

## High Power Products Based On PP-IGBT

- HV High Power STATCOM ( MAXI Var )
- VSC-HVDC Valves and Controls (HVDC Smart)
- High-Voltage Variable Frequency Drive System (MAXI Vert)

### RXHK Products

#### ● HVDC Series

VSC-HVDC Valves and Controls

#### ● Power Quality and Safety Series

HV High Power STATCOM ( MAXIVar )

#### ● Electric Drive and Motor Control Series

1. High-Power Variable Frequency Drive System (5MVA and Above)
2. General Variable-Frequency Drive System
3. Four-Quadrant Variable-Frequency Drive System

RXHK retains the right to change the design/ technical parameters/dimensions, in case of any changes to product dimension/parameters, refer to the latest technical document.

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RXHK provides customers with a full range of technical services for our products and systems



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We optimize energy



*maxivar*

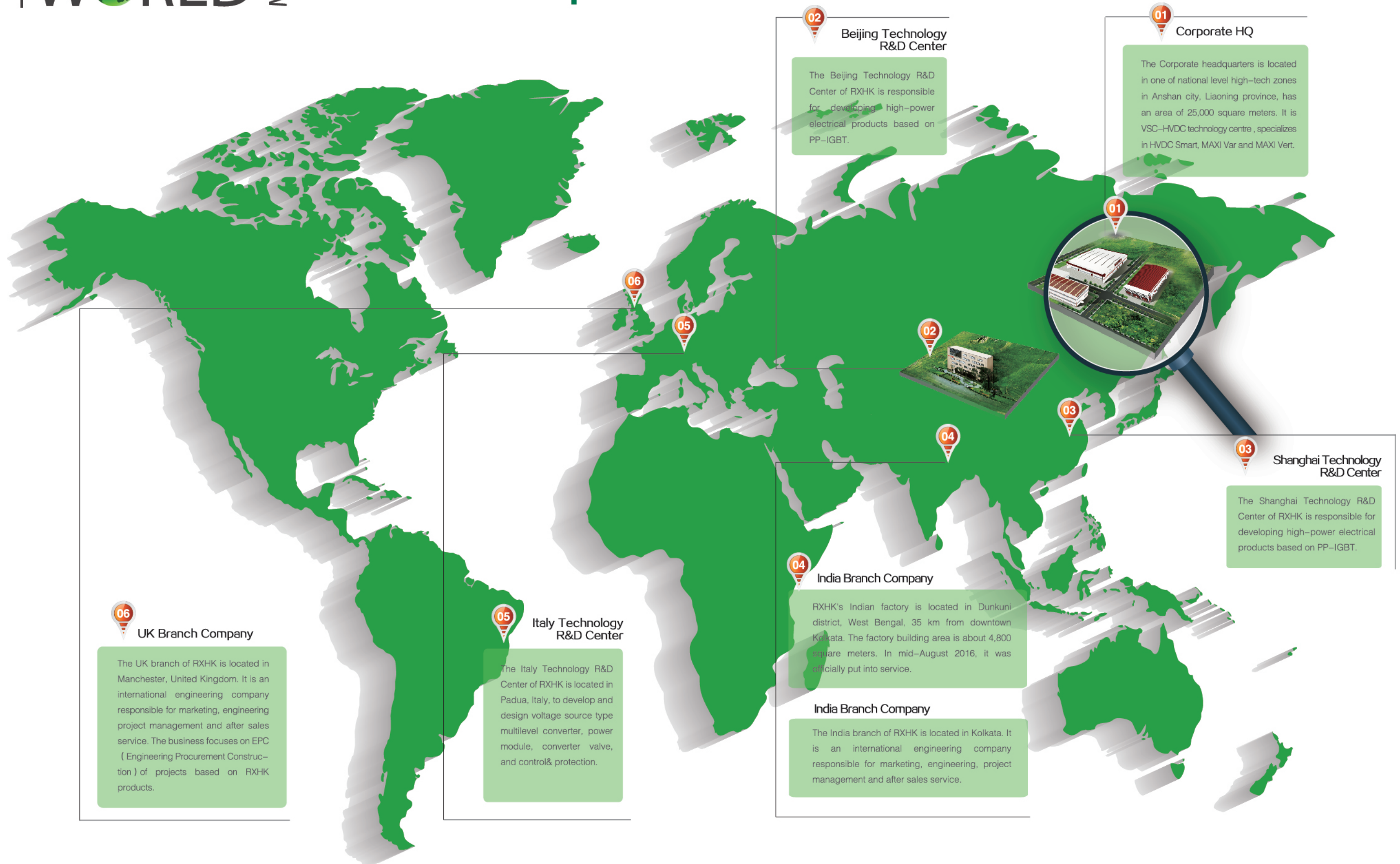
6-66kV  
±6~±300MVar

## High Voltage High Power STATCOM

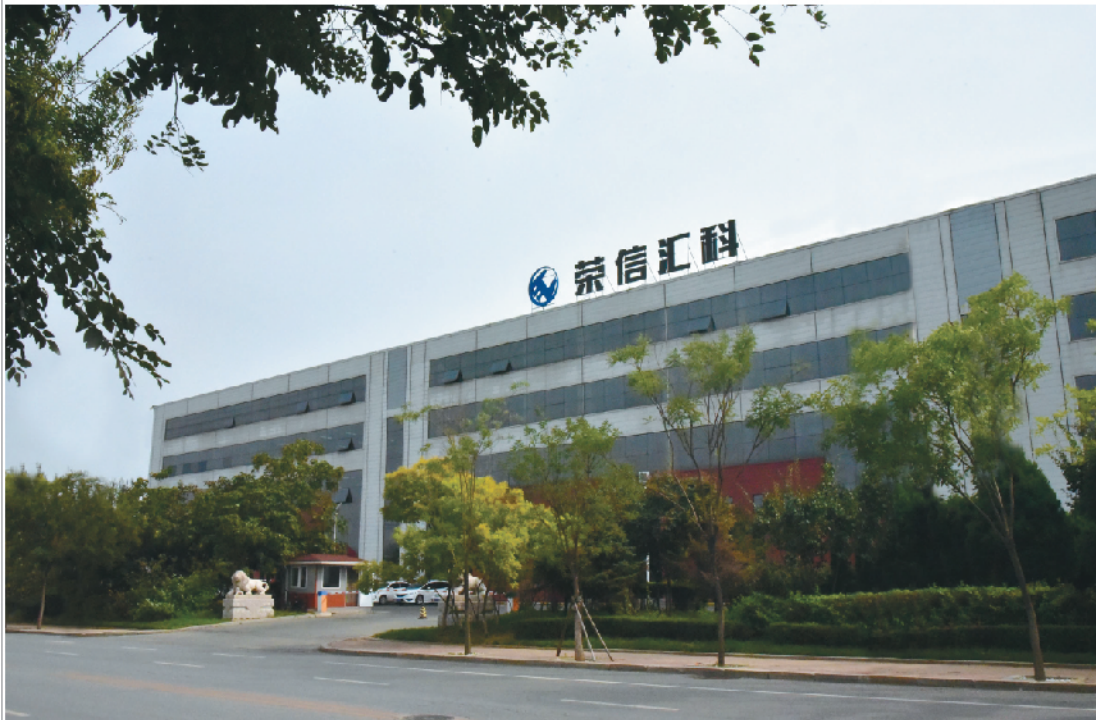
RXHK [ Rongxin Huiko Electric Technology Co., Ltd. ]



## Industrial Footprint



## Company Profile



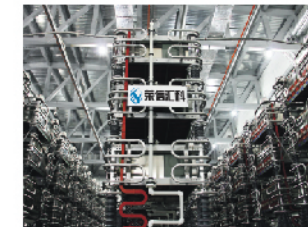
Rongxin Huiko Electric Technology Co., Ltd. is a global leader in the manufacturing of high-power power electronics equipment. RXHK is engaged in R&D, design, manufacturing, factory testing and commissioning of PP-IGBT technology based equipment. The main products include: VSC HVDC, STATCOMs and high-power variable frequency drives. RXHK provides solutions for power quality improvement, control optimisation, energy saving and losses reduction to our clients.

The Corporate headquarters is based in one of China's national level high-tech zones in Anshan city, Liaoning province, RXHK has established technical R&D centers in Beijing and Shanghai in China and in Padova in Italy. Additionally RXHK has established branch companies and manufacturing bases in UK and India.

RXHK has a strong innovation capability. The company own 32 patents, is currently leading 14 Chinese state funded scientific research projects and has numerous International Certifications in place such as TUV (German) and CE for their product range.

RXHK's products and solutions are widely used by electrical Transmission System Operators, long-distance oil & gas pipeline companies, LNG plants, railways, metals processing, mining, wind power and other renewable energy production. Projects have been completed in multiple countries of Europe, Africa and Asia with high levels of customer satisfaction, including UK, Serbia, South Africa, Mozambique, Kenya and India.

## Company Strength



Globally RXHK is the first company to develop products, including VSC-HVDC, STATCOM, and high power variable frequency drive system, based on PP-IGBT.



Test platforms include a  $\pm 12kV/36MW$  back-to-back VSC HVDC prototype testing system, a 20-level dynamic simulation platform and a RTDS simulation platform in the factory



The largest manufacturing base of STATCOM in China, which can manufacture  $35kV/\pm 200Mvar$  multi-level high-voltage high-power STATCOM.



