
FACTS

PCS 6000 STATCOM

Dynamic reactive power compensation



ABB is focused on providing systems and equipment that optimize the backbone of the electricity industry – the transmission grid. We strive to be innovative and present solutions that are cost efficient, fault-tolerant and environmentally friendly.

Dynamic reactive power compensation

Providing stability, security and reliability

ABB's FACTS (Flexible Alternating Current Transmission Systems) technologies let users solve power quality issues, ensure grid code compliance, maximize productivity and increase profitability.

Power quality issues are becoming more disruptive with the increasing complexity of the electrical grid. These problems can adversely impact the financial and operational performance of energy producers and consumers.

Installing a STATCOM (or static synchronous compensator) at one or more suitable points on the network is a powerful and cost effective method to increase grid transfer capability and enhance voltage stability.

What is a STATCOM?

A STATCOM is a dynamic voltage regulating device. It is based on a power electronics voltage-source converter and can act as a source or sink of reactive power (volt-ampere reactive (VAR)). It detects and instantly compensates voltage fluctuations or flicker, as well as controls reactive power and power factor. As a fully controllable power electronic device, the STATCOM is capable of providing both capacitive and inductive VARs.

STATCOM applications

Renewable energy developers, heavy industries and electrical utilities face a number of challenges related to reactive power. Developers and utilities may be confronted with voltage sags, poor power factor and even voltage instability. Heavy industrial applications can cause disturbances like voltage unbalance, distortion or flicker on the electrical grid. Dynamic reactive power control can resolve these issues by improving the power factor or compensating for the voltage instability. In many cases, the traditional solutions of switching capacitors is too coarse and slow to stabilize a weak network.

The most advanced way to compensate for reactive power is to incorporate a voltage source converter (VSC) as a variable source of reactive power. These systems offer advantages compared to standard reactive power compensation solutions in demanding applications. For instance, in wind farms and industrial mills, normal reactive power control from generators or capacitor banks alone are too limited and slow for the sudden load changes.



PCS 6000 STATCOM

Proactive solutions for reactive needs

- 01 On/offshore wind farms and solar parks
- Ensuring grid code compliance by providing dynamic reactive power capability
 - Complying with fault ride-through requirements
 - Resolving harmonic issues in plants
 - Utilities and industrial plants

- 02 Utilities and industrial plants
- Voltage support and stabilization (dynamic support to power grids, increased transmission capacity)
 - Compensation of rapidly fluctuating loads (flicker, harmonics)
 - Power oscillation damping
 - Increased productivity and reliability for industrial applications and utilities

- 03 Railways - Load balancing
- Grid code compliance by compensation of unbalanced traction load, providing power factor correction and harmonic filtering
 - Enabling efficient electrification of railway lines

PCS 6000 STATCOM

The PCS 6000 STATCOM is part of the FACTS portfolio. It covers the medium-voltage power range with modular and scalable system sizes, from 20 megavolt-ampere reactive (Mvar) up to 100 Mvar.

It is an efficient power system package specifically designed for connection to demanding networks. The flexibility of the system allows it to be applied to a wide range of applications.

The PCS 6000 STATCOM is particularly competitive in terms of installation time and space requirements. Furthermore, the high efficiency and low maintenance lead to low operational costs. The PCS 6000 provides outstanding performance for both steady state and dynamic operation as a pure static device with no switched passive elements.

