RXHK

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Company profile

Rongxin Huiko Electric Co., Ltd. (RXHK) is a high-tech enterprise specializing in the R & D, manufacturing, sales and service of high-end power equipment such as flexible AC/DC transmission and FACTS devices and high-power converters. It is committed to providing customers with intelligent power high-end equipment, complete and comprehensive system solutions and services, and helping to build a new power system based on new energy. The company's main products include three series: HVDC Smart, FACTS and MaxiVert. The products and solutions have been widely used in power transmission and distribution, clean energy and other key areas. Being one of the leading enterprises of high-capacity and high-end power equipment manufacturing in China, RXHK has participated in the construction of many key projects in China, achieved the localization of key equipment, promoted the development level of China's high-capacity power conversion equipment, and helped the upgrading of China's high-end power equipment manufacturing industry.

HVDC Smart is the core equipment of flexible DC transmission system which is one of the key technologies for building a new power system mainly based on new energy and represents the highest level of transmission technology in the world. The 800kV/5000MW UHV flexible DC transmission converter valve independently developed, designed and manufactured by the company has been successfully applied in the national key project of West to East power transmission (Guangdong-Guangxi Multi-Terminal VSC-HVDC demonstration project at Wudongde station of CSG), marking that the company has become one of the suppliers capable of providing similar products with the largest capacity and the highest voltage level in the world. In addition, the company has also participated in many national key projects of VSC-HVDC transmission, such as the Baihetan project of SGCC, the Rudong offshore wind power project in Jiangsu, the Guangdong Power Grid DC back-to-back project and the Qingzhou offshore wind power project of Three Gorges in Yangjiang, Guangdong province. In 2024, RXHK successfully won the bid for the VSC-HVDC converter stations for COA-WOA interconnection link in Saudi Arabia, which is the first overseas VSC-HVDC project of the company, marking a major breakthrough of VSC-HVDC product in overseas market with independent intellectual property rights in high-end flexible DC transmission technology, standards and manufacturing.

Flexible AC transmission system (FACTS) assemblies are used to improve and enhance the performance of AC transmission systems. The static synchronous compensator (STATCOM) of RXHK FACTS product series is mainly targeted at overseas markets with international customers, being used for renewable energy connection to the grid, transmission network stability and industrial load power quality. These solutions, which comply with IEC and local standards, have been exported to Europe, Africa, Australasia, North America and other regions. The large-capacity high-voltage active filter (HAPF) developed by the company, has been applied to the Fujian Guangdong interconnection DC project, a collaboration between SGCC and CSG to solve the problem of harmonic amplification of conventional DC converter stations and ensure the stable operation of DC system. The SSR-DS product launched by the company is mainly for power plant customers, it applies damping control technology to effectively suppress the occurrence of SSR (Sub-Synchronous Resonance) preventing the damage of thermal generator unit shafts, prolong the service life of the generator and ensuring the safety of power generation. RXHK is one of the manufacturers to apply this technology for the first time in China.

High end converter equipment such as MaxiVert is mainly used in clean energy and national key strategic projects. The 10kV/20MW super power frequency conversion device, independently developed by the company, has broken the previous monopoly of foreign suppliers in China, and has led to the complete substitution of imported equipment in key long-distance natural gas pipeline projects of China, and has driven technological progress and domestic application of core devices such as press pack IGBT. The newly developed power supply assembly by the company for electrical arc furnace can effectively improve the poor power quality caused by rapid voltage and current fluctuations during the operation of traditional AC and DC electrical arc furnaces. Additionally, it eliminates the need for grid-side filter, thereby reducing operating costs of customers. Currently, the company has won bids for projects in the United States, Thailand, Germany, etc. The high-power four-quadrant converter developed by the company is widely used for the BEST (back pressure extraction steam turbine) in domestic million-kilowatt thermal power plants, significantly reducing in power and coal consumption rates at the power plants, thus yielding substantial economic benefits. The 86MVA variable frequency drive independently developed by the company for aerodynamic test platform has broken through several key technical difficulties of frequency conversion such as super power, high speed accuracy, high dynamic response, high energy consumption braking, high electromagnetic compatibility and high reliability, solving the bottleneck in aerodynamic test of big aircraft in China. In parallel this development has promoted the progress of relevant domestic industries, and has made important contributions to the development of aviation equipment in China through the enhancement of R&D and testing capacity of key national major technical equipment.

“Energy equipment manufacturing base”

Globally the Energy Transition has seen an increased focus on VSC-HVDC, FACTS devices and energy efficient electrical drive systems. In order to meet the growing market demand and to support an expanded scale of business, RXHK is building an enhanced energy equipment manufacturing base in Anshan’ s High-tech District harnessing intelligent manufacturing technologies orientated to the demanding high-end requirements of the transmission and distribution industry.

