1.2. Classification Society

1.2.1 NK Technical Rules

The following is a summary of the main amendments made to the NK Technical Rules, relating to machinery and electronics, from 1 January to 31 December 2007:

This amendment is based on IACS UR 11 through 13. It adds requirements, for ships that navigate in ice-infested waters, such as the Arctic Ocean year-round, in addition to those that already exist for navigation in normal waters.

(2) Embarkation Ladder (Guidance for Safety Equipment)—Effective from 1 October 2007.
It is amended that embarkation ladders have to be installed on both sides of cargo ships of less than 85m in length other than tankers, chemical tankers and gas carriers that are installed with lifeboats and liferafts as specified in 16.1 Chapter III SOLAS in accordance with IACS UI SC215.

With regard to preventive machinery maintenance systems (PMM), up until recently the only ships with PMM notation were steam turbine ships. However, as the scope of its application expanded to include diesel ships, the relevant rules for PMM have been amended so as to include current technologies and systems. With regard to equipment installed condition monitoring systems, requirements of the Preventive Machinery Maintenance Scheme (PMMS), which maintains machinery, equipment and parts based on periodical condition monitoring and diagnosis, have been overlapped by the Planned Machinery Maintenance System (PMS). In order to eliminate this redundancy, PMMS has been deleted and its requirements have been consolidated into those of PMS.

(4) Shafting Coupling Bolts (Rules for Survey and Construction of Steel Ships, Part D)—Effective from 1 January 2008.
The previous formula for calculating bolt diameter was based on the nominally rated engine torque, which is prescribed in IACS UR M34. However, research by the Society analyzing the failure of shafting coupling bolts has determined that the failure of these bolts is caused by torsional vibration. Therefore, the formula has been amended to consider torsional vibratory torque.

Requirements regarding the overall functions of the computer-based control systems including the software have been specified in accordance with IACS UR E22.

With regard to the environmental test for automatic equipment, the relevant requirements have been amended to include a flame retardant test to flammable enclosures of equipment in accordance with IACS UR E10 rev. 5.

(7) Type Approval Crankcase Oil Mist Detection Arrangement (Guidance for Survey and Construction of Steel Ships, Part D/ Guidance for the approval and Type Approval of Materials and Equipment for Marine Use)—Effective from 1 January 2008.
With regard to the approval test of crankcase oil mist detection arrangements for diesel engines, the
requirements regarding the implementation of EMC testing for detectors as well as detailed procedures, regarding the performance of the arrangement, have been specified in accordance with IACS UR M67 rev.1.

1.2.2 IACS Technical Rules

The following is the main revisions that were made to IACS Technical Rules, such as the Unified Requirements (UR) and Unified Interpretations (UI), in relation to machinery and electronics approved by IACS, from 1 January 2007 to 31 December 2007:

1. Flexible Hoses (UR P2.12, rev.1, August 2007)
2. Type Testing Procedure for Crankcase Explosion Relief Valves (UR M66, rev.2, September 2007)
3. Embarkation Ladder (UI SC215, new, February 2007)
5. Annex IV of MARPOL 73/78 (UI MPC91, new, September 2007)

1.2.3 Trend of IMO

In the International Maritime Organization (IMO), there are two technical committees which control the international conventions and associated instruments. One is Maritime Safety Committee (MSC) which is considering with regard to the safety of life at sea, and another one is Marine Environment Protection Committee (MEPC) which is considering with regard to the prevention of pollution on marine environment. In 2007, both of Committees (MSC/MEPC) were properly embarking new measures that are more safety and friendly for human and environment through life of ships. The key topics are presented as follows:

1. Criteria for the Provision of GMDSS Satellite Providers: Amendment to SOLAS Chapter IV/4-1
   At the eighty-third session of the Maritime Safety Committee (MSC83) held in October 2007, the amendment to SOLAS Chapter IV/4-1 to allow satellite providers except the INMARSAT Ltd. as GMDSS satellite provider were adopted and will enter into force on 1 July 2009.

2. Carriage of Material Safety Data Sheets (MSDS): Amendment to SOALS Chapter VI Reg.5-1
   At the MSC83, the amendments to Chapter VI Reg.5-1 to require providing with a material safety data sheet prior to the loading of MARPOL Annex I Cargoes and marine fuel oils in accordance with the Res. MSC.150(77) “Recommendation for Material Safety Data Sheets for MARPOL Annex I cargoes and marine fuel oils” were adopted and will enter into force on 1 July 2009.

