

SVG Statcom Line products

SVG-Static Var Generator / Statcom – Static Synchronous Compensator



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Renewable Energy & Drives aim to deliver products to support industries’ energy requirements and provide solutions to overcome the current challenges they face.

With our range of products we deliver the capability of efficient energy use and distribution for manufacturing processes, energy providers and networks, all in an economically and environmentally friendly package.

We are specialists in developing products to support the renewable energy industries’ requirements and provide solutions to satisfy current challenges, a key focus of Renewable Energy & Drives. We aim to continue to develop our current innovative product range in line with our customers’ future requirements.



Leading provider of technology

- ✓ World-leading power unit manufacturing line
- ✓ Exclusive >100Mvar Statcom national R&D manufacturing facility
- ✓ Complete HV high-power full load test centre for Statcoms
- ✓ Standardised and modularised structure design
- ✓ Modularised and open software protocol

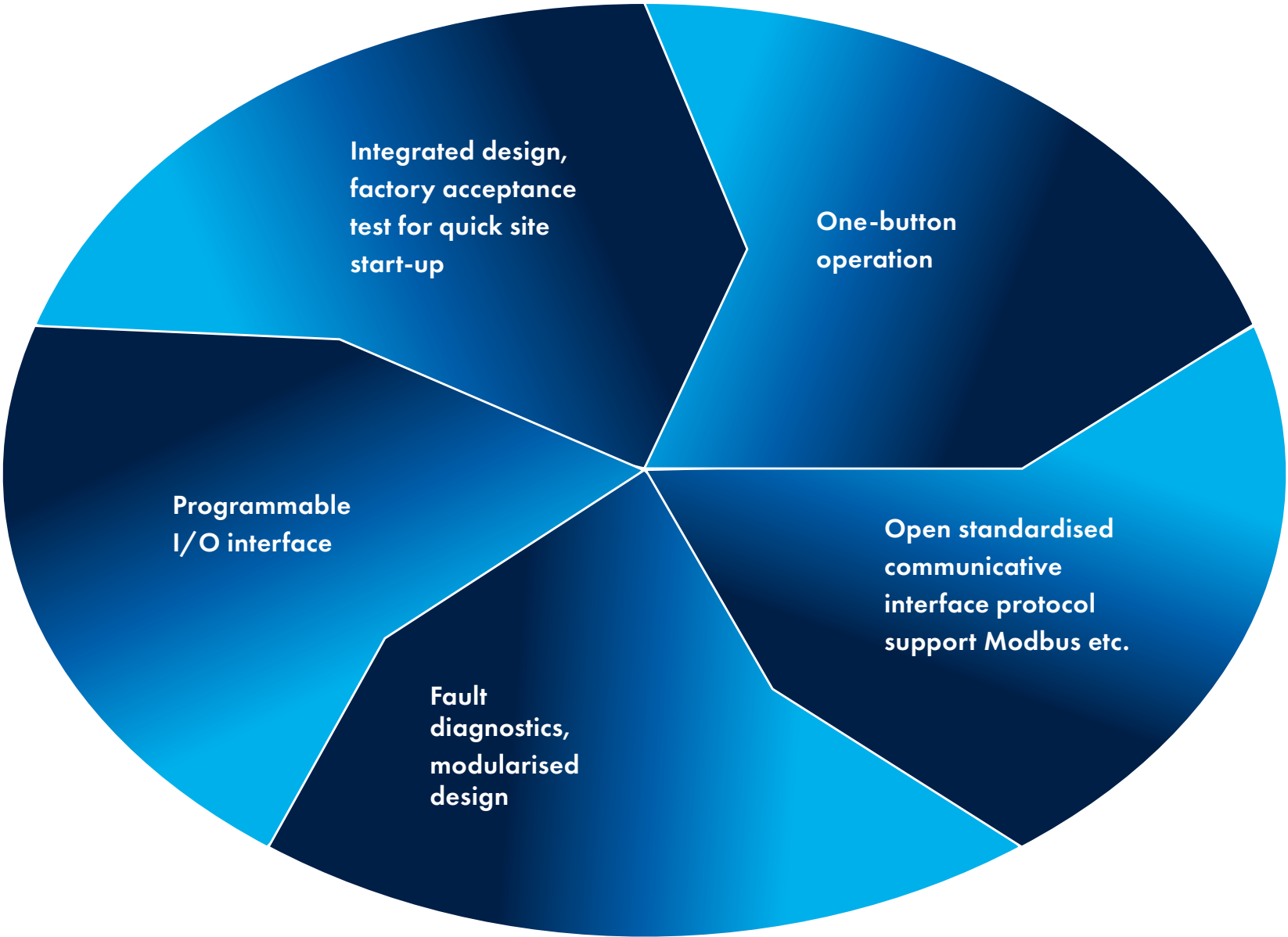
Complete Quality Assurance System

- ✓ 100% component Quality Inspection System
- ✓ International advanced technology of automatic soldering and detection
- ✓ Advanced paint-spray and high / low temperature aging techniques
- ✓ Rigorous anti-interference test & HV withstand test
- ✓ 100% Power unit full load test and high temperature aging test
- ✓ 100% complete set equipment, full load test up to 200Mvar



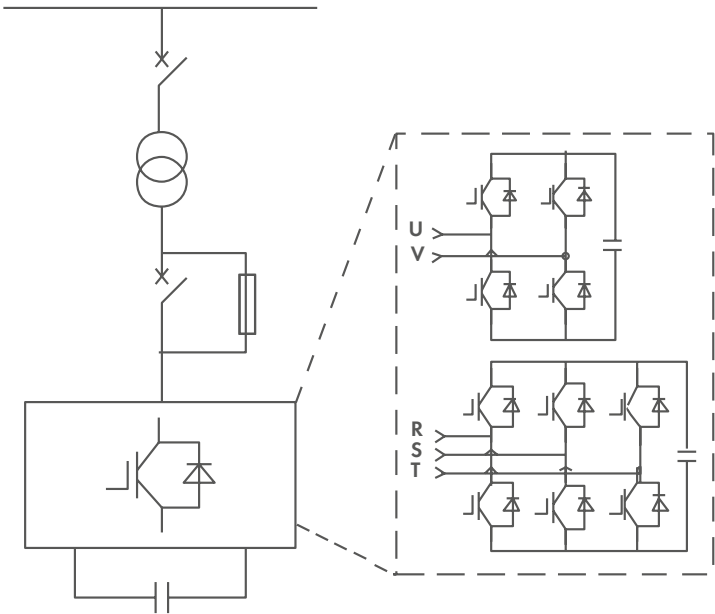
Unique technology

- ✓ Start up diagnostics
- ✓ Built-in PLC to improve communication, reliability and response time
- ✓ Communicative error detection technology
- ✓ Double loop power supply
