

Press Information

September 9, 2024

Success in performance testing of a liquid ammonia pump for thermal power generation

Nikkiso has successfully conducted the LPG performance testing of a pump for liquid ammonia with a motor capacity of 132 kW and confirmed that it performs as designed. This pump has Submerged structure, that does not leak liquid ammonia outside, and uses a canned motor to protect the motor from corrosive ammonia.

This is the world's largest successful test of an ammonia pump with a Submerged structure using a canned motor. The scale of the pump is compatible with applications of where it is installed in storage tanks at thermal power plants where ammonia is mixed with a portion of the fuel and pumped to boiler facilities.



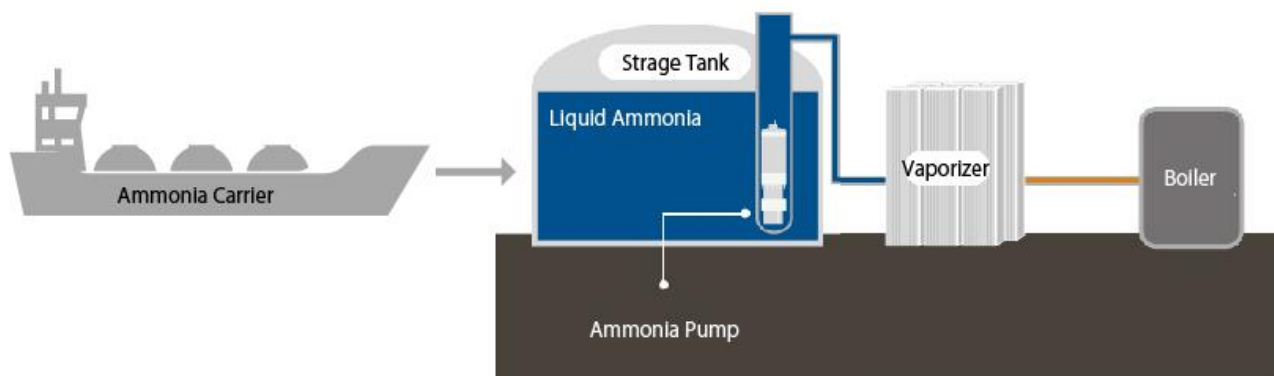
Left Ammonia pump after testing

Right Cryogenic pump test facility

■Key technology -canned moter pump-

Nikkiso has already established and commercialized canned motor pump technology for liquid ammonia, and has delivered several thousand pumps worldwide for ammonia refrigeration. Normal pumps, in which the drive motor and pump are separated, liquid leaks occur from the connections, whereas canned motor pumps eliminate the risk of leakage with no connection. In addition, the motor is isolated from the liquid flow path to prevent deterioration due to exposure to the corrosive liquid ammonia.

Toward the realization of a decarbonized society, liquid ammonia is expected to find new applications as a fuel for power generation and as a hydrogen energy carrier. In particular, the use of the ammonia pumps in ammonia storage tanks at thermal power plants and ammonia terminals requires larger pumps than traditional uses due to the need for large scale transfer.



To meet this need, Nikkiso has developed a pump for liquid ammonia that incorporates the technology of cryogenic pumps used for mass transfer at LNG terminals to achieve a larger pump size. The submerged structure used in cryogenic pumps also prevents leakage of liquid ammonia outside the tank.

In this LPG performance test, the pump successfully transferred LPG with a motor capacity of 132 kW, one of the largest in the world for a liquid ammonia pump with a submerged structure using a canned motor. The fact that Nikkiso was able to successfully conduct performance tests on a scale consistent with use in storage tanks at thermal power plants is due to the technology and knowledge it has accumulated over many years in the area of both canned motor pumps and cryogenic pumps.

■LPG Performance Tests

The LPG performance test is a performance test conducted using LPG (-42°C), which has a temperature range similar to that of liquid ammonia (-33°C). When the pump is immersed in liquid ammonia at -33°C, it is cooled and each metal part is affected by shrinkage and other factors. This time, the test was conducted under conditions similar to the actual operating environment with liquid ammonia, using a pump with a shape and corrosion countermeasures closer to those of the actual pump. This allowed us to obtain data that approximated actual operating conditions and to confirm the integrity of the pump with respect to characteristics of liquid ammonia.

■Future Developments

In Japan, there are plans to start commercial operation of thermal power plants with 20% ammonia mixed in as early as FY2027, and Nikkiso aims to bring a pump for liquid ammonia for thermal power generation to market in 2026. In addition, we will continue to develop the larger liquid ammonia pumps for accommodation higher ammonia co-firing rates and expanding the use of the pumps into PC tank* applications at ammonia bases.

Nikkiso will support the entire supply chain of ammonia, from production, storage, and transportation to consumption, with pumps that customers can use safely and without leaks, thereby contributing to the reduction of greenhouse gases in Japan and around the world.

*PC tanks...Reinforced concrete tanks that do not allow piping to be installed through the wall.

<Nikkiso Miyazaki's cryogenic pump test facility>

The LPG performance test was conducted at the cryogenic pump test facility at Nikkiso Miyazaki Co., Ltd. Performance tests are conducted using actual LNG and LPG to confirm the effects of cryogenic fluids on the pumps. Demand for liquid ammonia pumps for thermal power plants is

expected to grow, especially in Japan and Asia. We will produce highly reliable products by having our customers witness the operation of our pumps and incorporating their needs.

<Appendix: Market Outlook>

Fuel ammonia is expected to be used as an alternative fuel for thermal power generation toward carbon neutrality in 2050. According to the "Green Growth Strategy for 2050 Carbon Neutral" (2021), which was prepared mainly by the Ministry of Economy, Trade and Industry, Domestic demand for fuel ammonia is expected to be 3 million tons per year in 2030 and 30 million tons per year in 2050.

In addition, "R&D and Social Implementation Plan for "Fuel Ammonia Supply Chain Establishment" (the Ministry of Economy, Trade and Industry, 2024) under the Green Innovation Fund Project of the New Energy and Industrial Technology Development Organization (NEDO), the global market for fuel ammonia through power generation and supply chain establishment is expected to be approximately 0.75 trillion yen per year in 2030 (power generation: 0.15 trillion yen, supply chain: 0.6 trillion yen) and approximately 7.3 trillion yen per year in 2050 (power generation: 1.7 trillion yen, supply chain: 5.6 trillion yen).

International Renewable Energy Agency (IRENA) reports in "INNOVATION OUTLOOK RENEWABLE AMMONIA" (2022), that global demand for ammonia will grow more than three times in 2050 from the projection for 2025 under the scenario for limiting global average temperature increase to less than 1.5°C above pre-industrial levels. This is due to growth in marine fuel, hydrogen energy carrier, and fuel co-firing applications beginning in the late 2020s, reaching approximately 688 million tons in 2050.

About Nikkiso

Since its establishment in 1953, Nikkiso has contributed to solving social issues by anticipating the changing times with world-first and Japan-first technologies and products. In the industrial business, Nikkiso has created new markets by developing products in the energy field, hemodialysis-related products in the medical business, and CFRP (carbon fiber reinforced plastic) aerostructures in the aerospace business.

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Business Overview:	Nikkiso provides specialized pumps and systems in the Industrial Business, CFRP (carbon fiber reinforced plastic) aircraft parts in the Aerospace Business and hemodialysis related products in the Medical Business.
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