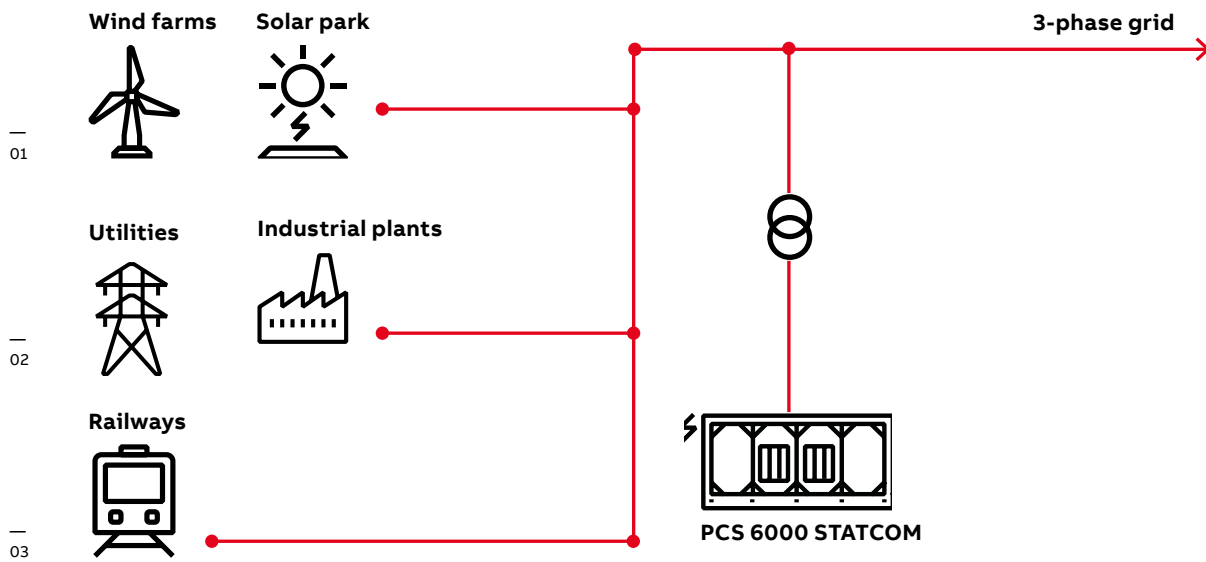
The PCS 6000 STATCOM solution is virtually maintenance free, due to the minimized number of moving parts. Outages for inspection can therefore be scheduled according to the customer's needs and preferences. No rotating parts in the energy path result in extremely high reliability,

availability and low operational costs combined with long life expectancy.

ABB has ensured that the design concept of the modular container system reduces on site construction time to a minimum. The converter equipment is pre-assembled and tested to the highest standards, and is shipped to site as a container package ready for immediate installation. Thanks to the high degree of standardization, the defined interfaces for on site commissioning work can be reduced to a minimum. Due to the modular design the system can even be relocated to a new site within a short time.

PCS 6000 converter

The PCS 6000 STATCOM uses advanced IGCT (Integrated Gate Commutated Thyristor) technology that has been developed by ABB from a proven bipolar semiconductor background (GTO). The PCS 6000 converters are based upon IGCT PEBB (Power Electronic Building Block). This standardization allows systems to be realized with lower engineering and design costs and therefore affecting the customer's end cost in a beneficial way. The innovative connection configuration allows for very good harmonic performance with typically no need for a harmonic filter.



PCS 6000 STATCOM

Engineered for user simplicity

Benefits

- Power quality and plant reliability improvement
- Network stability and transmission capacity increase
- Grid compliance for renewable energy
- High availability and reliability
- Comprehensive lifecycle service and support
- Small footprint
- Low maintenance
- Standardized converter blocks for simple long term operation and maintenance
- Compact transformer integration for optimal footprint and low installation costs

Features

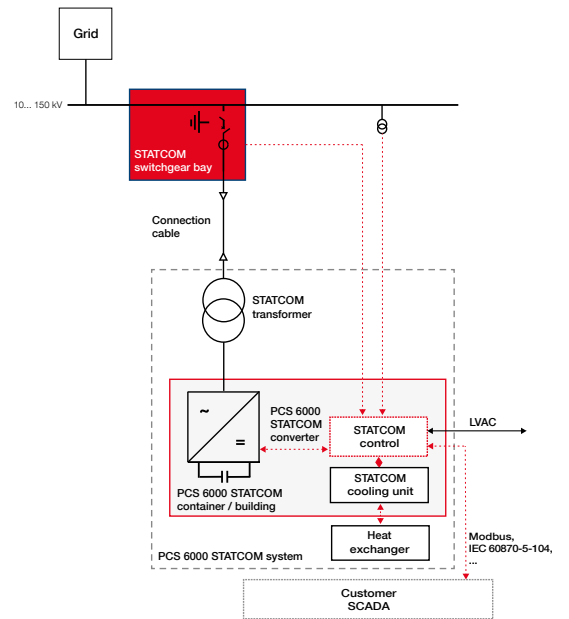
- Continuous dynamic response without steps
- Voltage control (slope characteristic)
- Power factor control
- Dynamic reactive power control (slave)
- Unbalance control
- Flicker compensation
- Active harmonic filtering (current and/or voltage harmonics)
- Active resonance damping
- Multiple system parallel control
- High and low-voltage ride through

01 Outdoor installation

- Converter, control and cooling in one container (IP54)
- Transformer and water/air heat exchanger outdoor

02 Indoor installation

- Converter (IP00), control and cooling unit indoor
- Transformer and water/air heat exchanger outdoor



