

GSC Series STATCOM/SVG Product Guide

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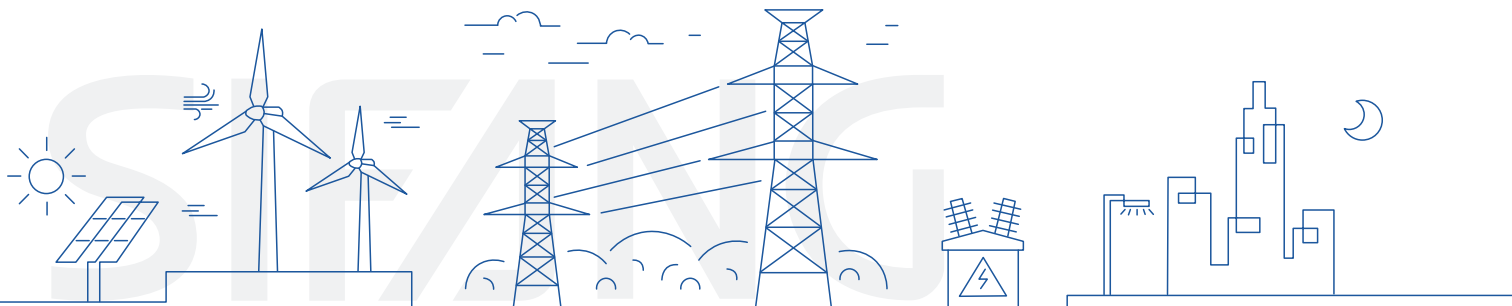
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Overview



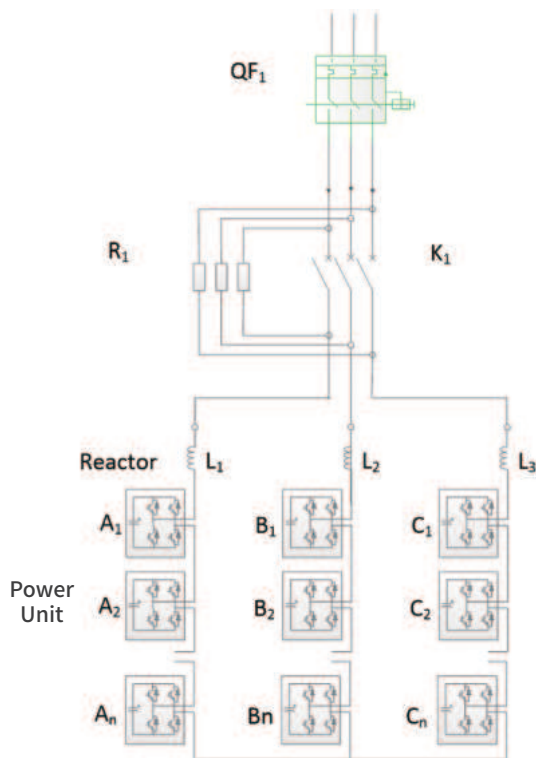
The GSC series SVG/STATCOM from Sifang adopt advanced and mature cascaded converter structures in the field of power electronics. Combined with a powerful control system, these devices not only provide conventional dynamic reactive power compensation but also offer advanced functionalities such as active harmonic filtering, improvement of three-phase imbalance, flicker suppression, and sub synchronous oscillation suppression. They comprehensively address power quality issues across various application scenarios, including renewable energy power plants, electric arc furnaces, rolling mills, petrochemical plants, rail transportation, data centers, and power transmission and distribution.

Main functions include

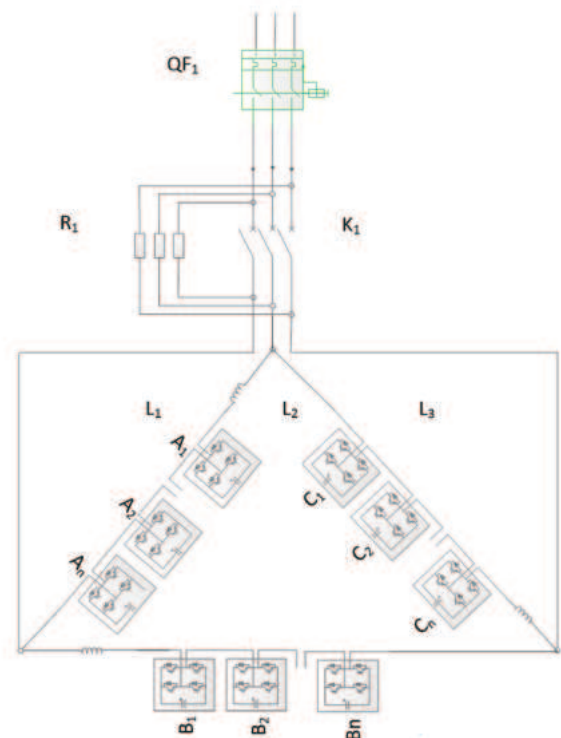
- Rapid, continuous, and dynamic output of inductive and capacitive reactive power
- Maintain the stability of line and load voltage, suppress voltage fluctuations and flicker
- Compensate system reactive power, improve power factor, and reduce line losses
- Eliminate negative-sequence current and suppress three-phase imbalance
- Dynamic harmonic compensation to improve power quality
- Hybrid control (SVG+FC)