- ✓ Flexible starting configuration to avoid network shocks
- ✓ Redundancy & modularised design
- ✓ Current test based on instantaneous reactive power theory
- ✓ PWM current tracing control technology
- ✓ DC side voltage balancing control technology
- ✓ DC current control, fast response time up to 5ms
- ✓ Multiple compensation function (reactive power compensation, harmonic current compensation, negative sequence current compensation and comprehensive compensation)



Topological structure

Identical structure and performance for each power unit greatly enhances the reliability, flexibility and availability of the SVG Statcom.



SVG Topological structure

Functions

The SVG Statcom adopts the world’s leading reactive power compensation technology. The Shunt Statcom acts as a variable reactive power supply to compensate for variation of reactive power in the load. Main function includes:

- ✓ Improving power transmission stability
- ✓ Maintains the receiving-end voltage level to strengthen system voltage stability
- ✓ Compensates Reactive power and improves PF
- ✓ Harmonic static compensation
- ✓ Reduces voltage fluctuation and flicker
- ✓ Reduces 3-ph unbalance

INPUT	
Rated Volt	1-ph / 3-ph, 50Hz 6kV / 10kV / 27.5kV / 35kV / 55kV
Nominal Volt	< 120%
PERFORMANCE	
PF	> 0.95
Harmonics	In accordance with related IEEE Standard
Response time	Up to 5ms
Reliability & service time	Designed service time: 20 years MTBF>75000 hours; MTTR<5 minutes
OTHERS	
Protections	Over-current, short-circuit, grounding, over / under-voltage, open phase, over-temperature, control power supply fault & communication fault
Structure	Modularised design facilitates ease of transportation & site installation
HV isolation	Fibre optic communication
Power semi-conductor	IGBT
Cooling	Air cooling / water cooling
Protection class	IP 20 (customisation available)