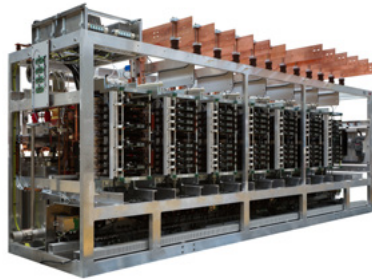
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02

PCS 6000 STATCOM

Product portfolio



Configurations	Rack	Container
Unit continuous rating (+/-) ^A	14 - 38* Mvar	14 - 38* Mvar
Housing	Open rack	Walk-in container
Protection class	IP00	NEMA 3R / IP54 (higher on request)
AC grid		
AC grid voltage connection	10 kV to 230 kV (others on request)	10 kV to 230 kV (others on request)
Output frequency	50 / 60 Hz	50 / 60 Hz
Harmonic distortion, current	IEEE / IEC compliant	IEEE / IEC compliant
Transient overload rating ^B	Application specific	Application specific
Extended overload rating (30 s)	Application specific	Application specific
Response time	Sub-cycle	Sub-cycle
Control	ABB AC 800PEC control platform	ABB AC 800PEC control platform
Environmental conditions		
Cooling	Water cooled	Water cooled
Ambient temperature range (nominal) ^C	0 °C to 40 °C	-25 °C to 50 °C (others on request)
Seismic rating	Zone 2 (higher on request)	Zone 2 (higher on request)
Humidity	< 95% non-condensing	Condensing
Housing options - dimensions and weights		
W x D x H - mm (inches)	5,500 x 2,095 x 2,352 (216.6 x 82.5 x 92.6)	12,000 x 3,000 x 3,500 (472.5 x 118.2 x 137.8)
Weights, kg (lbs)	9,000 (19,841)	26,000 (57,320)
Includes converter transformer in footprint ^D	No	No
Communication protocol		
System monitoring	Digital recording of system action, multiple inputs, alarms and warning signals	
Communication protocol	Ethernet connectivity, Modbus, TCP, DNP-3, SCADA, IEC 60870-5-104, others possible	
Installation		
	Converter, cooling unit and controls are placed indoors. Transformer and water-air heat exchanger are located outdoors.	Converter, cooling unit and controls are installed in the container. Container, transformer and water-air heat exchanger are placed outdoors.

* - Depending on grid conditions

A - All configurations can be paralleled to obtain higher ratings needed

B - Application specific overload ratings and duration

C - System temperature rating depends on housing selection; systems require derating for ambient temperatures over 40 °C

D - Typical dimensions of a complete system including container, transformer and heat exchanger: 20,000 x 20,000 mm

Value added solutions

Standard and engineered products

ABB's containerized solution combines rugged construction with industry leading engineering, providing a system that can operate under the harshest environments common in utility, industrial and renewable applications.

ABB's standard and engineered systems provide

- Flexible and robust design suitable for harsh environment
- Advanced functionality to solve complex power quality issues caused by harmonics, voltage dips, flicker, etc.
- Reliable and proven technology
- Simple system integration and programmability for easy accommodation to customer requirements
- Turnkey systems
- Option for grid integration studies to minimize risk
- Hybrid system options to fit customer needs
- Long engineering experience
- Study expertise with common power system simulation environments



PCS 6000 STATCOM installations

Selected references

— 01 Westermost Rough offshore wind farm, UK
Reactive power compensation and grid code compliance

— 02 British Columbia Transmission Corporation, Canada
Heavy load compensation of long power line

— 03 Whitelee onshore wind farm, UK
Grid code compliance for UK's largest wind farm

— 04 Harestanes onshore wind farm, UK
Improve power quality and transmission capacity

Westermost Rough offshore wind farm, UK

The offshore wind farm is situated 8 kilometers (km) off the Yorkshire Coast, north of Hull and contains 35 turbines of 6 megawatts (MW) capacity, covering a total area of 35 km² and providing enough electricity to power around 180,000 homes per year.

Customer needs:

Dynamic reactive power compensation at onshore grid connection to meet grid code requirements.

ABB's solution:

- Two containerized 25 Mvar PCS 6000 STATCOM units
- Three 16.67 Mvar reactors
- Switchgear and auxiliaries installed in container
- Design, engineering, installation and commissioning

Customer benefits:

- Ensuring full wind farm export capability
- Grid code compliance
- Turnkey solution and project execution from one company

BC Transmission Corporation, Canada

Capacity expansion of an oil pipeline in British Columbia (BC) included three additional pumping stations with high power motors.

Customer needs:

As part of the capacity expansion, the effects of heavy load changes need to be compensated from the long radial power line.