3. Protective Coating for Void Space
   As measures for structural deterioration of ship, performance standard for protective coatings for void spaces on bulk carriers and oil tankers was adopted as non-mandatory requirement at the moment. Specifications of this standard is relaxed mildly compared to PSPC for ballast water tank adopted at December 2006

4. Prevention of Air Pollution from Ships
   The fifty-sixth session of Marine Environment Protection Committee (MEPC56) agreed to extend the work plan regarding the draft amendments to MARPOL Annex VI and NOx Technical Code considering from 2005 which included stricter specification on NOx/Sox emissions, for an additional one year. This resulted in expected schedule as follows:
   * February 2008: BLG12 (Considering the draft amendments to MARPOL Annex VI and NTC)
   * April : MEPC57 (Finalization of the draft amendments)
   * October : MEPC58 (Adoption of the draft Convention)

5. Development of the Convention on Ship Recycling
   The current MEPC is progressing in the development of the Convention for Ship Recycling as new legally
binding instrument on ship scrapping / recycling to be ready for adoption in 2009. At the MEPC56, substantial progress was made in developing the draft text of the Convention and future work plan was agreed as follows:

- January 2008: 3rd Intersessional meeting of the working group on Ship Recycling
- April : MEPC57 (Review on the draft Convention)
- October : MEPC58 (Finalization of the draft Convention)
- May 2009 : Diplomatic Conference

6) Ballast Water Management Convention related issues

The MEPC is continuing development of guidelines specified technical requirements to implement smoothly the Ballast Water Management Convention adopted in 2004. This Convention will enter into force 12 months after ratification by 30 States, representing 35 per cent of world merchant shipping tonnage. As of the end of March 2008, 13 States, representing about 3.62% of the world's merchant shipping, have ratified the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention), which was adopted in February 2004.

At MEPC56, the “Pure Ballast system” proposed by Norway got both Basic Approval and Final Approval and the “NK Ballast Water Treatment System” proposed by the Republic of Korea got Basic Approval.

7) International Convention on the Control of Harmful Anti-Fouling Systems on Ships: AFS Convention

Requirement for entry into force of the International Convention on the Control of Harmful Anti-fouling Systems on Ships (the AFS Convention) is ratification by 25 States, representing 25 per cent of world merchant shipping tonnage. This Convention will enter into force on 17 September 2008, following accession to the ratification by Panama on 17 September 2007.

1.2.4 Studies at ClassNK Research Institute

ClassNK started project and practical type investigations planed for two years in addition to conventional type investigations. Following investigations concerned with machinery were held in 2007.

[Conventional type investigation]

1) Study on condition monitoring methods of marine engine and machinery

In a study on condition monitoring methods of marine engine and machinery, appropriate monitoring and sensing techniques for diagnostic indications of damage to apply the condition monitoring system on main engine and machinery in engine room is investigated. In addition to sensing by high frequent vibration and online monitoring of iron particles concentration in lubricating oil, sensing method by AE (Acoustic Emission), which has been commonly used for monitoring plane bearings in machinery in some ironworks, has been found to be effective for monitoring plan bearing like main bearing of main diesel engine after tested on experimental testing machine and actual main engines with confirming by ferrography check of oil.

2) Studies of analytical methods on combustion characteristic of marine fuel oils and degradation of lubricating oils of 4 stroke diesel engines

A safety zone for combustion has been proposed using some condition parameters as a diagnostic method for adequate combustion of fuel oil with showing recent tendency of poor combustibility of fuels. And it is found that the exhaust gas may be used for diagnostic method of fuel oil with ignition delay / combustion periods etc., on testing by a constant volume combustion analyzer.

3) Studies on crank shaft deflection of main diesel engine

Strength analysis using Finite Element Method with ascertainment by actual measurement is conducted to seek appropriate estimation method and proper critical standard for crank shaft deflection considering appropriate shaft alignment for amendment of the Rules.

4) High safety oriented ergonomic design of marine machinery systems
In an attempt to further improve the safety of marine machinery systems through easy operation, maintenance and inspection, ergonomic design guidelines for these systems complementary to the current classification rules consisting of mainly strength related requirements are developed.