Working Principle

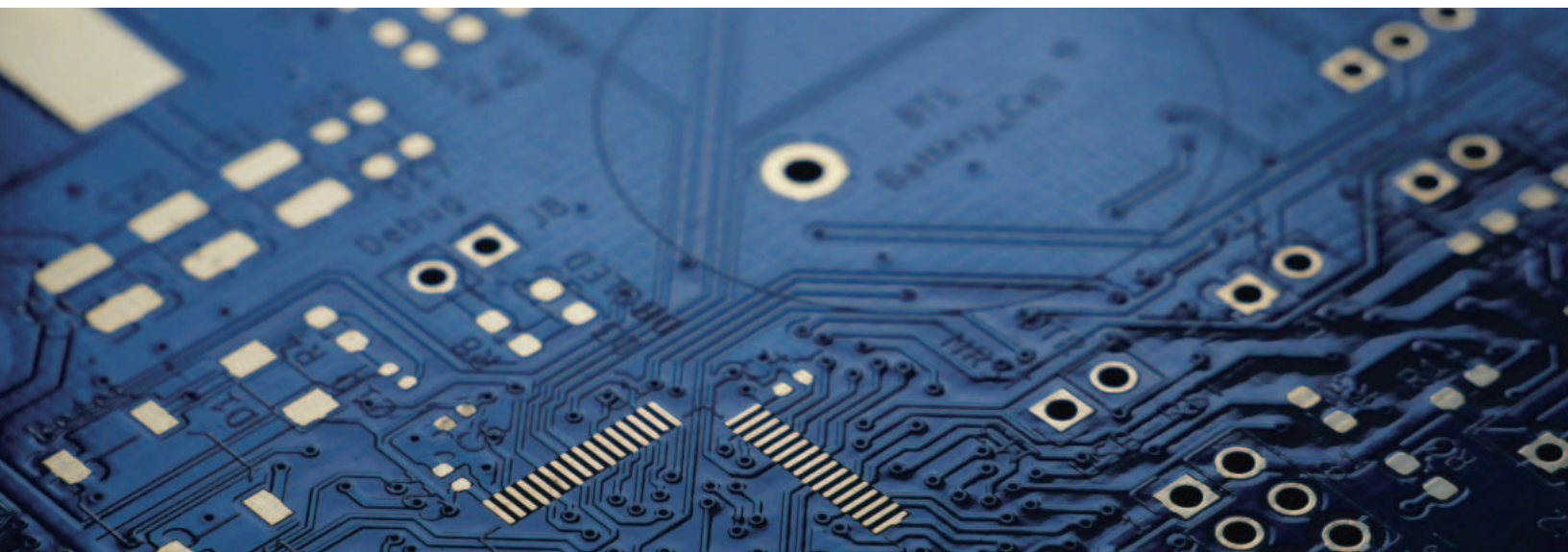
GSC is composed of several converter bridges in series by using the power electronic device IGBT as the switching elements. The main circuit topology includes star connection and delta connection. The star topology is suitable for conventional reactive power compensation and harmonic filtering, and the delta topology is suitable for comprehensive compensation of reactive power, harmonic, negative sequence and flicker.