ABB's solution:

- Three containerized +/-12 Mvar PCS 6000 STATCOM units with 280 % overload capability including transformer, control and cooling systems
- Design, engineering, installation and commissioning

Customer benefits:

- Efficient compensation of heavy load changes using a very fast reactive power compensation
- Improved power quality by harmonic controller which actively filters existing grid harmonics
- Increased transfer capacity of power line

Whitelee onshore wind farm, UK

Whitelee in the UK expanded to over 500 MW of generating capacity and generates power for the equivalent of 304,000 homes.

Customer needs:

Additional compensation equipment to meet the national grid code and gain more power capacity.

ABB's solution:

- Three containerized 15 Mvar PCS 6000 STATCOM units
- Design, engineering, installation and commissioning
- System studies to demonstrate grid code compliance of complete wind farm

Customer benefits:

- Meet demanding requirements of transmission operator
- Power quality improvements
- Grid code compliance

Harestanes onshore wind farm, UK

Harestanes is a 136 MW wind farm near Dumfries, one of Scotland's largest onshore wind farms. With 68 turbines it produces electricity to power over 73,000 homes per year.

Customer needs:

- Ensuring grid code compliance
- Increase network stability and wind farm export capacity

ABB's solution:

- Two containerized 34 Mvar PCS 6000 STATCOM units including transformer, control and cooling system
- Design, engineering, installation and commissioning
- System studies to demonstrate grid code compliance of complete wind farm

Customer benefits:

- Meet demanding requirements from transmission system operator (grid code compliance)
- Active resonance damping to comply with difficult wind farm resonance characteristics



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FACTS Care

Your uptime insurance

FACTS technologies provide high performance and stable power transmission – today and tomorrow. In order to ensure long-term availability and reliability of an installation, it is important to consider the need for future support and spare parts. FACTS Care offers you peace of mind throughout every phase of an installation's lifecycle.

FACTS Care is a comprehensive service offering from ABB, allowing you to take a lifecycle perspective on your installation and ensure maximum system reliability and performance.

Tailored program

Choosing from a wide range of services – including rapid response, training, scheduled maintenance, consulting and evergreen services – you are able to set up your own tailored program. You decide whether to implement a complete set of services right from the start or add services one by one as the need arises.

A service agreement from ABB lets you quickly access the correct expertise. We are committed to doing our utmost to maintain and maximize the availability and reliability of your FACTS system.

Service agreement

The best effect of a service agreement is achieved when implemented early in the system lifecycle. Following that, necessary services can be applied throughout all stages of the life of your FACTS installation.

During the warranty period, we will work together with your personnel to minimize future outages and unnecessary stoppages. In the post-warranty period, our FACTS customer service team can continue to handle any issue that may arise. Dedicated FACTS resources can also be appointed to support each service agreement.

Health and safety

Health and safety is one of ABB's top priorities, and includes all employees, contractors, visitors and public. We spend a large amount of time out at the production sites, and we always strive to provide a healthy and safe working environment at sites and facilities.

We take adequate steps to prevent accidents and injuries by minimizing, as far as is reasonably practicable, the causes of hazards inherent in the working environment. Zero injuries is our expectation, nothing else is acceptable.

Rapid response

- In case of an emergency or production stoppage, we will be there to provide instant support.
- When troubleshooting needs to be carried out quickly we identify and analyze the fault and recommend the most effective course of action.
- When you need expert advice on when to replace your equipment or make a quick and effective replacement, you can count on us.
- Available both on site and remote, our service is flexible and independent of time and place.

Training

- We offer training during all parts of the system lifecycle, from pre-commissioning to de-commissioning.
- Training can be focused on the parts of a customer specific FACTS installation that require the most attention from service engineers.
- There is always need for training after a new installation or an upgrade, as well as continuous repeat training.

Scheduled maintenance

- Preventive maintenance helps you to check the condition of your system and its components.
- It will determine the best solution to ensure system performance, safety, availability and reliability.





Consulting

- ABB can help identify critical equipment and how to minimize risks. Via on-site visit, visual inspection and evaluation, we do an assessment of age, condition and failure risk.
- Cyber security must be addressed continuously, which requires a comprehensive cyber security program including human resources with the appropriate skills.
- ABB can support with power system studies and simulations to analyze power system performance issues and to propose potential improvement measures.

Evergreen

- Spare parts management protects you from unknown and unexpected problems related to spare parts support.
- Updates ensure that the system is up to date and optimized and can be implemented in a few simple steps.
- An upgrade will improve your plant's capacity and production capability, while saving you valuable time and money.

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