(1) Risk assessment for LNG carrier propulsion systems

Aimed at developing a system for quantitatively assessing the risk of LNG propulsion systems, risk assessments were carried out for the following five LNG propulsion systems: 1) Steam turbine engines, 2) heavy fuel diesel engines, 3) dual fuel diesel generators with electric propulsion systems, 4) dual fuel diesel engines, and gas turbine generators with electric propulsion systems.

(2) Performance testing for Automated Systems

Among the many technical developments arising from the second phase of the Super Eco-Ship Project were a variety of automated systems designed to improve the safety of every aspect of ship operation. Based on research conducted in 2007, a method for evaluating the practicality and usefulness of these automated systems has been developed and preparations are underway for in-water testing to verify the applicability of these new automated systems.

(3) LNG Total Life Assessment (TLA)

A Study on RCM (Reliability-Centered Maintenance) / RBM (Risk-Based Maintenance) to apply preventative maintenance to marine machinery carriers is proceeded as a part of developing total life cycle care system of LNG. An appropriate RBM system for machinery in ships has been already developed with verifying using maintenance data of some actual vessels. Concerning piping system in LNG carriers, a guideline has been published as titled “Guidelines on Pipe Wall Thinning Taking into Account Flow Accelerated Corrosion of Water and Wet Steam Pipelines in Ships” summarized the result of a investigation on flow accelerated corrosion which caused by turbulent flow at a location after orifice, valve or in elbow, t-junction etc.

(4) Environmental awareness certification

Aimed at reducing the environmental burden caused by the shipping industry and awarding ships with environmentally friendly features, ClassNK has conducted research on environmentally friendly technologies and developed a new Environmental Awareness Certification program. Based on examinations of environmental efforts by the shipping industry and international bodies, and survey of the items that should be included in any environmental certification program, ClassNK has developed a new set of environmental appraisal standards. Based on these efforts, as well as a rigorous analysis of environmental data and current environmental standards, ClassNK has also developed a guideline to help address environmental problems at the design stage.

1.2.5 Domestic trend report by Class NK

The number of ships newly built and registered to Class NK in 2007 is 512 and that of prime movers on board the ships is 616. Table 1.2 shows the breakdown of them. Compared to last year, the number of ships increased 5, that of prime movers increased 4, and the total output increased 721,860kW.

Table 1.2 Output distribution of new registered ships

<table>
<thead>
<tr>
<th>output (kW) above--under</th>
<th>Steam turbine No. of ships</th>
<th>2 stroke Diesel engine No. of engines</th>
<th>Total output</th>
<th>4 stroke Diesel engine No. of ships</th>
<th>Total output</th>
<th>Total No. of ships</th>
<th>4 stroke Diesel engine No. of engines</th>
<th>Total output</th>
</tr>
</thead>
<tbody>
<tr>
<td>30,000--</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>27</td>
<td>27</td>
<td>1501809</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>25,000--30,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>7</td>
<td>188090</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20,000--25,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>8</td>
<td>174682</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>18,000--20,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>15</td>
<td>15</td>
<td>279450</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Translated from Journal of the JIME Vol.43, No.4 (Original Japanese)
1.2.6. Statistics and Summary of Machinery Damage

This is a summary of the incidents of machinery damage on ships classed with the Society based on the results of the investigation of survey records reported in 2006.

Fig. 1.2 shows the year-to-year changes for diesel main engines (numbers and damage rates). The figures show that the number of two-stroke engines was almost the same as the number of four-stroke engines for the period between 1986 and 1993. After 1994, the trend distinctly shows that the number of two-stroke engines increased, while the number of four-stroke engines decreased. Comparison of figures for the years 2005 and 2006 shows that the number of two-stroke engines increased by about 4.8%, while the number of two-stroke engines increased by about 3.1%. Incidentally, a comparison of the figures for 1994 and 2006, when such a trend started shows that the number of two-cycle engines increased by about 35.2% and the number of four-cycle engines decreased by about 28.9%. Although there is a change in the annual damage rate, an overall declining trend can be observed. The damage rate for the year 2006 declined for four-stroke engines but increased slightly for two-stroke engines when compared to the damage rate for the year 2005. The damage rate for two-stroke engines decreased to about one-third in 20 years. This trend is particularly noticeable in the components around the combustion chamber.
Fig. 1.2 Numbers and Damage Rates of Diesel Main Engines

[Hiromi Shiihara etc.,]