OPERATION MODE	FIGURE FOR WAVE FORM & PHASE POSITION	REMARKS
No load	(a) $U_1 = U_s$	In case of $U_1 = U_s$, Statcom doesn't compensate
Inductive operation	(b) $U_1 < U_s$	In case of $U_1 < U_s$, Statcom can output inductive current continuously
Capacitive operation	(c) $U_1 > U_s$	If $U_1 > U_s$ SVG can output capacitive current continuously

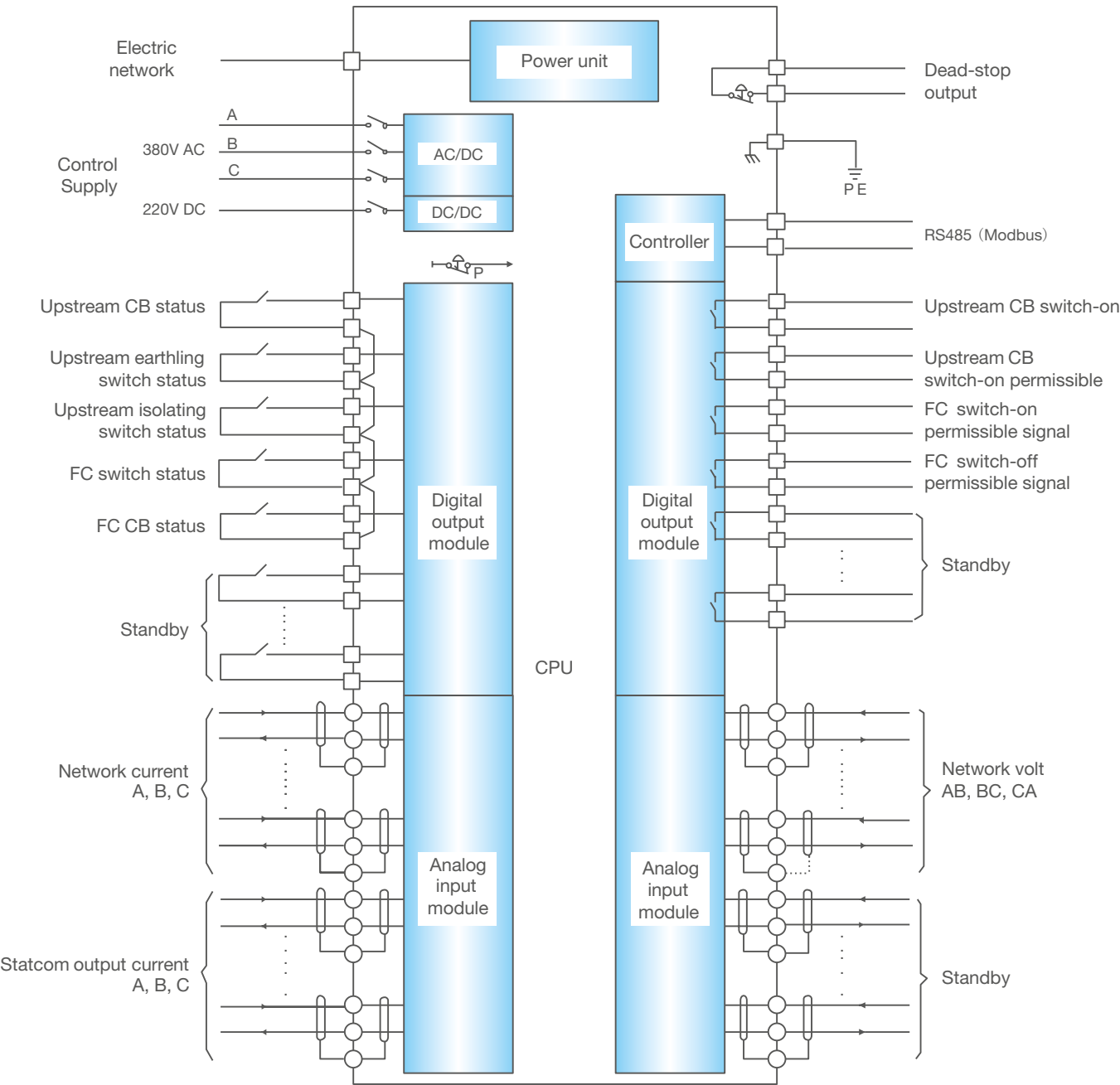
Features

The SVG Statcom Line products have the following advantages in comparison with conventional reactive power compensation devices:

- ✓ Faster response time
- ✓ Class leading ability to reduce for voltage fluctuation and flicker
- ✓ Wide operation range
- ✓ Multiple compensation functions
 - Lower harmonics
 - Small footprint

CONTROL	
Control mode	Instantaneous current test PWM current tracing DC current close loop control Voltage balancing technology on DC Side
Control chip	Advanced DSP Site programmable array
Auxiliary function	Full digital computerized control; real-time communication network, self-diagnosis & double circuit power supply
Control	Reactive power compensation, harmonic current compensation & negative sequence compensation
Power supply for control	380 VAC or 220 VDC
Protocol	Modbus
Display	Network current / volt, load current, compensation current, active & reactive power & PF
AMBIENT	
Installation environment	Indoor, free of corrosive or explosive gas
Ambient temperature	0 – 40°
Humidity	< 90%, non-condensing
Elevation	≤ 1000 meter above sea level (customisation available)
Storage / transportation temperature	From -40° to 70°

Standard input / output diagram



Standard power supply & signal interface

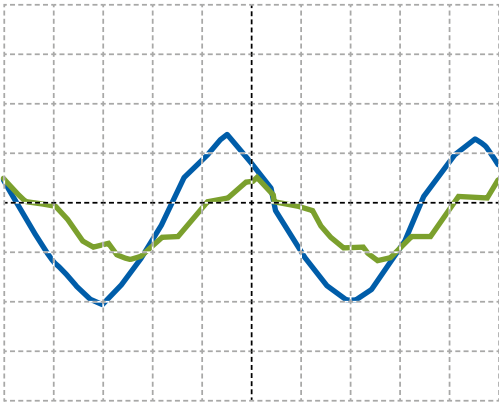
Input / output signal expandable & programmable according to site requirements

CUSTOMER SIDE INPUT TO SYSTEM	SPECIFICATION	REMARKS
Electrical network	Electrical network	Customer HV input
Controller supply	Power supply for Control loop & cooling fan	380VAC or 220VDC
Upstream CB status	N.O. provided by customer	Dry contact
Upstream earthing switch status	N.O. provided by customer	Dry contact
Upstream isolating switch status	N.O. provided by customer	Dry contact
FC switch status	N.O. provided by customer	Dry contact
FC CB status	N.O. provided by customer	Dry contact
Standby digital output	N.O. provided by customer	Dry contact
Network current	1A / 5A	Analogue input
Statcom output current	1A / 5A	Analogue input
Network line volt	0 – 100V	Analogue input
Standby analog output	1A / 5A or 0 – 100V	Analogue input

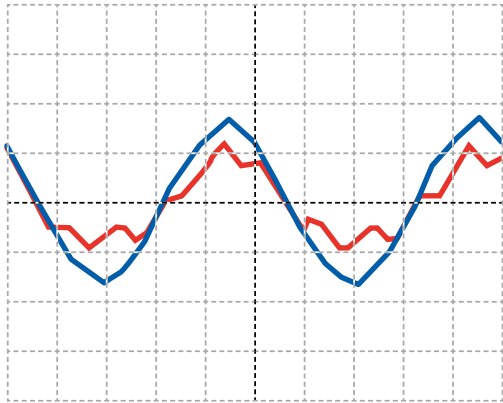
SYSTEM SIDE OUTPUT TO CUSTOMER	SPECIFICATION	REMARKS
Upstream CB switch-off signal	N.O. provided by system	Dry contact, capacity 250V AC / 8A
Upstream CB switch-on permissible signal	N.O. provided by system	Dry contact, capacity 250V AC / 8A
FC switch-on permissible signal	N.O. provided by system	Dry contact, capacity 250V AC / 8A
Standby signal output signal	N.O. provided by system	Dry contact, capacity 250V AC / 8A

Perfect compensation effect

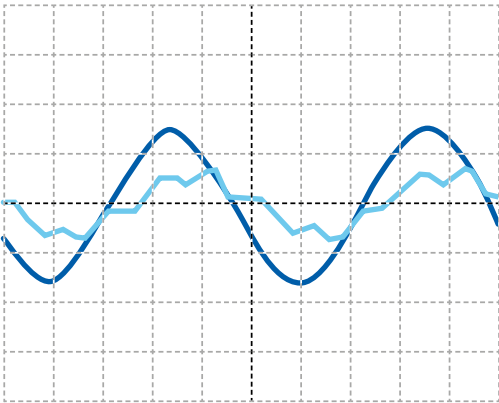
The SVG Statcom prevents other electric equipment from interruption by harmonics and retains PF around 1, therefore improving power quality.



