

NR COOLING SYSTEMS SOLUTIONS FOR RELIABLE ENERGY SUPPLY

NR Solutions

INTRODUCTION

NR Electric (NR), as a power stability expert, is dedicated to provide smart, flexible, reliable and environmental friendly solutions for power generation, power grid and industries. The products and solutions cover protection, automation & control, HVDC & FACTS, Renewable & Micro-grid and Engineering consulting & services.

NR has stood for rugged reliability and world-class engineering including more than 20 years of professional experience of digitization, electrification and high-tech innovations. NR provides a wide spectrum of electrical and power electronics solutions to enable its worldwide customers to meet the growing challenges of quality and safety. It also offers turnkey and specialist electrical services provided by more than 4000 high tech employees across the globe. NR has become a worldwide recognizable multinational company by expanding its business to over 100 countries & regions.



The Factory Effect Drawing

| WHY NR Electric (NR)

Flawless Quality and High Reliability

NR water cooling systems are of flawless quality and high reliability and can provide stable cooling for the power electronics equipment. NR cooling systems are designed with suitable redundancy, both in components and control. The redundancy can also be increased according to the requirements of users.

Custom Solutions

NR will provide the most suitable products according to needs of customers and different applications such as different voltage levels, different cooling capacity, different dimensions and different climate.

Mature Technology

NR has a complete R & D, production and manufacturing capacity from basic heat sink unit to complete valve cooling system. It can provide water cooling system custom-made solutions for various industrial and power transmission applications. NR water cooling systems are reliable and energy efficient solutions with optimized life cycle cost. They have a cooling capacity from 20kW to 8250kW or higher.

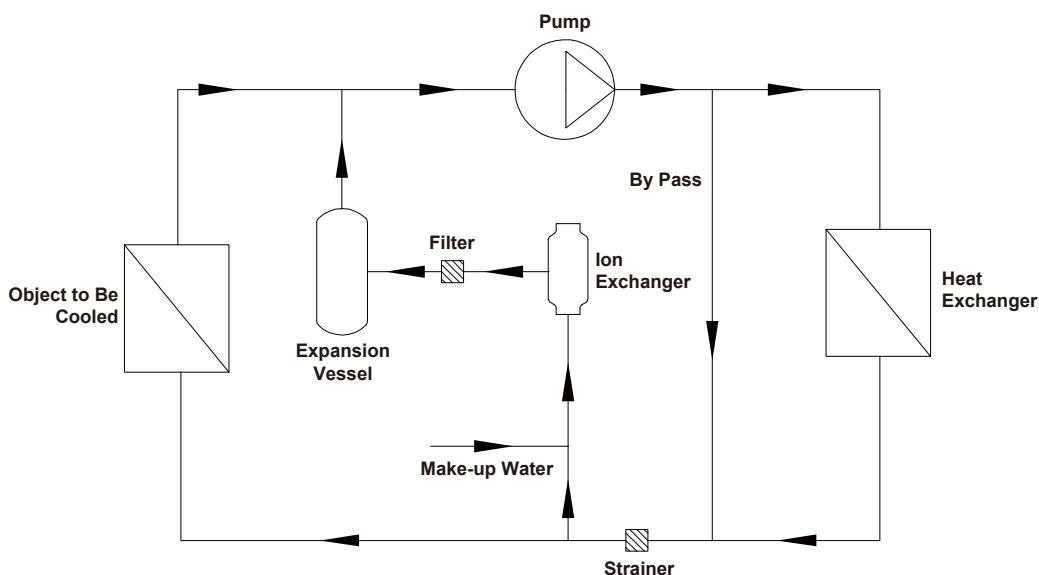
Experience in Cooling Electrical Power Equipment

NR is also a leading global technology company in power industry. It has a better understanding of how valves and cooling equipment work together.

How NR Cooling Systems Work

The principle of all water cooling systems is fundamentally the same. There is a main loop that cools the object.

Water transfers the heat to water-water or water-air heat exchangers. A small part of the flow from the main loop passes through a water-treatment circuit. The water is filtered mechanically and is also continuously purified, maintaining the conductivity of the cooling water as low as required.