The RTDS lab has the capability of high voltage DC transmission, high performance dynamic reactive compensation and variable frequency power supply simulation



Currently the only enterprise in China that can produce 240MVA HV high-power Variable Frequency Drive.



RXHK is the only company in China that has the ability to do the full load test for high-voltage drives



Supplier to the first back-to-back project combining LCC and VSC-HVDC in the world. The VSC HVDC converter on Yunnan side is provided by RXHK ( $\pm 350kV/1000MW$ ).



The high-voltage test lab has the capabilities to carry out type test, routine test and performance test for DC converter valve, STATCOM, insulator, capacitor and other high-voltage equipment.



The customers of RXHK come from Europe, Africa and South Asia. RXHK has branch companies in Manchester, UK and Kolkata, India.



The HVDC Smart Converter Valve, self-developed by RXHK, has passed all the type tests of IEC 62501, including operational test, dielectric test and AC-DC voltage test between valve terminals, witnessed by KEMA.

## Product Overview

Static synchronous Compensator (STATCOM) using full controllable power electronic device, based on VSC and PWM technology, is a type of shunt connected reactive power compensation equipment. As a key element of the modern smart power grid, STATCOMs can in real-time detect the power grid status and rapidly adjust dynamic reactive power

output to meet the system demand. This capability provides one of the important means to solve many challenges of power grid.

RXHK STATCOM (MAXIVar) equipment can directly connect to a 6~66kV grid providing up to  $\pm 300\text{MVar}$  reactive power output.

One of the core equipment and technology of FACTS.

## Technical Advantages and Features

Capacity range	$\pm 6\text{--}300\text{MVar}$
Multilevel chain structure	Low output voltage harmonics, low losses, relatively low switching frequency
Advanced power electronic device	PP-IGBT with high working voltage and current, and high safety
Modular design	Providing easy maintenance
Small footprint	Highly compact power unit, single power module power density up to 3MVA
Low losses	Valve loss $\leq 0.7\%$ , total loss $\leq 1.2\%$ (including transformer)
Low operating voltage	Operating voltage down to 0.2pμ
Fast reactive power response speed	Reactive power response time <10ms
Redundant design	After power module fault, system can bypass the faulty module and continue operating, bypass time <5ms
Rapid control system response	Dual redundancy and bumpless transfer supported
Installation	Building or container
Efficient cooling mode	Water-water, water-air
Various control function	Multiple control functions already proven in existing projects

## Application Field

### Wide application experiences



#### Power generation: suppressing sub-synchronous oscillation

- By adding sub-synchronous damping control to the existing reactive power control function, the STATCOM generates complementary compensating current at the shaft torsional vibration modal frequency, so that the torque on the shaft is rapidly damped and the sub-synchronous oscillation can be effectively suppressed.