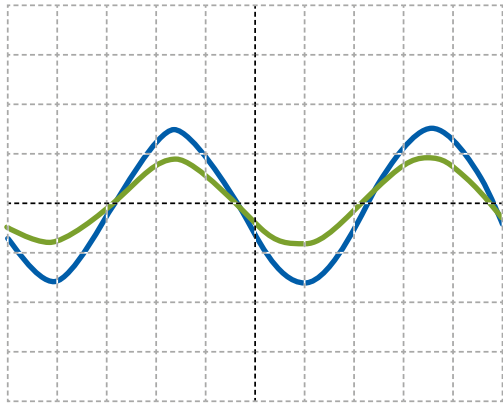
Pre reactive power compensation



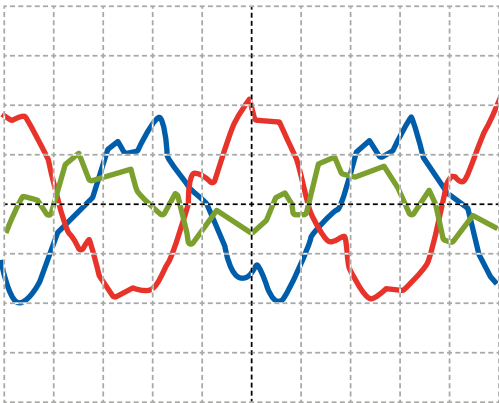
Post reactive power compensation



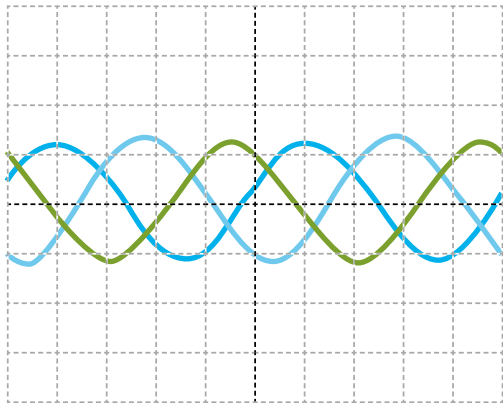
Pre reactive power & harmonic compensation



Post reactive power & harmonic compensation



Pre reactive power, harmonic and negative sequence current compensation



Post reactive power, harmonic and negative sequence current compensation

Application field of SVG Statcom

SVG Statcoms have been widely used in power transmission, electric railways, metallurgical, oil & gas, wind power and various other industries to improve power quality.

Long-distance power transmission

It has been widely proved that an SVG Statcom can greatly improve the transmission and distribution performance of electric systems. An SVG Statcom can be installed at various locations along the network to achieve the effect of stabilising voltage, reducing transmission loss, improving transmission capability, increasing transient stabilisation limit and damping small inference, strengthening voltage control and attenuating power oscillation.



Secondary substation (66 / 110kV)

The conventional fixed capacitor banks applied in regional grids can only offer capacitive power but can't adjust compensation in accordance with load variation. Although it can achieve higher PF, it may lead to over compensation and an increase in bus voltage and subsequent damage to electric equipment. At the same time, the increase of harmonics effect the safety of the capacitor banks. An SVG Statcom can quickly and precisely compensate both capacitive and inductive power, stabilize line voltage, increase power factor and at the same time avoid over compensation. Existing capacitor banks can be used with SVG Statcoms to reduce capital investment.



Local electric network

Large welding machines, timber processing plants, cranes / lifts, steel, petrochemical, oil and other industries consume large amounts of energy and have a negative effect on power grid quality including:

Voltage dips and fluctuations

Low power factor

High order harmonics which cause significant voltage distortion

SVG Statcoms provide comprehensive control of power quality to ensure local power utility requirements are met, plus at the same time saving energy.

Another example of applications that may affect the power grid is rolling mills and other industries that place an unsymmetrical load on the power grid. Again the impact is a voltage drop and fluctuations, which produces negative effects as above. The SVG Statcom can effectively solve these problems to ensure a stable bus voltage, high PF around 1 and low harmonics.

