

Research laboratories



Precise temperature control with air conditioning systems benefit State Key Laboratories

The Shanghai Institute of Applied Physics at Chinese Academy of Sciences is a state-run research institute for nuclear science and technology which deals in cutting edge technology and national strategic needs and stands at the global forefront of basic and applied research in its field. In recent years, increasingly in-depth research and high precision requirements for testing environments have resulted in the renovation of the air conditioning system in the Nuclear Lab, a two-storey /3,000 m² building with the following requirements: an exhaust function plus fume hoods supplying adequate amounts of fresh air when the laboratories on both floors are in use; fresh external air centrally processed in a rooftop unit before being dispersed through the various laboratory areas; and air-conditioning unit response varying depending on the interior exhaust output of each room, with air volume and cooling capacity adjusted as necessary; and laboratory temperature control as precise as +/-1°C during experiments.

Accurate cooling in varying occupancy

In response to the requirements of the Institute for its HVAC system, the firm winning the tender for the renovation - Jiangsu Great Air-conditioning Equipment Co., Ltd - customized the design and production of an air-cooled rooftop. In addition to the control of refrigeration system components such as compressors and electric expansion valves, the system's blower uses variable speed control and achieves precise regulation of air conditioning units by integrating continuous modulation with variable speed fan and inverter compressor. Great Environmental Equipment's GTAIR brand air-cooled direct expansion fresh air rooftop unit utilizes Danfoss'VZH inverter scroll compressors to treat outside supply air. During high power operation of the air conditioning units under peak loads, once rapidly approaching the set temperature, the VZH inverter compressor reduces its motor speed according to system load, running in a low energy-consumption mode while providing on-demand cooling capacity to precisely control temperature within the set range. Unlike traditional fixed speed compressors, a rooftop using variable speed compressors avoids frequent Start-Stop, reducing the pressure fluctuations of the air-conditioning system to achieve smooth and precise temperature control within ± 0.3 °C, fully meeting the laboratory's temperature requirements. At the same time, there are significant reductions in power consumption, thus saving energy and CO₂ emissions and high efficiency under part-load conditions.



±0.3°C

Stable temperature in a two-storey building of 3000m²

Renovation of Key Laboratory of Nuclear Analytical Techniques, Shanghai Institute of Applied Physics, Chinese Academy of Sciences

Chairman of GTAIR Mr. Chen De commented, "The high performance, energy efficiency and comfort offered by air conditioning systems using inverter technology are increasingly being recognized by customers, and these products are now our main focus. With Danfoss able to provide us the air conditioner manufacturers with an entire set of reliable and validated solutions including compressors, inverters, line components, and expansion devices, this greatly shortens our product development cycle, ensuring product quality and helping to win the trust of end users. We look forward to working even more closely with Danfoss in the future."

Danfoss partnering with GTAIR

As pioneer in **HVAC technology** targeting environmental and energy challenges, Danfoss offers a range of mature variable-speed solutions. Since its inception in 1968, Danfoss Drives has dedicated itself to the research, development and production of Variable-frequency Drives. The first company in the world to mass produces drives, it now boasts 47 years of experience in the field. In the early 2000, Danfoss Commercial Compressors have joined hands with Danfoss Drives to develop variable speed compressor solutions, tailor-making dedicated inverters for reciprocating compressors and scroll compressors.

In 2012, they introduced the VZH commercial inverter scroll compressor, which has subsequently been recognized in the market for its reliable performance. Danfoss'VZH inverter scroll compressor uses an interior permanent magnet (IPM) motor which operates at high efficiency throughout its entire speed range. Unique lubricant management design and exclusive multiple protection features serve to further enhance the reliability of the compressor. The VZH compressor and inverter package has been validated by extensive testing. The "plug and play" solution considerably shortens system development cycles, saving on manpower and financial investment while also simplifying after-sales maintenance work for the end user. Danfoss' team of technical experts provide comprehensive support to help OEMs respond to challenges arising during the application of new technologies, speed ups product launches, and seize market opportunities.

Danfoss' other components also contribute towards optimizing the system's performance. DC inverter controls and electric expansion valves have been utilized depending on the load variation of each laboratory room so as to precisely control supply from the refrigeration source. The expansion components employed in this Inverter HVAC system are Danfoss, with ETS12.5 electric expansion valves and the superheat controller EKC312, pressure transmitter AKS3000 and temperature sensor AKS21 together forming a stable and quick responding expansion device able to be precisely controlled. It is well known that variation in system load will give rise to changes in the load on a variable speed compressor, which turn affects the refrigerant flow in the heat exchanger. In order to have the cooling system respond quickly to load changes, an accurate and stable expansion device is essential, ensuring stable superheat for the evaporator. The electric expansion valve In Danfoss' ETS works in conjunction with the controller, temperature sensor and pressure transmitter to handle all the load changes generated by the variable speed compressor, so that heat exchange of the entire system is stabilized at the optimum operation.

Final commissioning of the laboratory building's new air conditioning system took place in December 2013, and the system has now been operating smoothly for over one year, a baptism which has encompassed Shanghai's scorching hot summer. The consummate air conditioning performance, precise temperature control and superior comfort experience has attracted praise from the researchers at the Institute of Physics and at the same time has solidified the partnership between GTAIR and Danfoss.

Danfoss inverter technology is increasingly being used in commercial and industrial central air conditioning, and to date has been successfully applied in a number of different fields such as data centers, shopping centers, holiday resorts, science campuses, and mushroom cultivation, bringing end customers cooling systems with higher energy efficiency, greater convenience, and more stable operation. We will continue to leverage advanced inverter solutions to create entirely novel inverter HVAC systems for still more customers in science, education, and other areas.

Information on products used in the renovation of the Key Laboratory of Nuclear Analytical Techniques:

- Equipment Name: GTAIR air-cooled direct expansion fresh air rooftop air rooftop unit
- Model: GT-WKX-240 x 3 units; GT-WKX-180 x 3 units;
- Danfoss products utilized:
 - Compressor + drive package: VZH088AG + CD5303; VZH117AG + CD5303
 - Control valve parts: ETS12.5 electric expansion valves; EKC312 superheat controllers; AKS3000 pressure transmitters; AKS21 temperature sensors; DML filter drier; sight glass

About GTAIR:

Jiangsu Great Air-conditioning Equipment Co., Ltd is a high-tech enterprise focused on the development and production of air conditioning products in air economization and artificial environments. Its products involve a number of specialized and general areas, including fresh air handling units, rooftop units, unitary air conditioner for large spaces, and specialized air conditioning systems. GTAIR products are widely used in sectors such as government, health care, scientific research and education, telecommunications, precision manufacturing, Bio-pharmaceutical industry and aerospace.