#### Power transmission: improving system stability

- For the interconnection of different power systems, positive damping by the STATCOM helps to reduce system oscillation.
- Increasing dynamic reactive power reserve for power grids, improving the ability to receive power, enhancing the ability to resist large faults, improving the stability of the power grid.

#### Electric railway: improving power factor; compensating phase imbalance

- The STATCOM's rapid asymmetric compensation reduces voltage fluctuation and unbalance, improves power quality.

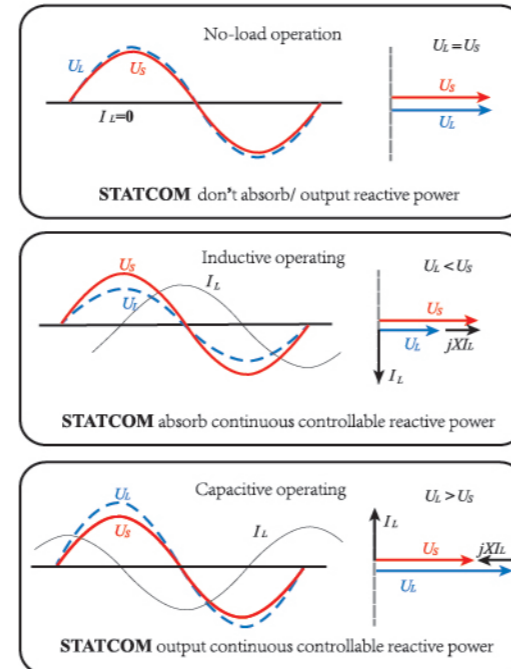
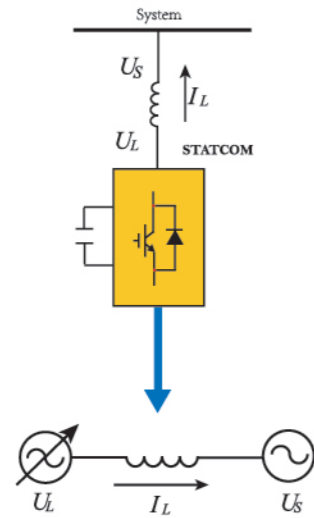
#### Metallurgy: improving power factor; suppressing voltage flicker

- Effectively improving system power factor, reducing the voltage fluctuation, and suppressing voltage flicker.

#### Alternative energy field: maintaining power grid voltage stability

- Solving the problems of power factor and voltage fluctuation caused by wind power.
- Low voltage ride through capability, reducing fault recovery process, increasing power grid stability.
- Supporting grid code compliance for reactive power delivery.

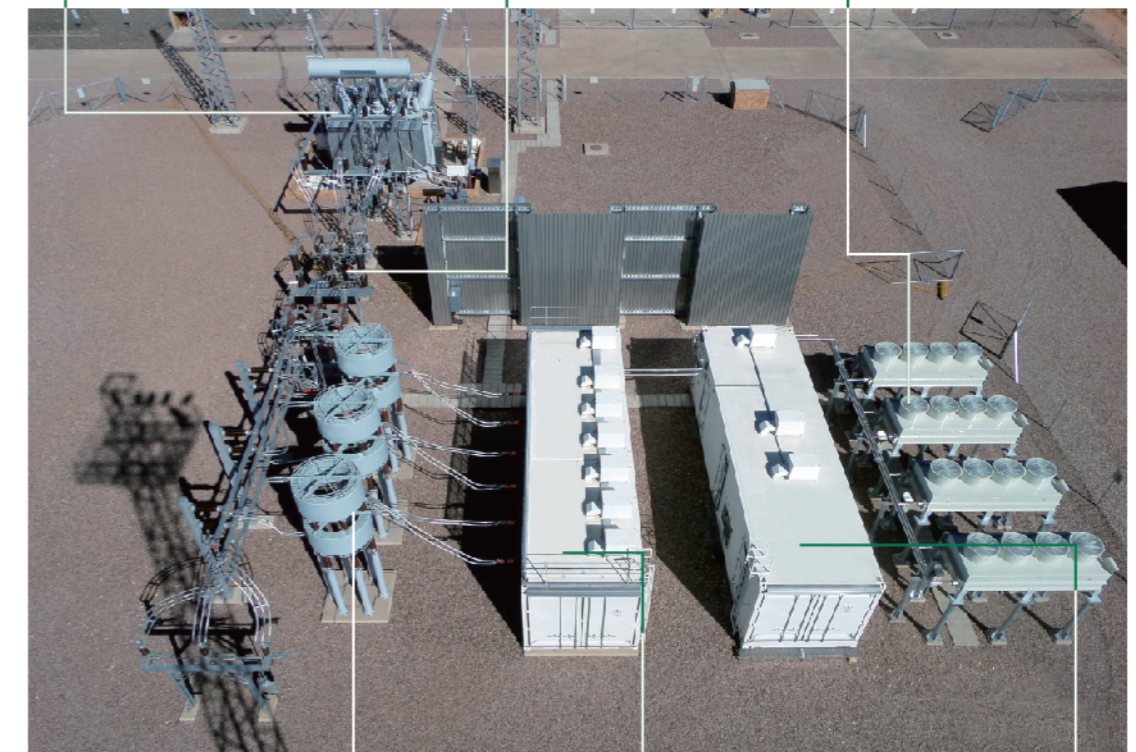
## Working Principle



## Main Components



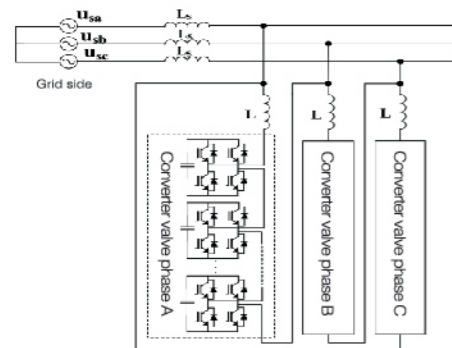
Coupling transformer    Charging resistor    Water cooling system