This new manufacturing base includes a manufacturing centre, production test centre and R & D centre. Upon completion, it will deliver the R & D, design, production and manufacturing activities of the company's flexible HVDC transmission converter valves and other products.

The base covers an area of 100,000 square meters. Within this area, the production test centre has high-end intelligent test facilities such as a 1100kV high-voltage insulation test hall, and converter valve operation test platform that simulates the actual project operation conditions. The manufacturing centre delivers a constant temperature and humidity production environment with anti-static controls. The combination of digitalisation and automation of the core process leads to greatly improved production efficiency and quality level.

Robot workstation for power stack pressing

- Man-machine cooperation

The robot workstation uses teaching technology which makes programming easier and easy to use. Parametric assembly can be realized by inputting simple data into the teaching panel.

- Multi-mode

The feeding slide of the workstation is equipped with high-precision sensors which can identify power stack of different heights, it also supports a variety of working modes to meet different working conditions.

- Intelligence, integration and digitalisation

The workstation detects the travel of the disc spring through high-precision sensor with the cumulative measurement accuracy of < 0.1mm.

Power module production centre

The power module production centre is professionally designed and tailored to meet the needs of the company's products. The facility can carry out the assembly, wiring and inspection of the whole power module starting from parts and components.

Comprehensive test platform for tightness of power module cooling circuit

The cooling circuit test platform provides air tightness and dynamic liquid stability testing. The liquid tightness test can simulate the actual working conditions of hydrodynamics and dynamically control the environmental variables. After passing the systematic test of this platform, the converter valve cooling circuit can fully meet the stringent requirements of the whole life cycle reliability of power grid and industrial operational scenarios.

Power module test platform

The power module test platform provides a highly automated intelligent test environment in which both specific and generic tests can be performed. The components of the test environment include the test object isolation room, relocatable test console and water cooling system. Test objects can include power modules made up from different types of power devices, power module topologies such as half-bridge, full-bridge, three-level, five-level as well as those with multiple voltage, current and conversion functions. Functional tests, communication tests, control and protection tests, device characterisation testing, operational tests and other R&D test, type test and routine test can all be accommodated in an environment characterised by high test accuracy, efficiency, safety, multi-functionality and convenient operation.

Valve section operation test platform

Consisting of an operational test circuit, short-circuit current injection circuit, power supply system, water cooling system, control protection and monitoring system, measurement system, etc. All type tests required on valve assembly levels that are needed to demonstrate compliance with requirements of GB/T 33348, IEC 62501 and IEC 62927 standards can be carried out, including maximum continuous operation load test, maximum transient overload operation test, maximum voltage continuous operation test, minimum DC voltage test, short-circuit current test, etc., as well as the routine operation test of power module and valve assembly. The test parameters can cover the test requirements up to those required for a 5000MW flexible HVDC converter valve, and will have the test extension ability for power modules and valve components of higher capacity in the future.

High voltage shielding laboratory

The high voltage shielding laboratory is equipped with power frequency voltage generator, DC voltage generator, AC/DC partial discharge tester, water cooling system and other test equipment. It has superior shielding performance and can carry out flexible HVDC converter valve insulation test items such as AC voltage test between valve terminals, DC voltage test between valve terminals and AC-DC voltage test between valve terminals, complying with GB/T 33348, IEC 62501, IEC 62927 GB/T 16927.1 and other relevant standards.

Production Test Centre

The RXHK production test centre comprises an area of approximately 15,000 square meters and is equipped with advanced testing facilities including a comprehensive power module testing platform, environmental laboratory, valve section operation testing platform, multi terminal flexible DC testing system, micro power high-power inverter testing platform, and facilities to test a fully assembled FACTS systems.

The test centre provides a complete facility for the testing of RXHK's three major product lines: HVDC Smart, FACTS, MaxiVert and new products such as energy storage systems, by providing multi-faceted and full working condition testing conditions for components, sub-assemblies and complete systems. As well as supporting production the facility further enhances and expands RXHK's research and development capabilities for leading edge high-capacity energy conversion systems for future power networks built on renewable energy sources.