Object to Be Cooled

Semiconductor valves for HVDC, SVC, SFC and STATCOM applications, etc.

Pump

To provide the power required by the cooling medium. Two pumps are equipped, one active and one standby, and each is with 100% of capacity.

By Pass

To distribute warm water in order to keep the cooling water at the required temperature.

Heat Exchanger

To dissipate the heat of the cooling medium in main cooling circuit.

Make-up Water

To replenish water manually or automatically when the cooling medium are consumed.

Ion Exchanger

To deionize the water to a defined level with chemical resin.

Filter

To prevent small particles from circulating in the system.

Strainer

To prevent particles from entering the semiconductor valve.

Expansion Vessel

To buffer the volume variations of the cooling medium caused by temperature variations.

| Products and Application

NR Electric is a leading specialized provider for closed-loop circulating water cooling equipment for high power electronic devices. We commit to provide professional and complete cooling solutions for global customers, consisting of water distribution solution, heat sink, water cooling system and valve cooling control and protection system.

At present, our cooling systems have been applied in over 100 countries & regions, including Mexico, Brazil, India, South Korea, etc.



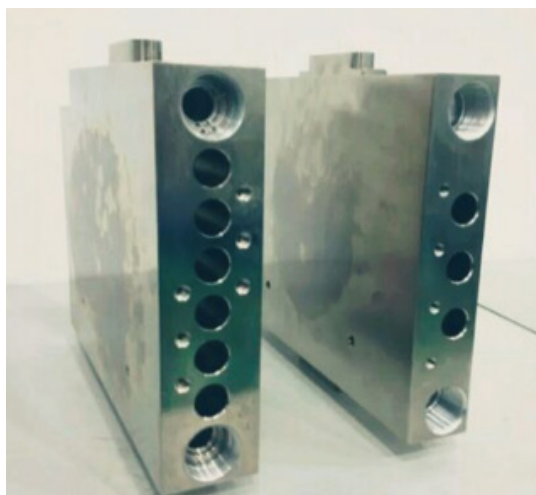
Countries Where NR's Cooling Systems Are Installed

What NR Provides

According to users' needs, NR not only provides a complete set of water cooling system, but also each part in it, including heat sink, water distribution solution, external cooling equipment, control & protection system, etc.

Heat Sink

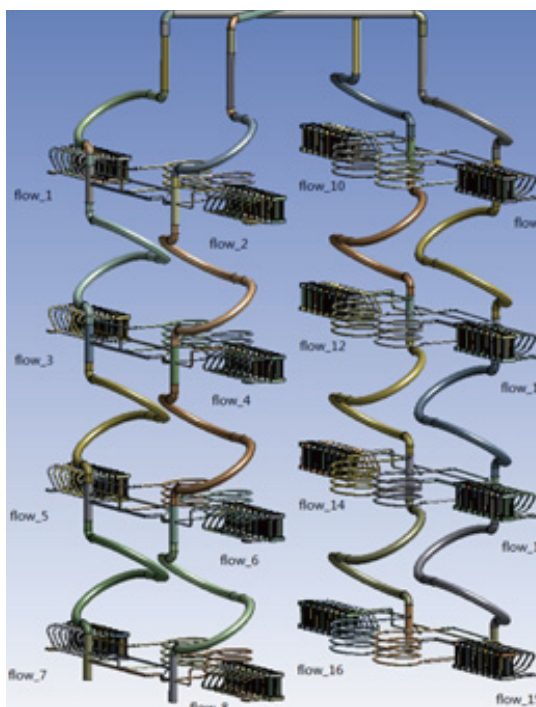
It is used to transfer the heat of IGBT or Thyristor to water. Welding process, material selection and runner form are the key to ensure its performance. The design of every kind of heat sink has been verified by experiment and simulation.



The Heat Sink

Water Distribution Solution

NR can provide water distribution design and related connecting pipes and fittings to avoid some thyristors working at dangerous temperature caused by uneven distribution of water.