Wind farms

Grid integration of wind farms produces the challenges of low PF, voltage deviation, fluctuation and flicker. Voltage fluctuation of the system will also have an effect on the normal operation of wind turbines. SVG Statcom's solve these problems and reduce the negative effect of system voltage fluctuation upon the turbines. Statcom system application can be very cost-effective when combined with shunt reactors and capacitors. The scalability features of the SVG Statcom ensures ease of expansion with the development of the wind farm.



Electric Arc Furnace (EAF)

As a nonlinear load, EAFs lead to negative sequence current, 3-ph unbalance, coexistence of high order harmonics (odd 3, 5 & 7 order; even 2 & 4 order) and low power factors. The SVG Statcom will respond in 5ms or less, which offers arc furnaces with fast reactive power support.

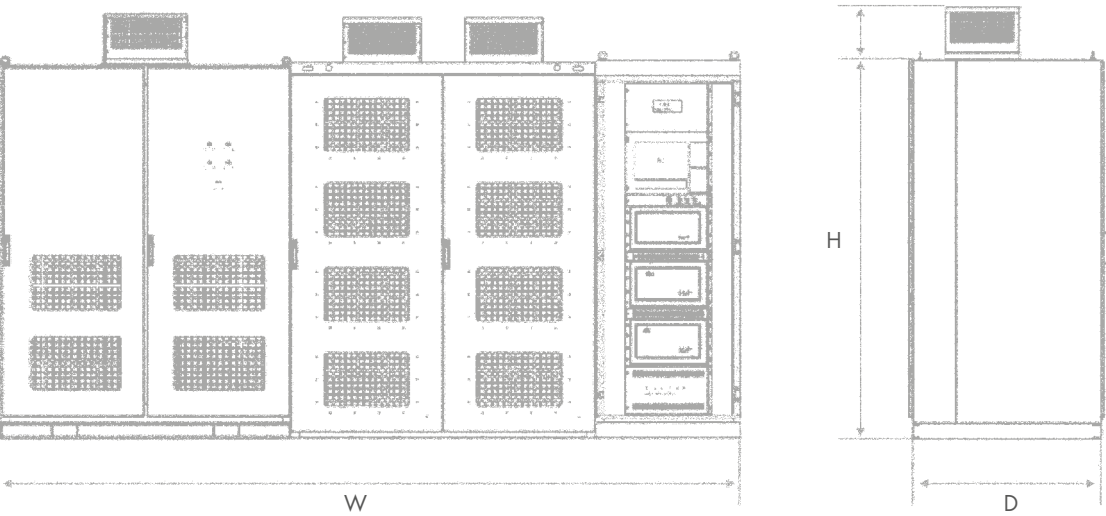
SVG Statcoms significantly reduce the voltage flicker and stabilize the line voltage which leads to increased metallurgy power output and productivity. The SVG has phase compensation and can eliminate 3-ph unbalance caused by the arc furnace. The Harmonic filter will remove harmful high order harmonics and offer capacitive power.

Electric locomotive power supply

Electric trains cause serious problems to the grid. The single phase power supply leads to serious 3-ph unbalance, low PF and negative sequence current. With an SVG Statcom installed along the railway, the 3-ph grid can be balanced and PF increased. When traction systems are connected with some weak grids, the SVG Statcom's voltage supporting capability can enhance traction power supply and reduce low frequency oscillation.