1100kV Ultra-high Voltage Dielectric Test Hall

RXHK's 1100kV ultra-high voltage dielectric test hall covers an area of about 5000 square meters, with a building height of 48.2m. It is equipped with a 2400kV DC voltage generator, 1800kV power frequency test transformer, 4800kV impulse voltage generator, 1800kV radio interference measurement device, and AC compensation circuit matching equipment. It can carry out valve section DC withstand voltage test, AC withstand voltage test, and operation functional tests. All insulation test items for flexible DC converter valves specified in IEC and national standards, such as lightning impulse test on valve supports and AC-DC withstand voltage test between valve ends, have a voltage level of 1100kV, which meets the international advanced level of ultra-high voltage. This provides strong test conditions support for the RXHK flexible DC transmission complete set of equipment products.

Num.	Name	Test Equipment Function Description
1	DC voltage generator	Output DC voltage to meet the DC withstand voltage test between valve bracket and valve end
2	AC voltage generator	Output AC voltage to meet the AC withstand voltage test between valve bracket and valve end
3	Impulse voltage generator	Output lightning and operation impulse test voltage to meet impulse withstand voltage test requirements
4	Radio interference measurement test device	Can be used as a coupling capacitor for radio interference measurement tests, a coupling capacitor for partial discharge measurement, and a capacitive voltage divider for AC voltage measurement
5	Compensation circuit device	Adjust the parameters of the test circuit

HVDC Smart

Technical advantages

- Voltage level and capacity : the maximum voltage level reaches ±800kV and the maximum capacity reaches 10000MW.
- Operating efficiency : the press-pack IGBT flexible HVDC converter valves now have extensive application experience, and the efficiency of the new generation of low loss crimped IGBT converter is higher than 99.3%.
- Reliability : the full link redundant valve control system avoids the bypass of the converter valve power module caused by the failure of a single board card. The multilevel redundant bypass intrinsically safe converter valve technology avoids the system locking trip caused by the failure of a single power module of the converter valve.
- Control performance : the high-speed control platform, communication delay is only 26μs, which can manage the voltage balance across up to 512 module levels.
- Environmental adaptability : fully airtight press-pack power device based compact and lightweight converter valve provides strong environmental adaptability, having passed the environmental tests such as salt spray, mold, vibration, etc.
- Maintainability : expert system for the overall health status of converter valve and the intelligent maintenance plan developed based on big data analysis.

Typical performance of HVDC Smart

Guangdong-Guangxi Multi-Terminal VSC-HVDC Demonstration Project at Wudongde Station of CSG

Based on the Chinese national key R&D program 'Research on key technologies and engineering demonstration application of high voltage and large capacity flexible HVDC transmission', RXHK has successfully developed the ±800kV/5000MW UHV (Ultra High Voltage) flexible HVDC transmission converter valve.

The ±800kV/5000MW flexible HVDC transmission converter valve of RXHK adopts symmetrical bipolar, high and low voltage valve bank, full bridge and half bridge hybrid modular multi-level topology, and has the ability of DC fault self-cleaning and online switching off of the valve bank. The converter valve has rated DC voltage of ±800kV, rated DC current of 3125A, rated active power of 5000MW and rated reactive power of 1000MVar.

The RXHK ±800kV/5000MW flexible HVDC transmission converter valve successfully passed the type tests in accordance with IEC62501-2014 and were witnessed by a third party. The project has demonstrated that RXHK has the product development and engineering capacity to meet the standard and engineering requirements, as well as the product appraisal and overall technical level to reach world leading levels.

RXHK designed and supplied the ±800kV/5000MW flexible (VSC) HVDC converter valve for the Longmen station pole 1 (first set) of Wudongde project, which was put into commercial operation in December 2020.

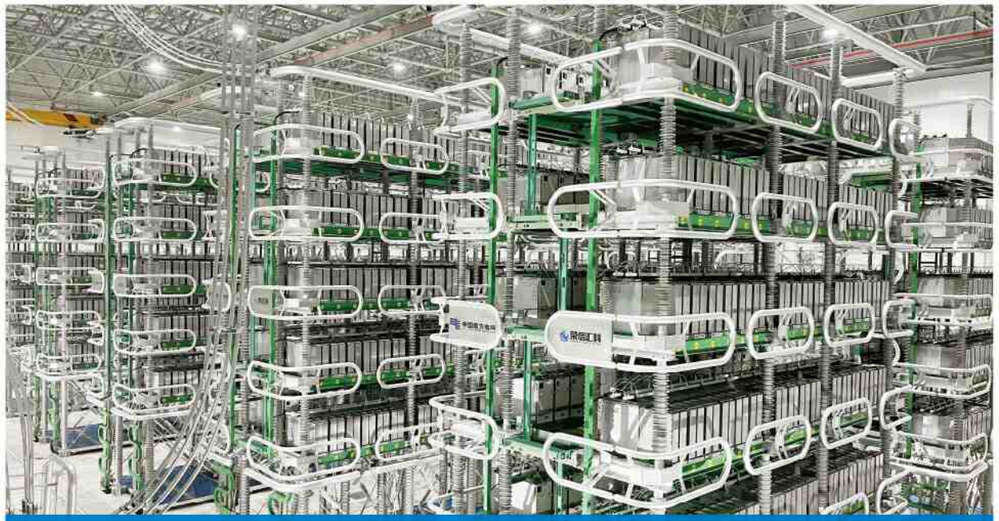
Rudong-Jiangsu Offshore Wind Power VSC-HVDC Transmission Project