Star connection

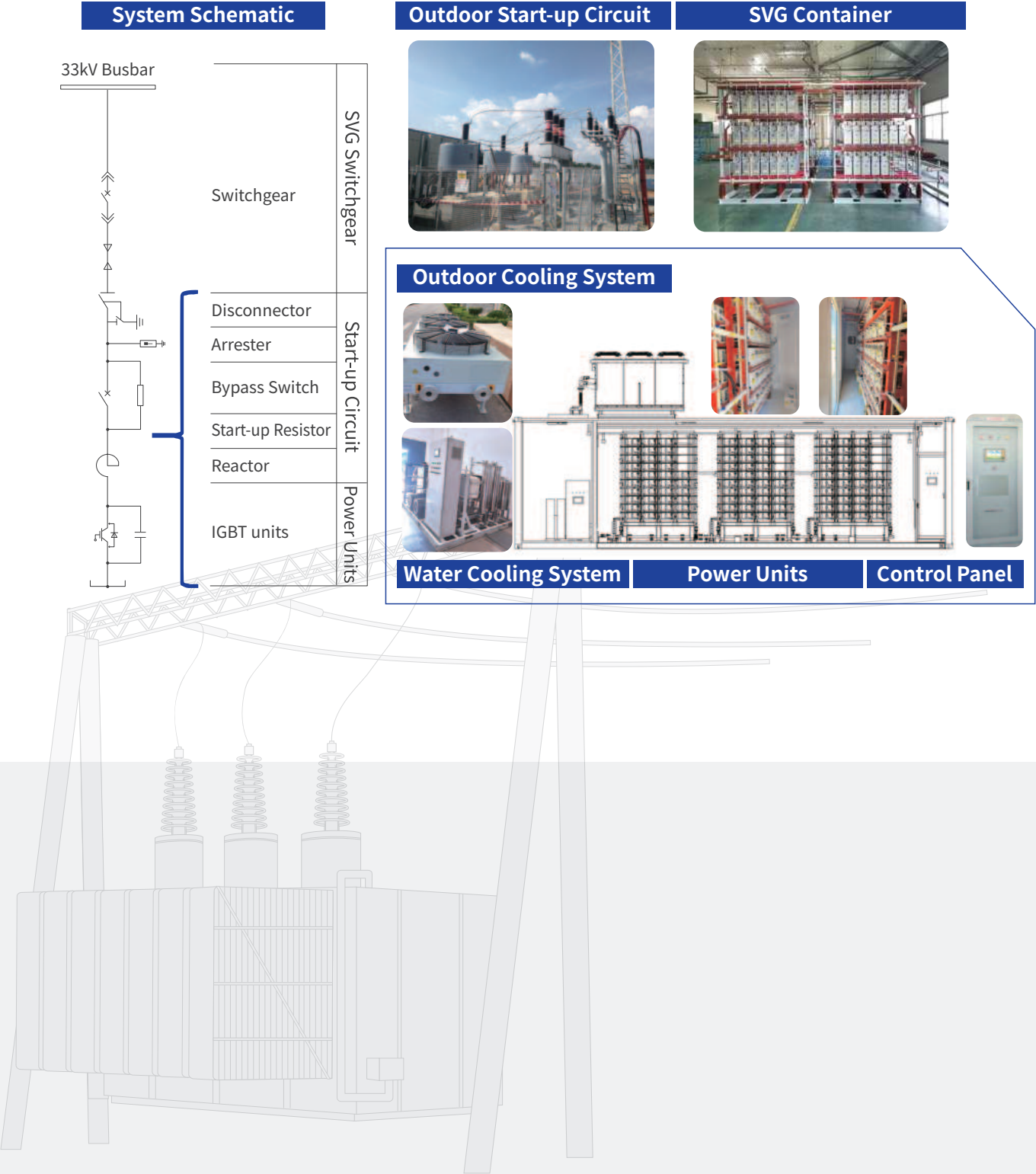


Delta connection



GSC is connected to the grid in parallel through reactor or transformer, which can be equivalent to a voltage source. By adjusting the amplitude and phase of GSC output voltage, differential voltage is generated at both ends of the reactor, thus capacitive or inductive reactive power is generated.

The main components of the GSC series SVG include a control cabinet, power cabinet, startup circuit, and cooling system. The connection reactor and step-down transformer are configured based on the site conditions.



Features

System

- Fast response time, as quick as 5ms;
- Equipped with control and protection features such as power unit bypass and voltage ride-through, ensuring long-term stable operation of the device;
- Low harmonic current, with the ability to filter typical harmonics below the 25th order, enabling sub synchronous oscillation suppression;
- Real-time communication network, supporting master-slave coordinated control;
- User-friendly monitoring system with simple operation, making it convenient for users to operate and maintain;
- Small footprint, easy installation, and minimal on-site construction work.



Power units

Modular Design: Drawer-type modular structure, integrated cabinet design, significantly reducing footprint, facilitating maintenance, and enabling fast and simple on-site installation.

High Reliability: Self-excited power supply system, with full isolation for both high and low voltage, ensuring safety and reliability.

High Safety: Partitioned explosion-proof design to prevent fault propagation, ensuring high safety performance.

High Protection: Designed for high-altitude (up to 5000m), high-temperature, high-humidity, high-salt mist, and high-acidity gas environments.



