Natural Gas (LNG) Carriers: Packed with Innovations to Accommodate the World’s Energy Supply Needs

Liquefied natural gas (LNG) carriers are marine vessels designed to transport natural gas liquefied at a cryogenic temperature of -162 °C at atmospheric pressure. Kawasaki is the first company to have built domestically produced LNG carriers in Japan. These vessels have three technological features:

1. High-speed, energy-saving propulsive performance
2. Superior energy-saving, propulsive performance
3. Propulsive performance that achieves improved maneuverability and efficient transport operations

Shipbuilders achieve good propulsive performance by optimizing the design of the underwater portion of the ship, in order to reduce hydraulic resistance during navigation, and also by improving engine performance. Optimization of ship structure, in particular, calls for time-tested technological expertise in LNG carrier building and ample navigational experience. The level of such expertise directly affects the design capability of shipbuilders. As the builder of Japan’s first LNG carrier, Kawasaki boasts an unrivaled accumulation of knowledge and expertise in this field.

One invention that epitomizes this expertise is successful development of a proprietary propulsion system powered by a dual-fuel, electronically-controlled gas injection marine diesel (ME-GI) engine, which is capable of using boiled-off gas as fuel and re-liquefying the excess gas. This system results in the world’s lowest boil-off rate. Moreover, Kawasaki has developed a new non-spherical tank that allows for a ship design that enables it to maintain the required size to access major LNG terminals in the world and pass through the expanded Panama Canal, and, at the same time, achieves a larger carrying capacity of 180,000 m³. This advantage makes the tank suited to marine vessel application.

Kawasaki’s Liquefied Natural Gas (LNG) Carriers: A leader in ever-evolving LNG carrier designs

Commentary

Takumi Nozaki
Assistant Manager (right)
Initial Planning Section 2
Engineering Department
Engineering Division
Kawasaki Heavy Industries, Ltd.

Naoko Indoh
Assistant Manager (left)
Initial Design Department, Engineering Division
Kawasaki Heavy Industries, Ltd.

Kawasaki’s Superior Technology

A cutting-edge, energy-saving engine that achieves the world’s lowest boil-off rate

Dual fuel, slow-speed, gas injection marine diesel (ME-GI) engines are becoming mainstream for LNG carriers. The use of both boil-off gas (BOG) boiled off from the LNG in the cargo tank and marine fuel oil, combined with the ship’s unique structure, results in a significant improvement in fuel efficiency. Moreover, by adding Kawasaki’s own BOG partial re-liquefaction system to the propulsion plant, the company has achieved the world’s lowest boil-off rate at 0.015% per day, an impressive improvement from the 0.075% achieved by the tank’s insulation performance alone. The system is designed to liquefy BOG that was not used as fuel, so the system can be defined as one which completely eliminates waste.

Superior Energy-saving, Propulsive Performance

Reshaped tanks for use in a 180,000 m³ LNG carrier that meets the New Panamax requirements

Achieving a 15% increase in capacity compared to a conventional spherical tank of the same diameter and height, this newly-developed tank can be installed on ships that meet the breadth requirements (i.e., the “New Panamax”) to pass through the renovated Panama Canal. The combined volume of four of these tanks is 180,000 m³, an increase in capacity of 25,000 m³. The tank has been designed with a semi-spherical shape, which contracts as a “skirt” that holds the tank, and also by improving engine performance. Optimization of ship structure, in particular, calls for time-tested technological expertise in LNG carrier building and ample navigational experience. The level of such expertise directly affects the design capability of shipbuilders. As the builder of Japan’s first LNG carrier, Kawasaki boasts an unrivaled accumulation of knowledge and expertise in this field.

One invention that epitomizes this expertise is successful development of a proprietary propulsion system powered by a dual-fuel, electronically-controlled gas injection marine diesel (ME-GI) engine, which is capable of using boiled-off gas as fuel and re-liquefying the excess gas. This system results in the world’s lowest boil-off rate. Moreover, Kawasaki has developed a new non-spherical tank that allows for a ship design that enables it to maintain the required size to access major LNG terminals in the world and pass through the expanded Panama Canal, and, at the same time, achieves a larger carrying capacity of 180,000 m³. This advantage makes the tank suited to marine vessel application.