5. Propulsion system

5.1. General

According to the survey conducted by Nippon Kaiji Kyokai (Class NK), the actual results in respect to the new building ships registered in Class NK in 2008 were 552 ships (excluding barges and pleasure yachts), 643 screws and 5,505 MW, which increased by 40 ships, 25 screws and about 96 MW, respectively, compared with those of the previous year. The details are as follows:
- 1 engine and 1 screw ship: 461 ships, 2 engines and 2 screws ship: 91 ships
- Oil lubrication ship: 400 ships, Sea water lubrication ship: 152 ships
- Class 1C propeller shaft: 198 shafts (All 1 engine and 1 screw)
- Class 1A propeller shaft: 2 shafts (Partly rubber rolling, 2 engines and 2 screws)
- FPP : CPP = 533 : 19
- Aluminum bronze cast propeller = 85.0%
- Keyless propeller = 74.6%
- Highly skewed propeller = 22.3%

As shown in the survey report of Class NK, the domestic shipyards have expanded their facilities and progressed with the new technologies for curtailment of the construction period etc., and therefore, the new building amount of ships has been rapidly increasing. In this Chapter, the introduction is made on the biodegradable lubricant newly developed for thruster in addition to the new technologies which contribute the short construction period.

5.2. Biodegradable lubricant

With the amendment of the law by America in February 2009, the use of biodegradable lubricant to the stern tube and the thruster has been recommended. The major concern is when the above recommendation will become obligatory. As for the stern tube, the biodegradable lubricant has already been sold by several makers, and therefore, there have been considerable actual results. However, almost no actual result has been traced of the thruster, since it is not so easy to make lubricant having with the biodegradability. Under the circumstances, Kobelco Eagle Marine Engineering Co., Ltd. (KEMEL) has begun to sell a new product called the biodegradable lubricant for thrusters “KEMEL TH-100” (TH-100). The product of TH-100 is water-soluble lubricant based on polyethylene glycol (PEG), and it has the same characteristics as gear oil has, and further, in addition to biodegradability and non-toxicity, the lustrous membrane is not formed on the surface of sea water body. And also, the lubricate ability is maintained even when sea water is contaminated in there.
PEG has not been used previously, as the compound made swelling FKM which has widely being used as the rubber material for propeller shaft seal. However, the KEMEL, which is a maker of seal rings, has developed the seal materials suitable to TH-100. Also, the KEMEL has developed the seal system of thruster called “Barrier Thruster Seal” (BTX), in which TH-100 and gear oil of mineral system have been combined. The BTX (Fig. 5.1) consists of 4 seal rings, and it is so constructed that the highly pressurized TH-100 chamber is formed between No. 3/4 seal rings and the leakage of gear oil to the outside of ship and the intrusion of sea water into thruster itself can be prevented, and it has been adopted in American market.

5.3. Mono-block type stern tube

Mitsui Engineering & Shipbuilding Co., Ltd. has adopted the mono-block type stern tube called “SIMPLEX-FlexiTube” (Flexitube) sold by Blohm + Voss Industries GmbH (BVI) for handy-max bulk carriers. (Fig. 5.2) As shown in Fig. 5.3, the Flexitube consists of one set of stern tube including the piping for stern tube seal, the temperature sensors for stern tube bearings (Resistance bulb), and stern tube bearings, etc. It fits to the hull structure by resin. In case of a bulk carrier, the Flexitube is cooled with cooling water. The special feature is that the Flexitube can absorb the deformation around stern tube due to thermal expansion since the forward side of the product is not completely fixed to the hull as indicated by the name of “Flexitube.” Also, the sealing must be formed properly, so that resin does not leak until when it has solidified after its infusion. A certain sealing device has been provided by BVI. As shown in Fig. 5.4, the retractable sealing is shrunk by removing the pressure not so as to disturb the works upon the installation on the hull structure, and then the pressure returns to atmospheric pressure. By the procedure, the seal of resin can be easily formed. Besides, the shafting works at shipyard can be curtailed considerably since the alignment works of stern tube bearings become easy and the installation works of piping and temperature sensors to the stern tube block become unnecessary.

![Fig. 5.2 Mount of the Flexitube](image1)

![Fig. 5.3 Flexitube](image2)

![Fig. 5.4 Retractable sealing](image3)

(Shuji Nomura)