Controller

SIFANG SVG is provided with mature, reliable and highly integrated controller. The safety and stability of the controller platform have been fully verified in hundreds of thousands of high-voltage protection relays. It has the features below:

High Reliability and Compact Design: Based on the high-voltage protection hardware platform, with an integrated design that offers strong electromagnetic interference resistance and convenient on-site maintenance.

Fast Response: Utilizes high-speed, large-capacity FPGA, resulting in short control cycles and minimal control delays, with dynamic response ≤ 1 ms. This significantly reduces the risk of coupling oscillations between the SVG and the system, enhancing overall system stability.

Powerful Recording Capability: Supports 1000 fault recordings and 240GB of steady-state recordings, with comprehensive real-time recording and fault analysis functions for quick fault location.

Rich Interfaces: Supports multiple communication methods, including FT3, 61850, and Modbus, to meet the communication needs of simulation systems, Gateway, SCADA, and AVC.



HMI

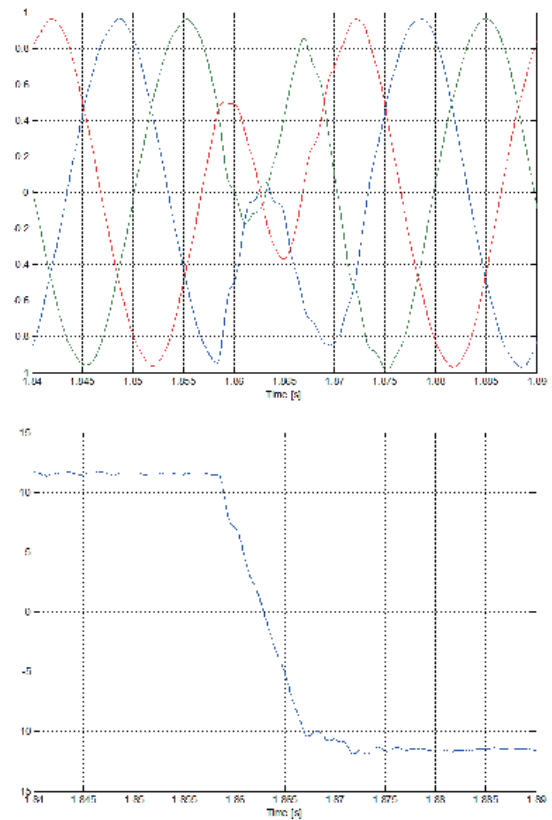
SIFANG SVG is provided with simple and friendly user interfaces (HMI):

- HMI based on SIFANG SAS platform, which have been used in tens of thousands of substations, with rich communication interface and high reliability.
- Have perfect fault analysis method and real-time recording function.



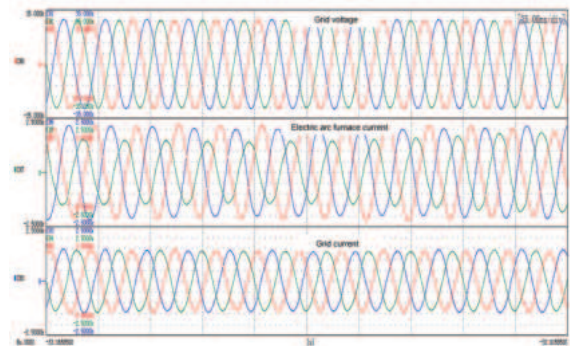
Fast Response Time

- Select high performance DSP and large capacity FPGA
- Based on protection relay platform with high-speed data bus and parallel processing technology
- The shortest control cycle can be 20us
- Response time from zero to rated output can be less than 5ms.



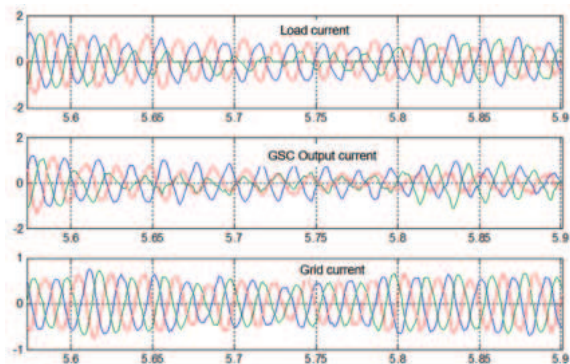
Negative Current Compensation

Delta connection topology can perfectly compensate negative sequence current.



Harmonic Compensation

- The 13th and below harmonics and inter-harmonics are completely filtered out.
- Can effectively improve harmonics below the 25th.
- Can suppress line sub-synchronous oscillations with additional damping control.