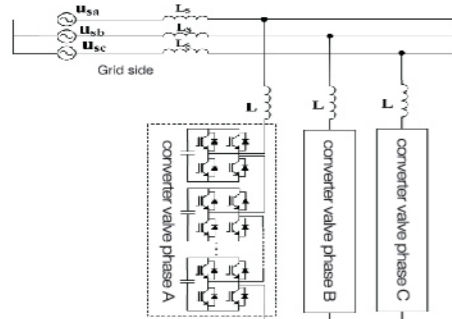
Reactor    Valve container    Control container



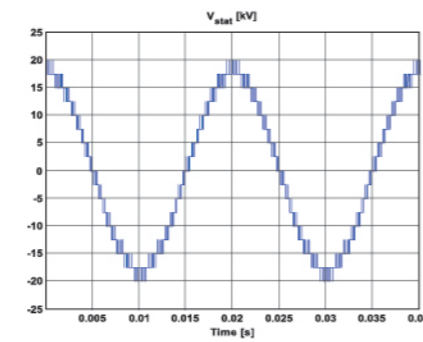
## Topology



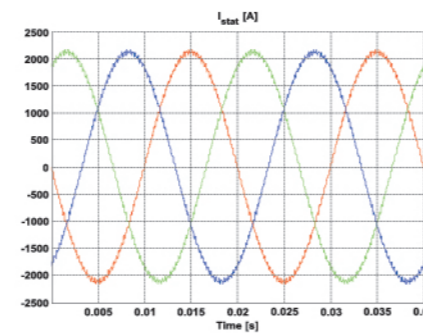
Delta connection



Star connection



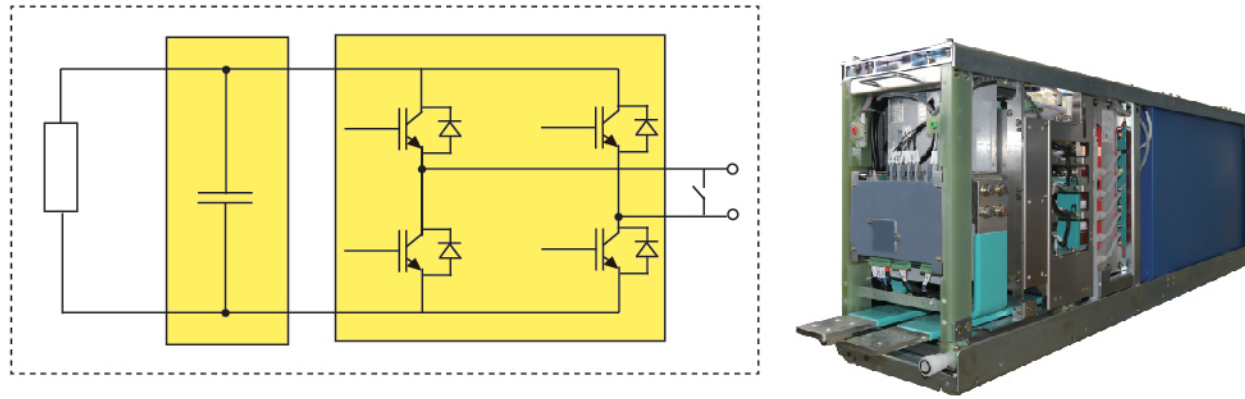
Voltage



Current

Multi-level Chain-Linked solution excellent waveform quality without need for harmonic filter.

## Power Unit



- Based on single piece high-performance press packed PP-IGBT with explosion-proof encapsulation, providing high safety and reliability, double side heat dissipation, high power density, and long service life.
- Using self developed second generation driver board, adopting short circuit fault soft switch off technology, providing high stability and rapid response speed.
- Valve control device power supply derives power directly from high voltage, simplifying the power unit design, and increasing reliability.
- Maintenance free roller bearing installed on bottom of power module, together with handle in the front, makes sure the power unit can be quickly replaced.
- Water pipe side installation, if leakage, easy to maintain.
- 5ms automatic rapid bypass, increase product availability.
- Separate power module and capacitor section design for easy maintenance.
- Automatic water leak detection and alarm.

