For the U.S. published by

Siemens Industry Inc.
3617 Parkway Lane
Peachtree Corners, GA 30092
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Article No. SIEA-B10041-04-7600

TH S24-240354