Typical Application

Application 1

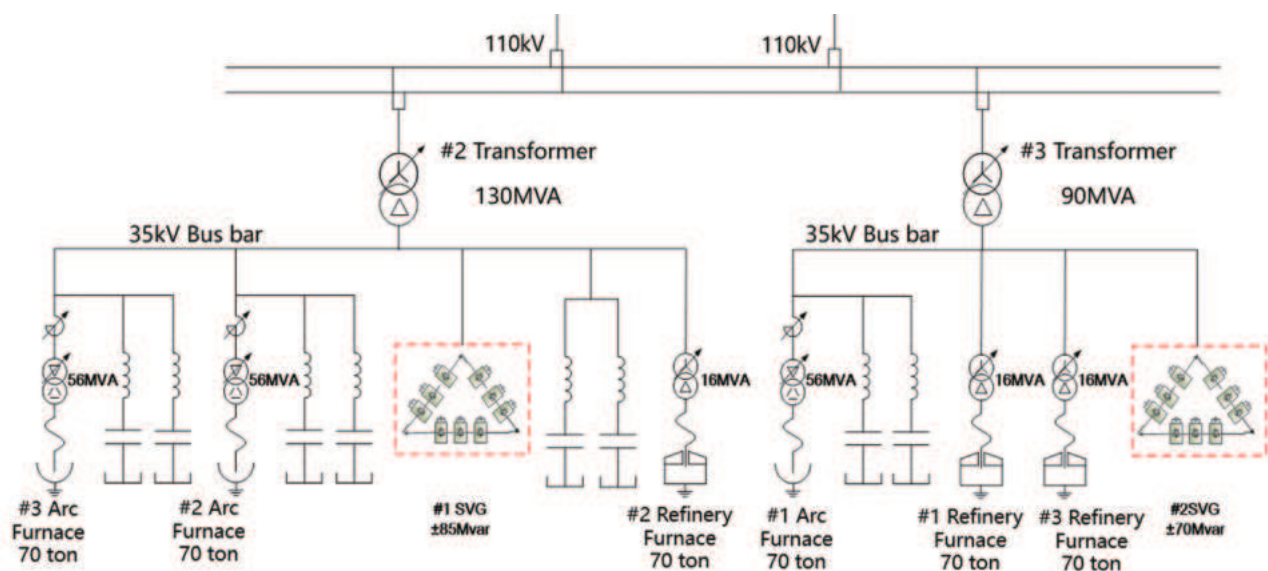
Zheng Feng Iron and Steel 110kV Substation Reactive Power Compensation

SVG Capacity: 85Mvar SVG+50Mvar FC, 70Mvar SVG+50Mvar FC

Project Features:

- Steel plant arc furnace (the most difficult power quality compensation scenario).
- 35kV bus bar power factor is low with severe voltage fluctuation.
- The three-phase voltage unbalance is obvious, and the harmonics exceed the standard.

Solution: Adopt SVG+FC dynamic and static compensation solution to reduce project investment cost and comprehensively improve power quality to meet national standard requirements.



1#SVG

Type	Parameter	Performance				
		SVG Stability	Compensation effect	Voltage fluctuation	Flicker	Harmonicfilter
GSC-35/85-DW	85Mvar Water cooling Delta connection	SVG Voltage stable	Power factor meet the requirement	More than 80%	More than 60%	Can be use

2#SVG

Type	Parameter	Performance				
		SVG Stability	Compensation effect	Voltage fluctuation	Flicker	Harmonicfilter
GSC-35/70-DW	70Mvar Water cooling Delta connection	SVG Voltage stable	Power factor meet the requirement	More than 80%	More than 60%	Can be use

Application 2

Putian Offshore Wind Project

SVG Capacity: $\pm 62\text{Mvar}$ ($2 \times 31\text{Mvar}$), $\pm 50\text{Mvar}$

Project Features:

- High salt corrosion
- Large voltage fluctuations in the submarine cable transmission

Solution: Use indoor type equipment (only water-air heat dissipation equipment outdoor). The indoor and outdoor cooling system is made of 316 stainless steel with C5 anti-corrosion grade.

Application Effect: Solve all power quality problems of offshore wind power transmission lines with advanced anti-corrosion measurement.



Application 3

Ethiopia Railway 20kV Substation

SVG Capacity: $\pm 3\text{Mvar}$ (3 sets), $\pm 4\text{Mvar}$ (4 sets)

Project Features: 20kV bus bar of the traction substation has high harmonic current, and the negative sequence current exceeds the standard

Solution: The single phase SVG harmonic compensation function to solve the problem of harmonic and negative sequence current.

Application Effect: The harmonic current is reduced, and the problem of negative sequence current exceeding the standard is improved.



Application 4

350MW WIND Project at BEED, Maharashtra, India

SVG Capacity: 2x30Mvar

Project Features: High temperature, exceeding 50°C in summer, long-term maritime transport.