The Three Gorges group has built an 800MW (H6, H10) offshore wind power project in Rudong, Jiangsu Province. The project is located in the Huangshayang sea area east of Rudong, with a total investment of about 14.3 billion RMB and 200 sets of 4MW wind turbines with total installed capacity of 800,000kW. In parallel CGN built a 300MW (H8) offshore wind power project in Rudong, Jiangsu Province, the project is located also in the sea area east of Rudong, with a total investment of about 6 billion RMB and 67 sets of 4.5MW wind power with total installed capacity of 300,000kW.

Three Gorges Group and CGN have jointly built an offshore VSC HVDC grid connection. This is the first time that VSC HVDC transmission technology has been applied to offshore wind power in China. It is also the first ±400kV VSC HVDC transmission offshore wind power project in China, with a capacity of 1100MW and DC submarine cable length of more than 100km, and also being at the time of commissioning the highest voltage level and the longest transmission distance in China.

The offshore VSC HVDC grid connection for the project includes the construction of an offshore converter station and an onshore converter station. RXHK undertook the development and supply of the ± 400kV/1100MW converter valve for the onshore converter station, and signed the supply contract in October 2019. Now commissioned, in November 2021, it can achieve an annual on-grid power of 2.4 billion kWh, which can meet the annual power consumption of about 990,000 households. Compared with coal-fired power plants of the same scale, it can save 740,000 tons of standard coal, ~1.83 million tons of carbon dioxide and ~7.12 million cubic meters of fresh water every year, which has important economic, social and ecological benefits.

Typical performance of HVDC Smart



Back-to-Back VSC-HVDC project of Guangdong Power Grid

The project significantly improves the mutual power capacity assistance of the southeast and southwest regions of Zhuhai, effectively resolve the problem of the short-circuit current of Guangdong power grid being exceeded, reducing the AC/DC interaction impact of the Guangdong power grid and the risk of large-scale power outage. Thus ensuring the safe and reliable power supply of Dawan district, and helping the economic and social development of Dawan district. Completed in July 2022 the converter stations of the project are the largest indoor back-to-back VSC HVDC converter stations in the world.

RXHK has delivered four sets of ±300kV/1,500MW VSC HVDC converter valves and auxiliary equipment for the project.

SGCC Baihetan-Jiangsu ±800kV VSC-HVDC project

The project adopts the world's first VSC plus conventional LCC hybrid cascade HVDC transmission technology. The project developed and applies a controllable self-recovery energy absorber that can deliver millisecond energy balance, changing the HVDC scheme from relying on the power grid to supporting the power grid. This alleviates the voltage stability risk caused by the reduction of thermal power units in East China Power Grid, and thus improves the power receiving capacity of East China Power Grid. The Gusu converter station at the receiving end of the project is the world's first converter station with hybrid cascade connection of LCC and VSC HVDC.

RXHK were awarded a contract by SGCC to supply an IGBT converter valve for Gusu converter station of the project. After the completion of the project in July 2022 large-scale power transmission from Baihetan hydropower station is ensured, which in turn has supported the transformation of Sichuan's resource advantages into economic advantages, and another energy artery from East to West in China has been added.

FACTS

Technical advantages

- Parallel connection to 6-110kV power grid
- Multi-level structure with small output voltage harmonic, low loss and switching frequency
- Advanced PP-IGBT power device application delivering high reliability
- Small footprint
- Low loss, valve bank loss ⩽ 0.7%
- Minimum operating voltage up to 0.1pμ
- Fast reactive power response, less than 10ms
- Redundant design with bypass time less than 5ms to continue the system operation
- Control system with fast response, <100 μs, double redundancy and seamless switching
- Efficient heat dissipation design and various control functions with various installation forms

Typical performance of FACTS

OZ Minerals Carrapateena STATCOM, Australia

- Carrapateena mine power grid connection
- Stabilize voltage and improve power quality
- Capacity: 2×±15MVar
- Equipment voltage level: 11kV