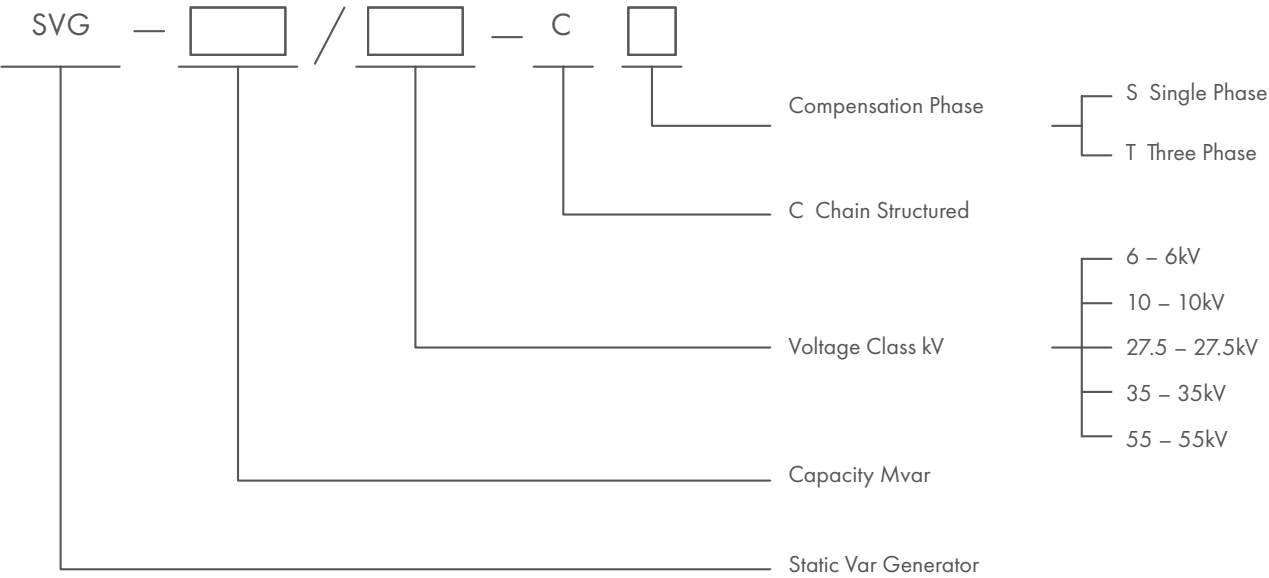


Specifications



See tables on pages 13 & 14 for specific dimensions

Equipment model



Product selection

VOLTAGE (KV)	DIRECT CONNECTION / STEP DOWN	CAPACITY (Mvar)	CONNECTION MODE	COOLING
6kV	Direct connection	<7.8M	star	Air
		<13.5M	delta	Water
10kV	Direct connection	<13M	star	Air
		<22.5M	delta	Water
27.5kV	Step down	<3.5M	6kV single phase	Air
	Direct connection	3.5 ~ 18M	27.5kV single phase	Water
				Air
		<55M	27.5kV delta	Water
35kV	Step down	Recommend 6kV or 10kV step down design		Air
	Direct connection	7 ~ 45M	Star	Water
		<29.5M	Delta	Air
				Water

Notes

- 1 The device can be customised when the voltage and capacity is beyond the range of the above table.
- 2 Capacity less than 3.5Mvar, 27.5kV single phase device, recommend 6kV step-down design.
- 3 Capacity less than 7Mvar, 3.5kV device, recommend 6kV / 10kV step-down design.
- 4 SVG device used to control the negative sequence, flickering and other special function or with high capacity, recommend delta connection.

6kV Chained SVG
10kV Chained SVG

SVG 6kV LINE PRODUCTS								
MODEL	VOLT	CAPACITY	PHASE	DIMENSIONS (MM)			WEIGHT	AIR RATE
	KV	Mvar		W	D	H	KG	M3/H
SVG 0.5 / 6 CT	6	0.5	3	4700	1300	2300	4700	10000
SVG 1 / 6 CT	6	1	3	4700	1300	2300	5000	10000
SVG 1.5 / 6 CT	6	1.5	3	4700	1300	2300	5200	15000
SVG 2 / 6 CT	6	2	3	4700	1300	2300	5500	15000
SVG 3 / 6 CT	6	3	3	4700	1300	2300	5700	15000
SVG 4.5 / 6 CT	6	4.5	3	4700	1300	2300	6000	15000
SVG 6.5 / 6 CT	6	6.5	3	5700	1500	2400	6500	20000
SVG 10 / 6 CT	6	10	3	7200	1500	2400	7700	25000
SVG 15 / 6 CT	6	15	3	8100	1500	2400	9400	25000
SVG 10kV LINE PRODUCTS								
SVG 0.5 / 35 CT	35	0.5	3	6200	1300	2300	5200	15000
SVG 1 / 35 CT	35	1	3	6200	1300	2300	5400	15000
SVG 2 / 35 CT	35	1.5	3	6200	1300	2300	5600	15000
SVG 2.5 / 35 CT	35	2.5	3	6200	1300	2300	5800	15000
SVG 3.5 / 35 CT	35	3.5	3	6200	1300	2300	6000	15000
SVG 5 / 35 CT	35	5	3	6200	1300	2300	6400	25000
SVG 7.5 / 35 CT	35	7.5	3	6200	1300	2300	6800	25000
SVG 10 / 35 CT	35	10	3	7700	1500	2400	7200	25000
SVG 13 / 35 CT	35	13	3	8500	1500	2400	8600	35000
SVG 15 / 35 CT	35	15	3	10400	1500	2400	9300	35000
SVG 18 / 35 CT	35	18	3	10600	1500	2400	10500	35000
SVG 25 / 35 CT	35	25	3	10900	1500	2400	11000	40000
SVG 28 / 35CT	35	28	3	12000	1500	2400	12000	Water cooling
SVG 40 / 35 CT	35	40	3	15000	1500	2400	20000	Water cooling