The Heat Sink

Heat Exchanger

Heat exchanger needs to be selected according to its working conditions. Dry air cooler, evaporator, chiller and PHE are provided to adapt to different conditions.



The Heat Exchanger

Control & Protection System

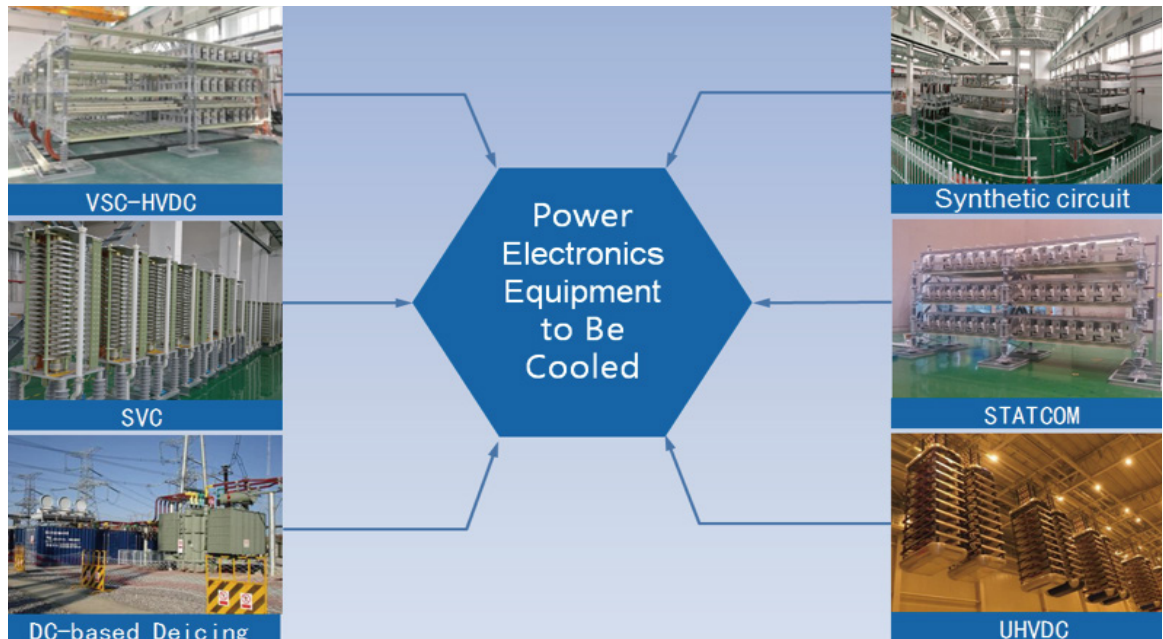
The reliability of NR Control & Protection System is reflected in:

- Systematic electromagnetic shielding design;
- Dual power supply design of host and IO unit
- Powerful software platform



The Control & Protection System

| Application of Water Cooling System



Water Cooling Systems for HVDC

HVDC systems require flawless quality and reliability to achieve the stable conversion of alternating current to direct current and vice versa. To optimize operational performance, all our cooling systems for HVDC are designed with high redundancy, both in components and systems. The water purity in general and low conductivity in particular are other important quality factors we put much effort into to secure flawless quality and highest availability.



The Water Cooling Systems for HVDC

Water Cooling Systems for FACTS Converter

The function principle of flexible AC transmission and distribution thyristor valve water cooling equipment is to take away the heat produced by power consumption of IGBT or Thyristor in SVC, STATCOM, and other high power devices. Closed-loop water cooling system has solved the heat dissipation problems for these FACT devices, while satisfying the compact design and environment friendly requirements. And it is the most widely used and most advanced cooling technology in today's world. The cooling systems for FACTS often have layout complex and short lead time. High quality of components and workmanship are equally important for FACT devices. Our vast experience combined with modular concept helps to deliver efficient solutions at optimized costs.



The Water Cooling Systems for FACTS Converter



Future Prospects

To enhance the security and reliability of power system with technical innovation, high-quality products, and dedicated services.



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