Stockyard Hill Wind Farm STATCOM, Australia

- Stockyard Hill wind farm
- Reactive power compensation, transient voltage support
- Capacity: 4×± 16MVar
- Equipment voltage level: 33kV

Moma B STATCOM, Mozambique

- Kenmare Moma B sands mine power grid connection
- Stabilize voltage and improve power quality
- Capacity: ±15MVar
- Equipment voltage level: 10kV

Typical performance of FACTS

Shenhua Shengli Power Plant SSR-DS project

- Shenhua Shengli 2×660MW power plant
- Suppression of sub-synchronous resonance
- Capacity: 2×±25MVA
- Equipment voltage level: 10kV

Fengjie Power Plant of Huadian Power International SSR-DS project

- Fengjie power plant
- Suppression of sub-synchronous resonance
- Capacity: 2×±14MVA
- Equipment voltage level: 10kV

Fujian-Guangdong DC Interconnection Converter Station HAPF project

- Fujian Guangdong interconnection converter station
- High voltage active filter
- Capacity: 2×±100MVA
- Equipment voltage level: 110kV

MaxiVert

Technical advantages

- Highly reliable engineering design, high-voltage press-pack IGBT power module, small number of devices, large power density and small footprint.
- Extensive product range, three-level, cascade multi-level products, voltage 3kV-18kV, power 5MVA-256MVA.
- Ultra high frequency output 0-350Hz, suitable for integrated compressor unit or ultra-high speed test bench.
- Mature network side rectification technology, including diode rectification and PWM feedback rectification can design two quadrant and four quadrant solutions according to requirements.
- The modular design of power unit and the design of water-cooled plug-in self closing lock make the maintenance simple and convenient.
- The efficiency is as high as 98.6%, which is energy-efficient and reduces the user's operational costs.
- A closed deionized water cooling scheme is adopted for the internal circuit with a variety of external cooling schemes to adapt to different project sites.
- The configuration scheme is flexible. It can be equipped with either oil immersed transformer or dry-type transformer, and can drive asynchronous motor, brushless or brush synchronous motor, and permanent magnet synchronous motor.
- Excellent control performance, two tenths of a million high speed accuracy, fast torque dynamic response, fast braking and parking function, meeting the application requirements of high demand test facilities.
- Strong adaptability to the power grid, no shutdown or capacity reduction in case of large fluctuation or instantaneous power failure of the power grid.
- Optional redundancy and highly configurable design, suitable for high reliability, long-term continuous and stable operation.

Typical performance of MaxiVert

Aerodynamic test project

- Main drive compressor of test bench: 1×11kV/86MVA (synchronous machine)
- Auxiliary drive compressor of test bench: 1×10kV/25MVA (synchronous machine)

Four-quadrant converter for BEST (back pressure extraction steam turbine) in million-kilowatt thermal power plants

- Huaneng Ruijin power plant: 2×8kV/21MVA
- Guoneng Yueyang power plant: 2×8kV/23MVA
- Shanxi Coal Yiyang power plant: 2×9kV/25MVA
- Fujian Huadian Kemen power plant: 2×8kV/25MVA

China-Russia Eastern Line Natural Gas Pipeline project

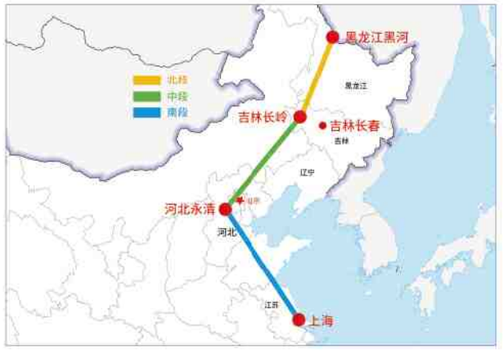
- Tangshan compressor station: 3×10kV/23MVA
- Shenyang compressor station: 4×10kV/20MVA
- Jinzhou compressor station: 2×10kV/20MVA

Petrochemical industry

- Jinneng Chemical 900,000 ton PDH project: 1×10kV/65MVA
- Wanhua Chemical PDH project: 1×10kV/44MVA

Shanxi-Beijing Fourth Line Gas Pipeline project

- Hongdunjie Station Phase II: 1×10kV/21MVA
- Tokto Station: 4×10kV/18.5MVA
- Ulanqab Station: 4×10kV/21MVA
- Ordos Station: 4×10kV/23MVA



China-Russia Eastern Line Natural Gas Pipeline project (Heihe-Changling) mainline

- Wudalianchi gas transmission station: 3×10kV/23MVA
- Mingshui gas transmission station: 4×10kV/23MVA
- Zhaoyuan gas transmission station: 3×10kV/23MVA