- Notes
- 1 Above height includes 100mm foundation but excludes cooling fan.
 - 2 Customisation for other voltage and capacity is available.

27.5kV Single Phase SVG
35kV Direct Connection Integration SVG

SVG 27.5kV LINE PRODUCTS								
MODEL	VOLT	CAPACITY	PHASE	DIMENSIONS (MM)			WEIGHT	AIR RATE
	KV	Mvar		W	D	H	KG	M3/H
SVG 0.5 / 27.5 CS	27.5	0.5	1	4700	1300	2300	4700	10000
SVG 1 / 27.5 CS	27.5	1	1	4700	1300	2300	5000	10000
SVG 1.5 / 27.5 CS	27.5	1.5	1	4700	1300	2300	5200	15000
SVG 2 / 27.5 CS	27.5	2	1	4700	1300	2300	5500	15000
SVG 3 / 27.5 CS	27.5	3	1	4700	1300	2300	5700	15000
SVG 4.5 / 27.5 CS	27.5	4.5	1	4700	1300	2300	6000	15000
SVG 6.5 / 27.5 CS	27.5	6.5	1	5700	1500	2400	6500	20000
SVG 10 / 27.5 CS	27.5	10	1	7200	1500	2400	7700	25000
SVG 16 / 27.5 CS	27.5	16	1	8100	1500	2400	9400	25000
SVG 35kV LINE PRODUCTS								
SVG 0.5 / 35 CT	35	0.5	3	6200	1300	2300	5200	15000
SVG 1 / 350 CT	35	1	3	6200	1300	2300	5400	15000
SVG 2 / 35 CT	35	1.5	3	6200	1300	2300	5600	15000
SVG 2.5 / 35 CT	35	2.5	3	6200	1300	2300	5800	15000
SVG 3.5 / 35 CT	35	3.5	3	6200	1300	2300	6000	15000
SVG 5 / 35 CT	35	5	3	6200	1300	2300	6400	25000
SVG 7.5 / 35 CT	35	7.5	3	6200	1300	2300	6800	25000
SVG 10 / 35 CT	35	10	3	7700	1500	2400	7200	25000
SVG 13 / 35 CT	35	13	3	8500	1500	2400	8600	35000
SVG 15 / 35 CT	35	15	3	10400	1500	2400	9300	35000
SVG 18 / 35 CT	35	18	3	10600	1500	2400	10500	35000
SVG 25 / 35 CT	35	25	3	10900	1500	2400	11000	40000
SVG 28 / 35CT	35	28	3	12000	1500	2400	12000	Water cooling
SVG 40 / 35 CT	35	40	3	15000	1500	2400	20000	Water cooling

- Notes
- 1 Above height includes 100mm foundation but excludes cooling fan.
 - 2 Customisation for other voltage and capacity is available.

10kV Indoor



10kV Containerised



Water cooling SVG

Water cooled SVG Statcoms use a water circulated cooling system, which accurately measures the temperature to provide reliable temperature protection for the power units, keeping the SVG in stable operation. It vastly improves the electronic components’ heat dissipation efficiency.

- ✓ High efficiency, stable heat dissipation
- ✓ Enclosed design, high enclosure rating
- ✓ Accurate water system design, high reliability and maintenance free
- ✓ Energy saving and environmental protection with low noise

Indoor



Outdoor



Customer focused services

High-quality service team

Professional support team provides you services covering installation, commissioning, maintenance and trouble shooting. After-sales engineers and technicians are available 24/7/365.

Advanced remote supervision system

24 hour global online diagnostics and trouble shooting service.





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