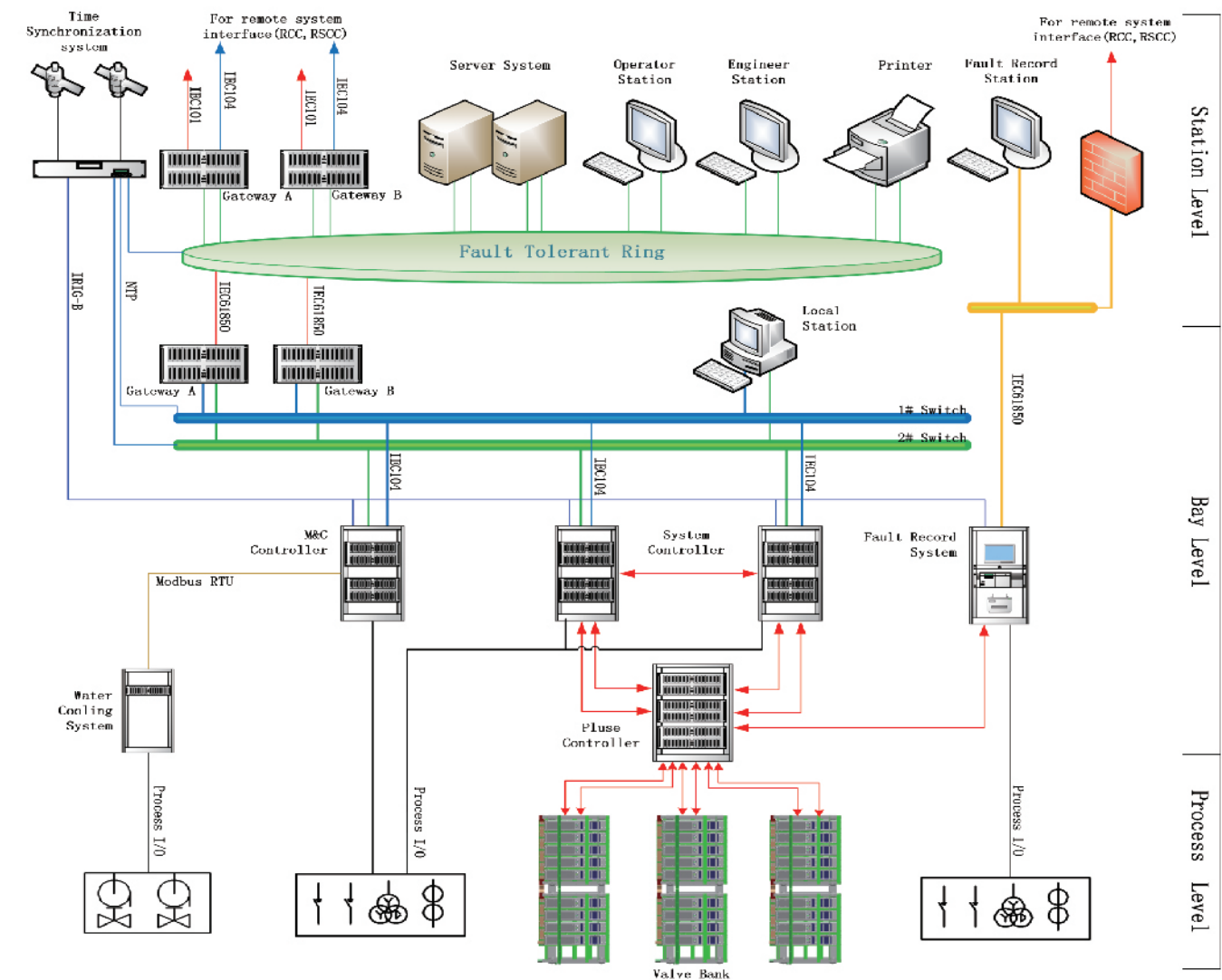
## Valve Section



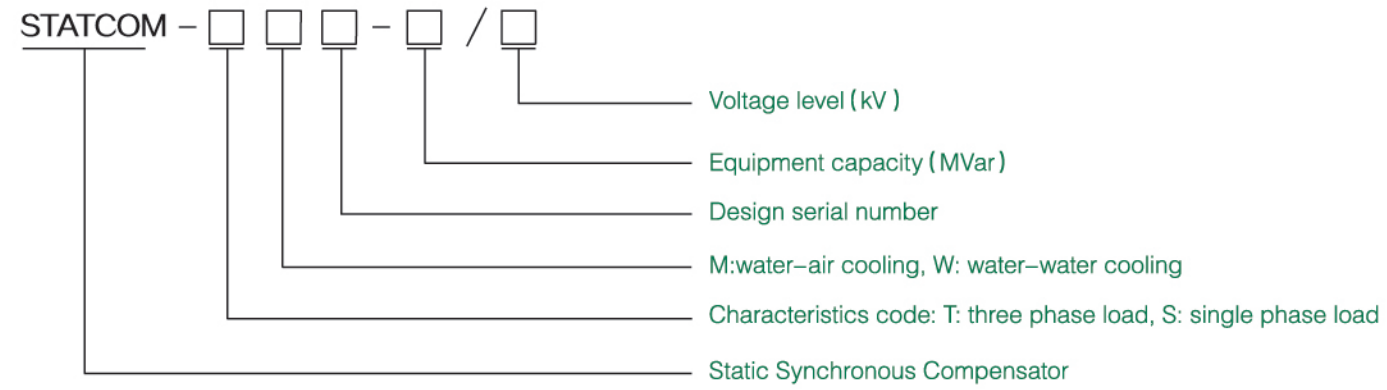
## STATCOM Control System

The MAXI Var control system has a well-developed structure, powerful computing capability, multiple interfaces, and easy scalability.

- EMC and environmental test in conformity with IEC 61000, IEC 60068 etc.
- Powerful high-speed floating-point computing capacity.
- Able to support extension with additional computer providing and providing dual redundancy system switch.
- Supports various communication protocols; IEC61850, IEC104, IEC103, TCP/IP MODBUS etc.
- Where allowed supports direct access by RXHK remote service system which aids in service support.