Solution: Cooling is achieved through redundant designs such as water machines and air conditioning, along with anti-corrosion packaging.

Application Effect: Meets high-temperature and maritime application requirements, resolving voltage fluctuations on the 33kV bus and other power quality issues, successfully passing operational acceptance through the Indian power grid.



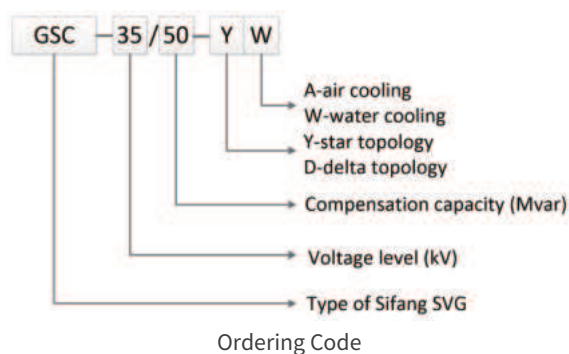
Application 5

400MW Solar Project Jaisalmer, Rajasthan, India

SVG Capacity: 2x45MVAR

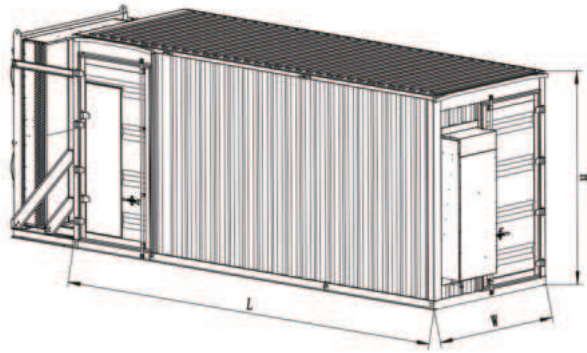


Technical Data



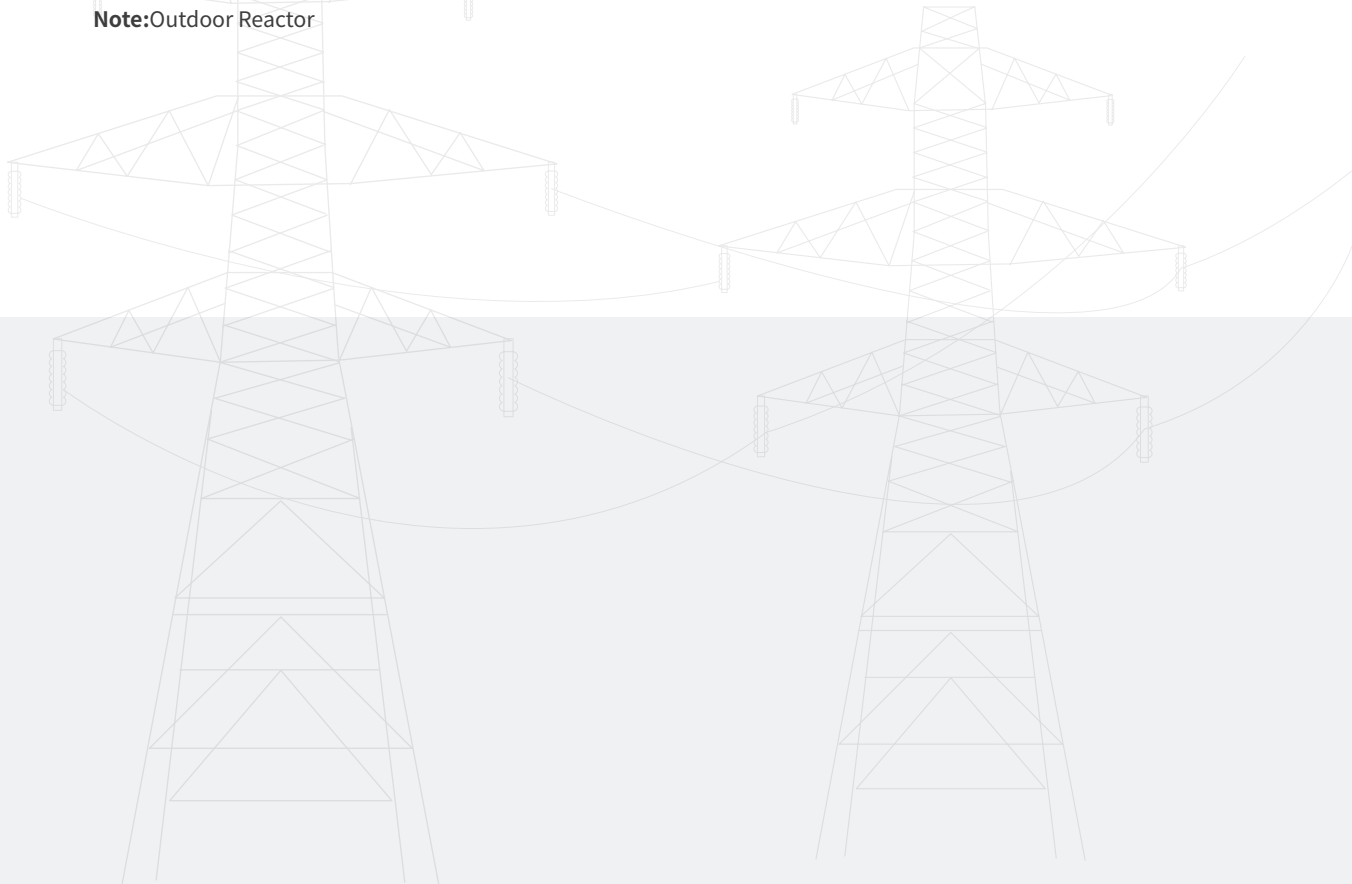
Electrical parameters	
Rated Voltage	3.3kV/6kV/11kV/33kV/66kV
Maximum Voltage	<120% ,Customized
Overload Capacity	110% long-term operation, 120% 1 minutes
Frequency	50/60Hz
Efficiency	>0.99
Capacity	≤300Mvar
Compensation Effect	
Control Function	Reactive power control, power factor control, voltage control, comprehensive control
Power Factor	>0.95 (Within the compensation capacity)
Response Time	<5ms
Protection Function	Over current protection, over voltage protection, IGBT driving circuit fault protection, PWM pulse abnormal alarm, power unit protection (DC overvoltage, over temperature, communication fault)
Reliability and availability	Design life:25 years MTBF>75000h, MTTR<5min
Harmonic	Meet the standard IEC61000-3-6
Advanced function	Meet the power quality harmonic standard of public power grid GB/T 14549-93 Negative sequence current compensation, voltage unbalance suppression, flicker control, harmonic compensation
Others	
Structure	Modular design, integral transportation
Cooling method	Air cooling/water cooling
Protection class	IP54/55 (Special requirement need customization)
Protocol	IEC61850, Modbus
Communication interface	Ethernet, RS485
Environmental parameters	
Field of use	Indoor, no explosive or corrosive gas
Operating temperature	-10~+40 °C
Storage temperature	-55~+70 °C
Humidity	20%~90%, Non condensing
Altitude	<1000, If it exceeds 1000m, the external insulation distance shall be increased by 1% and the rated output current capacity shall be reduced by 1% for every 100m increase