## Type and Specification

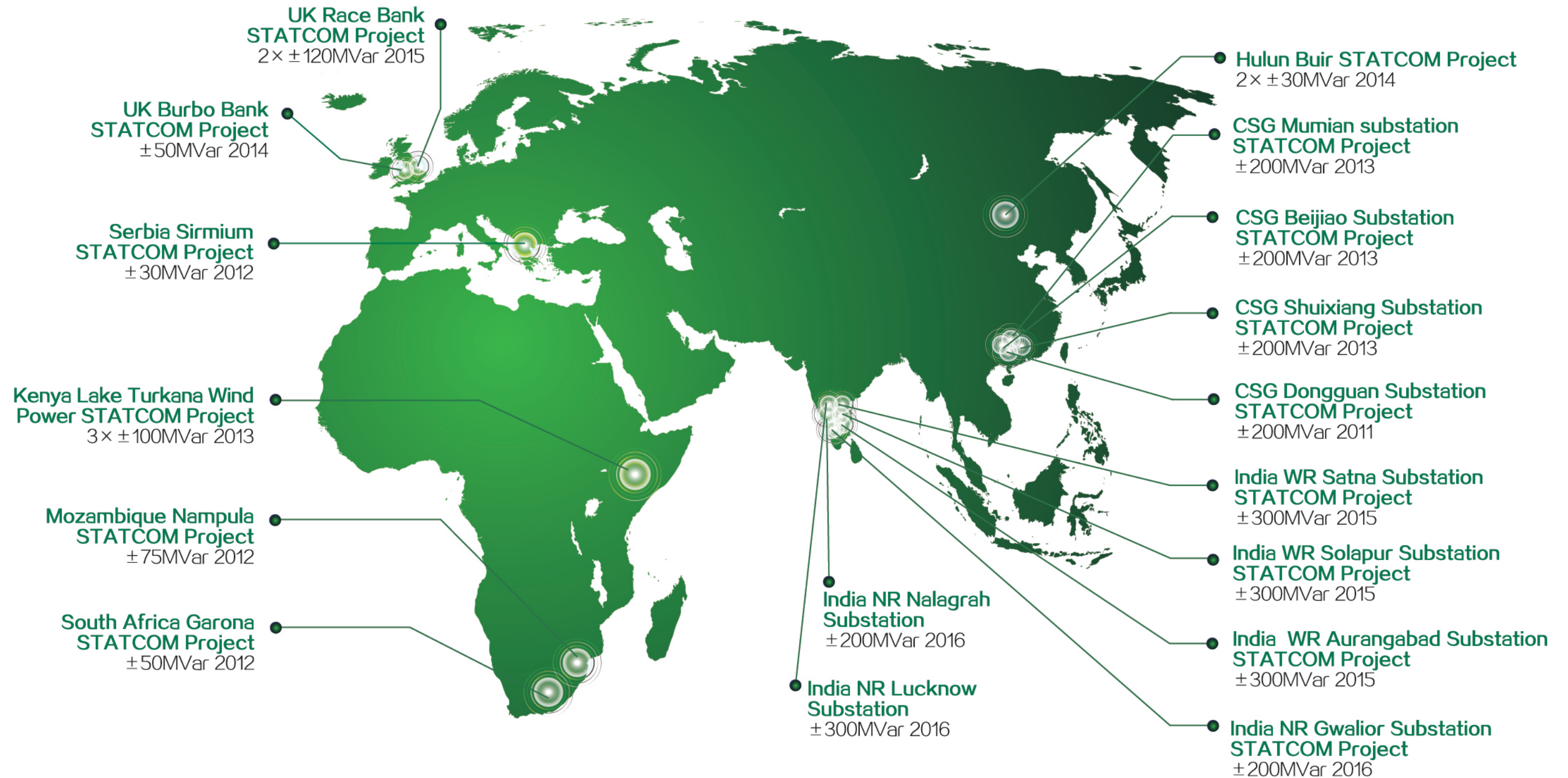


## Test Platform

- 1 Lightning impact test device
- 2 EMC test center
- 3 Operating test platform based on IEC62501/IEC62927
- 4 35kV, 100MVar reactor load and back to back test platform
- 5 Insulation voltage withstand test platform
- 6 Real Time Digital Simulation system
- 7 6-66kV, 16MVA power supply system



## MaxiVAR STATCOM Installed In The World (Contract Award Dates)



**RXHK is by volume the largest STATCOM provider in the world, and also has the largest utility references in 100MVar class.**

## Project Case Study

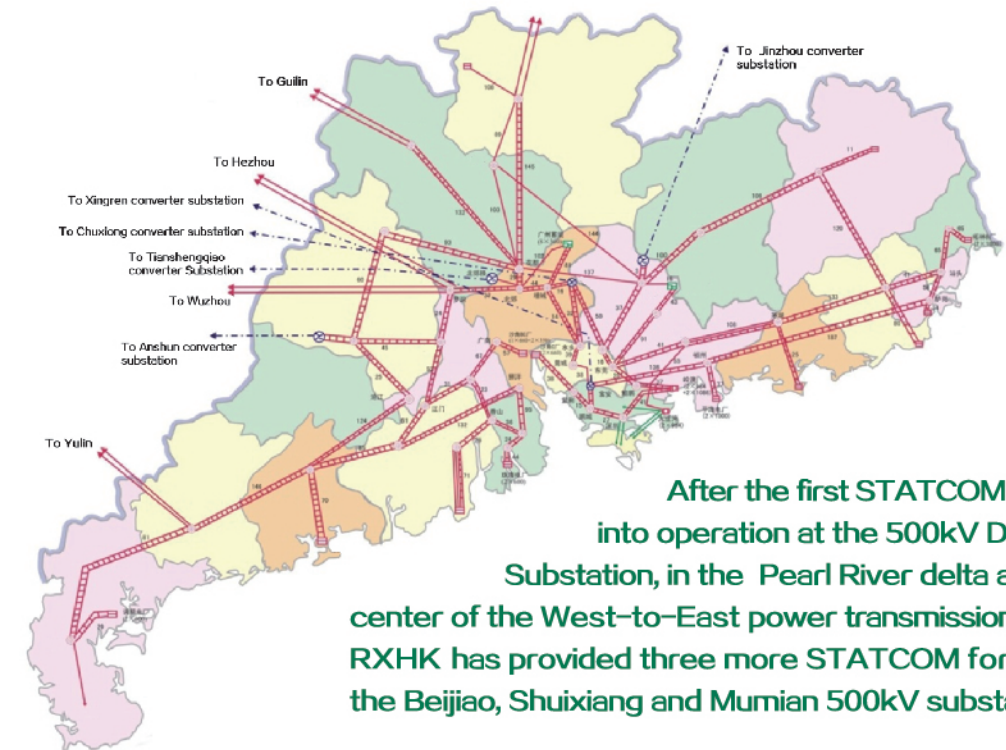


First PP-IGBT based STATCOM in the world

### CSG Dongguan Substation STATCOM Project

- Dongguan 500kV Substation
- Load center: dynamic reactive power compensation, voltage stabilization, reactive power reserve, against serious fault
- 35kV,  $\pm 200\text{MVar}$  STATCOM
- Commissioned: July 2011

## Project Case Study



After the first STATCOM was put into operation at the 500kV Dongguan Substation, in the Pearl River delta area load center of the West-to-East power transmission corridor RXHK has provided three more STATCOM for CSG at the Beijiao, Shuixiang and Mumian 500kV substations.



- First application using 100MVar level STATCOM to solve load end large grid reactive power shortage problem
- First application using 100MVar level STATCOM to solve DC connection point voltage recovery problem.

Increased power grid stability safety level, creating a utility application concept for the use of large capacity STATCOM in power grid.

## Project Case Study



### South Africa Power Grid STATCOM Project

- 275kV Garona Substation
- Electric railway: mitigate voltage fluctuation and phase imbalance
- Imbalance reduced from 2.5% to 0.5%
- Capacity:  $\pm 50\text{MVar}$

## Project Case Study



### Mozambique Nampula STATCOM Project

- 220kV Nampula Substation
- Transmission line: voltage stabilization, suppression of system oscillation
- Capacity:  $\pm 75\text{MVar}$

## Project Case Study

RXHK provided all the MV switch gear, auxiliary power supply, step-up transformer and installation.



### UK Burbo Bank STATCOM Project

- Burbo Bank Wind Farm
- Wind Farm: suppression of reactive power fluctuation, speed up voltage recovery after fault
- Capacity:  $\pm 50\text{MVar}$

## Project Case Study



### UK Race Bank STATCOM Project

- Race Bank Wind Farm
- Wind Farm: suppression of reactive power fluctuation, speed up voltage recovery after fault
- Capacity:  $2 \times \pm 120\text{MVar}$

## Project Case Study



### Serbia Sirmium STATCOM Project

- Metallurgy: mitigate voltage flicker
- Capacity:  $\pm 30\text{MVar}$
- Power factor  $> 0.97$
- Flicker mitigation ratio  $> 4$

## Project Case Study



### India Western Region Grid STATCOM Project

- India WR STATCOM
- Substation power grid reactive power compensation, transient voltage support
- 3 sets  $400\text{kV } \pm 300\text{MVar}$

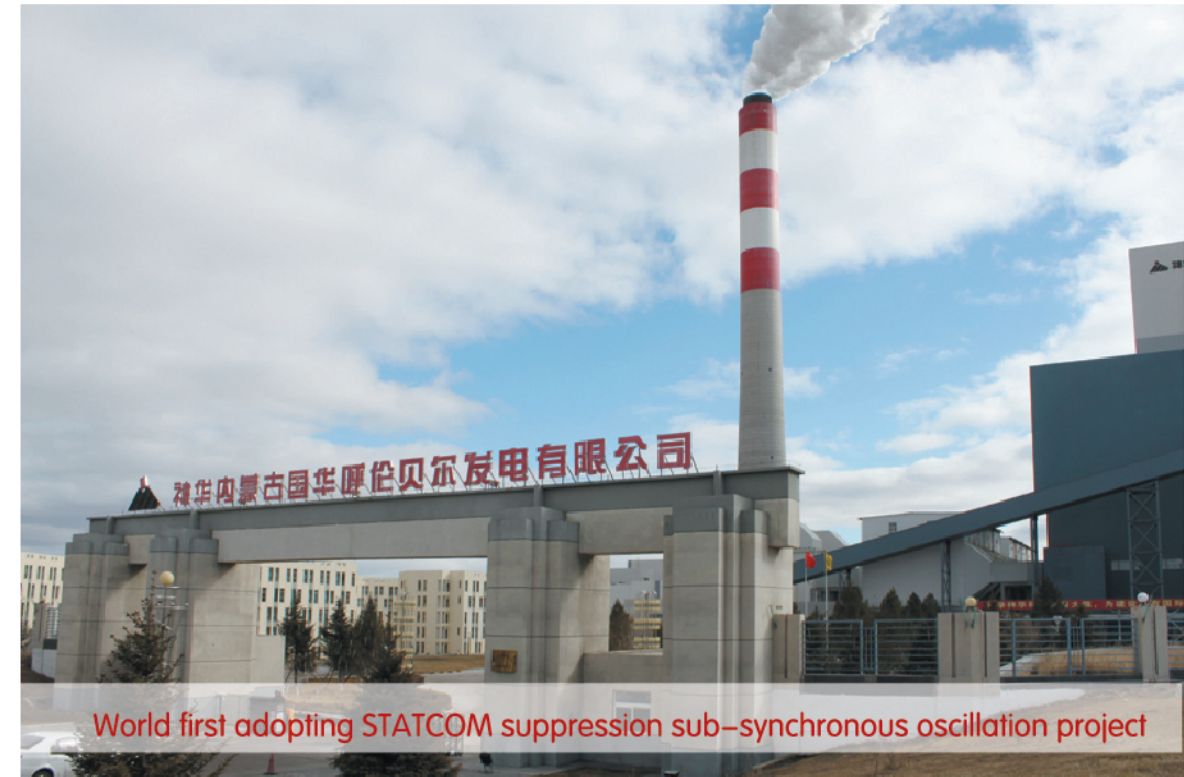
## Project Case Study



### Kenya Lake Turkana Wind Power STATCOM Project

- 220kV Loyangalani Substation
- Wind Farm: suppression of reactive power fluctuation, speed up voltage recovery after fault, stability export substation.
- 3 sets of 30kV ±100MVar