33kV SVG

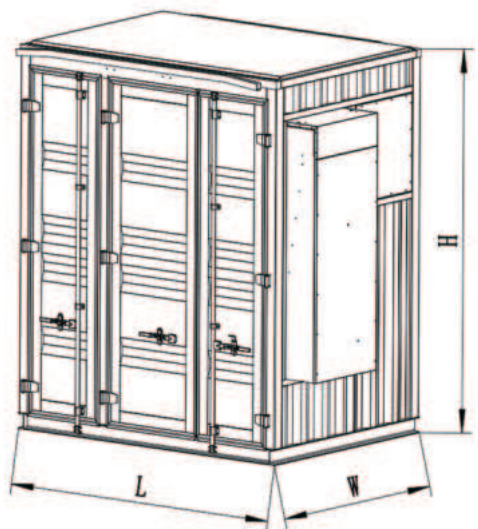


Capacity	Outdoor Circuit Dimentions	Body Dimentions	Outdoor Heat Exchanger Dimensions	Maximum single unit weight
(Mvar)	L×W×H (m×m×m)	L×W×H (m×m×m)	L×W (m×m)	(t)
2~20	8.5×8.5×4.1	6x2.44x2.95	2.44×1.45	8
21~30	8.5×8.5×4.1	7x2.44x2.95	2.44×1.45	9
31~35	8.5×8.5×4.1	7.8x2.44x2.95	4.3×1.2	10
36~50	8.5×8.5×4.1	8.4x2.44x2.95	5.3×1.2	11
51~60	9×9×4.1	9x2.44x2.95	8.1×1.2	12