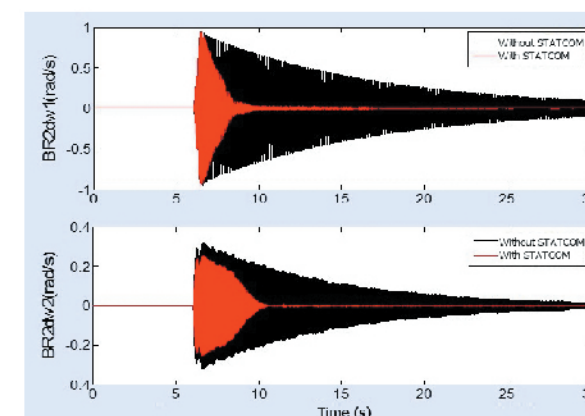
## Project Case Study



World first adopting STATCOM suppression sub-synchronous oscillation project

### Hulun Buir Power Generator Plant STATCOM

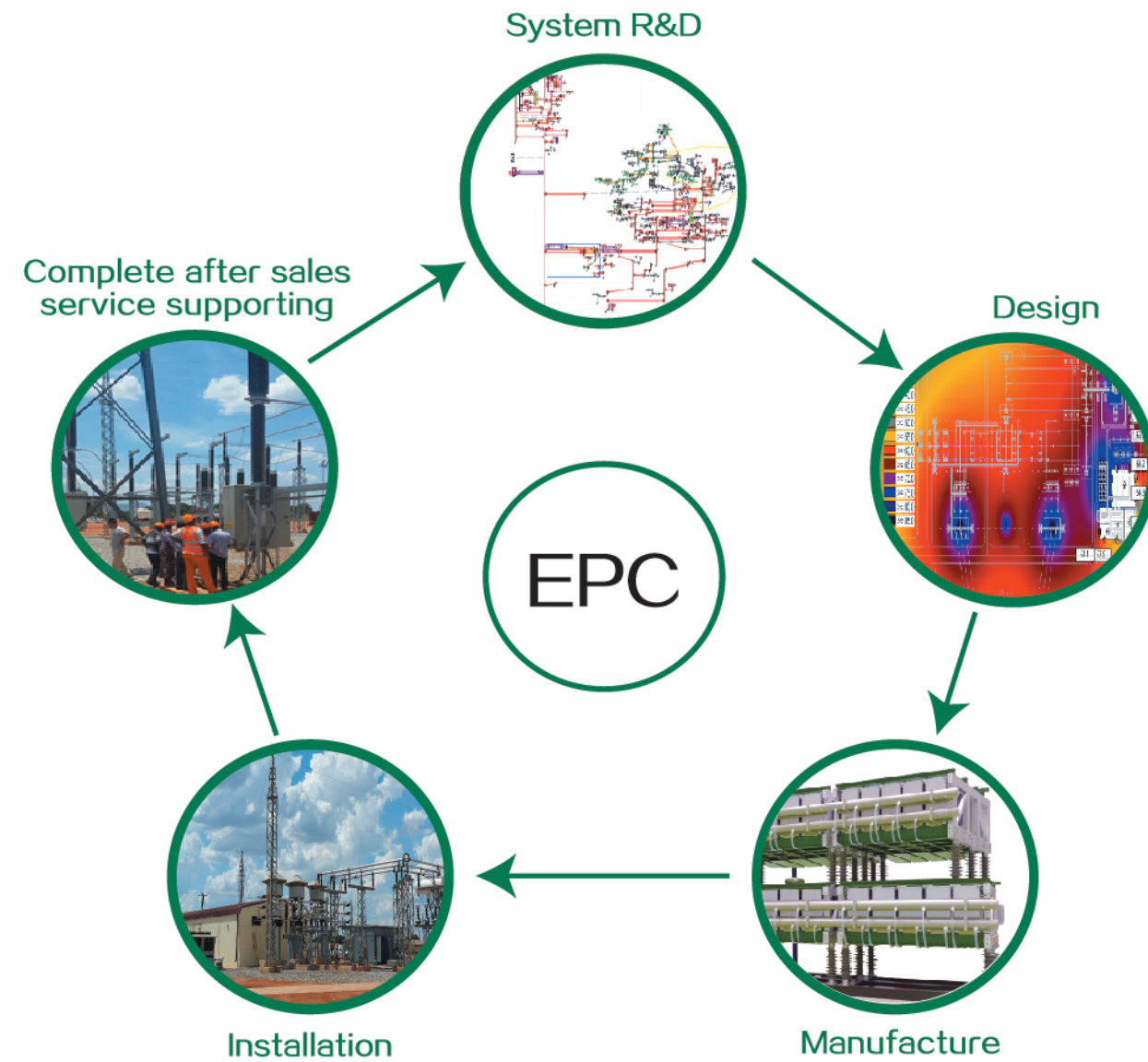
- 220kV Baorixile Substation
- 2 sets of 10kV ±20MVar
- Power generator plant: suppression sub-synchronous oscillation



Testing result shown as left waveform:(1. No.1 generator rotate speed deviation: 2. No.2 Generator rotate speed deviation).

When there is a fault in the power system, generator sub-synchronous oscillation occurs. It will take dozens of seconds for 1# generator speed deviation to decrease from 1rad/s to 0.1 rad/s. Divergence in special conditions will damage generator shaft to reduce life. With MAXI Var, generator speed deviation can be quickly reduced to less than 0.1rad/s. Consequently, the operational life of the generator shaft can be ensured.

# Product and Service System



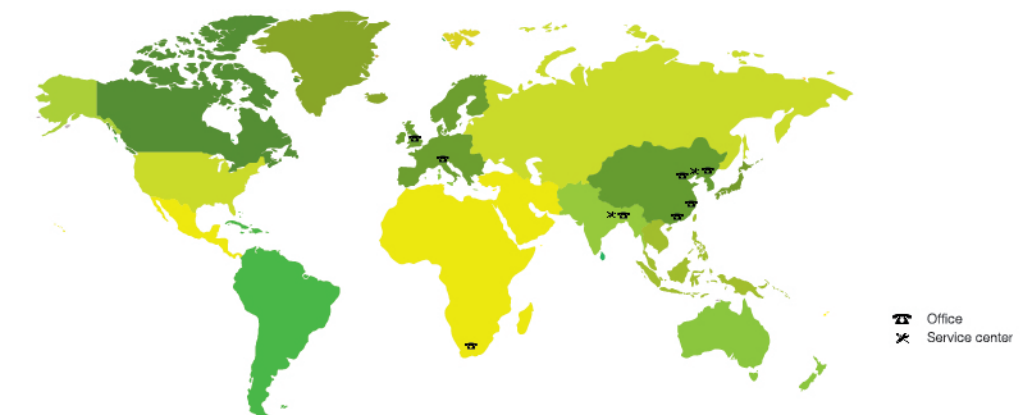
RXHK provide our clients around the world with services including consultation, design, purchasing, construction, operation and maintenance full life-cycle engineering service.

We concentrate on Client's actual needs, using state of the art technology, reliable quality, and service to win the trust of clients.

We have a professional service team. Each service representative has been trained comprehensively and professionally, so as to be able to provide on-site service for all the clients. At each stage of installation, putting in service, maintenance and troubleshooting, our after-sales service representative are available 24 hours, 7 days a week, providing you with timely technical support to solve your problems.



## Office and Service Center Location



## Customer Service



RXHK insists on "Customer-Centric, Service First, Quality Priority, Constantly Striving" principles, providing all our clients with high quality, rapid, convenient service.