Note:Outdoor Reactor



11kV SVG

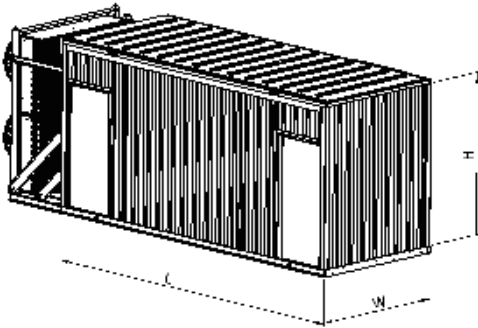


Capacity	Body Dimentions	Maximum single unit weight
(Mvar)	L×W×H(m×m×m)	(t)
1~2	2.9×1.9×2.92	4
3~4	3.1×2×2.95	5

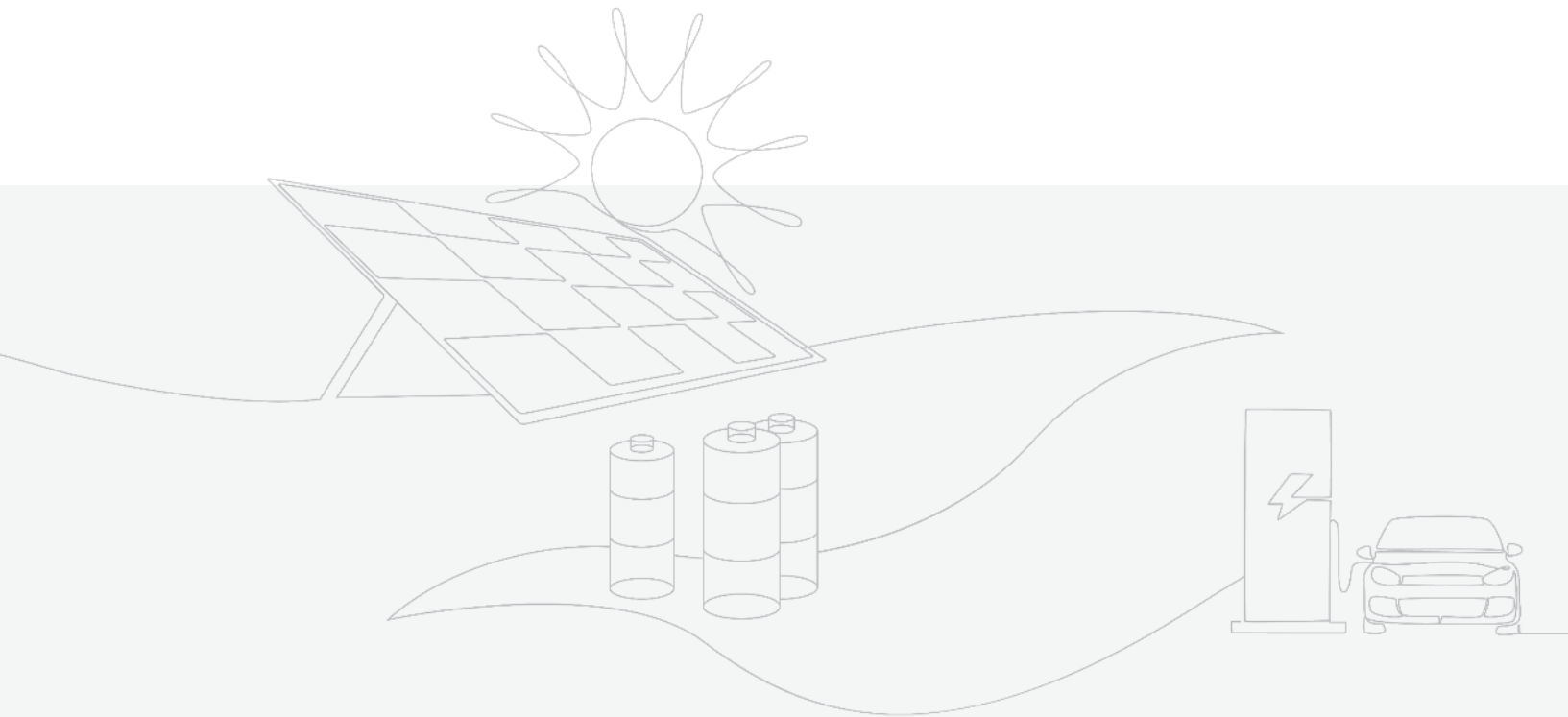
Note:Container with reactor and AC



11kV SVG



Typical Capacity	Body Size	Outdoor Radiator Size	outdoor circuit dimensions	Maximum Single Unit Weight
(Mvar)	L×W×H (m×m×m)	L×W (m×m)	L×W (m×m)	(ton)
4~6	5.5×2.44×2.9	1.5×1.2	\	8
6~12	4×2.44×2.9	1.5×1.2	7×4	6
12~16	4.3×2.44×2.9	2.4×1.2	7×4	6.5
16~20	6×2.44×2.9	1.2×2.44	7×4	7.5



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