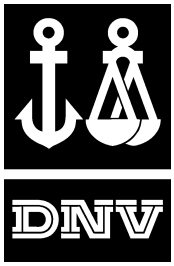

CLASSIFICATION NOTES

No. 62.1

GUIDANCE FOR THE ENVIRONMENTAL CLASS NOTATIONS CLEAN AND CLEAN DESIGN

MAY 2011

DET NORSKE VERITAS

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FOREWORD

DET NORSKE VERITAS (DNV) is an autonomous and independent foundation with the objectives of safeguarding life, property and the environment, at sea and onshore. DNV undertakes classification, certification, and other verification and consultancy services relating to quality of ships, offshore units and installations, and onshore industries worldwide, and carries out research in relation to these functions.

Classification Notes

Classification Notes are publications that give practical information on classification of ships and other objects. Examples of design solutions, calculation methods, specifications of test procedures, as well as acceptable repair methods for some components are given as interpretations of the more general rule requirements.

All publications may be downloaded from the Society's Web site http://www.dnv.com/.

The Society reserves the exclusive right to interpret, decide equivalence or make exemptions to this Classification Note.

Background:

The voluntary Environmental Class Notations **CLEAN** and **CLEAN DESIGN** encompass actual and future environmental regulations.

This edition of the Classification Note has been issued to support the January 2011 updating of the DNV Rules for Classification of Ships (Pt.6 Ch.12), reflecting the experience since the notations were first introduced and feedback from the market. It replaces the October 2005 edition of the document.

Main changes:

Amending the **CLEAN** and **CLEAN DESIGN** notation, in particular:

*For **CLEAN**:* As MARPOL Regulation 12A mostly covers **OPP-F** notation this is not anymore mandatory for **CLEAN**. Some requirements have been clarified (e.g. refrigerants and Ballast Water Management Plan). As option to use of low sulphur fuel, requirements for electric shore connection have been inserted. The recommendation for Green Passport has been removed.

*For **CLEAN DESIGN**:* Requirements on SO_x emissions have been aligned with the revised MARPOL Annex VI. As an alternative to the use of low sulphur fuel in ports, requirements on electric shore connection have been inserted. For the discharge into sea, IBTS requirements have been implemented. For bilge water, requirements on 5 ppm equipment have been inserted. It is now required to have the 5 ppm DNV type approval certificate. Grey water is now considered. Requirements on garbage have been aligned with the latest developments. Sterntube shall now be lubricated with water based (or biodegradable) oil. Finally double hull protection requirements have been clarified.

Any comments may be sent by e-mail to *rules@dnv.com*
For subscription orders or information about subscription terms, please use distribution@dnv.com
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1. General

1.1 Introduction

This Classification Note is a supplement to the DNV Rules for Classification of Ships Pt.6 Ch.12 Environmental Class. The information in this Classification Note is to be considered mandatory unless otherwise stated when issuing the Environmental Class Notation **CLEAN** or **CLEAN DESIGN**.

The document is intended to be a tool for support for the approval work and surveys when assigning Environmental Class Notations **CLEAN** and **CLEAN DESIGN**, and for annual surveys.

In cases of conflict between this Classification Note and the rules, the rules shall prevail.

1.2 Interpretation of the Rules

When writing the rules and requirements for the classification of ships it is impossible to foresee each and every vessel configuration, problem and interpretation that might occur. It is therefore important to keep the intention of the rules in mind when interpreting the rules, which in general is to limit the operational emissions and discharges from a vessel, as well as to limit the likelihood and consequences of accidents. It is also important to understand that the rules for Environmental Class *only* cover the environmental aspects of design and operation of vessels, and that the safety aspects for vessel and crew are covered elsewhere in the rules. Where a conflict between safety and environmental considerations occur, the safety of the passengers, crew and vessel shall prevail.

1.3 Further information and support

For information or help in interpreting the rules, contact the unit and staff in charge of Environmental Class Notations at DNV Head Office, Høvik, Norway.

2. Environmental Class Notations

The Environmental Class Notations **CLEAN** and **CLEAN DESIGN** are voluntary Class Notations, limiting the emissions of harmful pollutants, and limiting the probability and consequences of accidents.

CLEAN: MARPOL compliance with additional requirements

CLEAN DESIGN: As for **CLEAN**, but with more stringent requirements, and in addition provisions for accident prevention and limitation.

The rules for Environmental Class are under constant development as legislation comes into force and new legislation is proposed. Vessels holding the Class Notation **CLEAN** or **CLEAN DESIGN** are in the forefront of the international legislative regime on environmental issues. This also means that as some requirements in the Rules for **CLEAN** and **CLEAN DESIGN** are becoming mandatory, the Rules must be developed by adopting new legislation not yet ratified.

3. Environmental considerations

The main environmental considerations addressed by the DNV Rules for Environmental Class **CLEAN** and **CLEAN DESIGN** are discussed and explained below.

3.1 Emissions to air

3.1.1 NO_x – Nitrogen oxides

Nitrogen oxides are created in internal combustion engines such as diesel engine, as a function of pressure and temperature. NO_x is measured in g/kWh.

On a local level, NO_x contributes to the formation of low-level ozone, thereby contributing to respiratory problems, damaging forests, and other problems. On a regional level, it forms acid rain, and also causes over-fertilization of inland and coastal waters. In the latter years there has been a strong emphasis by national, regional and global legislative bodies on the reduction of NO_x-emissions.

The emission of NO_x can be limited by:

— "Upstream" technologies such as Direct Water Injection, Humid Air Motor or fuel/water emulsion, all aiming to reduce the peak temperature in the cylinder during combustion.
— "Downstream" technologies such as Selective Catalytic Reduction, introducing a reduction agent such as urea into a catalytic converter unit in the funnel, "cleaning" the exhaust gas.

The use of NO_x abatement techniques is mostly relevant to vessels with the Class Notation **CLEAN DESIGN**.

Vessels with **CLEAN** usually carry IMO NO_X-certificates or equivalent for the relevant engines, thereby fulfilling the requirements of the Rules. In cases where one or more of the engines do not fulfil the requirements for NO_X emission for **CLEAN DESIGN**, a separate study for the complete power/propulsion plant may be carried out to show overall vessel compliance with the Rules. Such assessment must be carried out by DNV Høvik (NACNO). A Memo to Owner must be issued detailing the assessment and any limitations that this may impose on the vessel.

In order to prove adherence to the Rules, the Operational Procedures and logs must show:

a) That the engine manufacturers' instructions with regard to spare parts and maintenance are followed and that the Engine Technical File is kept in order
b) That any NO_X-reduction units (DWI, SCR etc.) are operated according to instructions and that logs are kept to prove the use (e.g. urea consumption, water/fuel consumption etc.).

This must be verified at Annual survey by checking the technical file and NO_X-equipment log if installed.

3.1.2 SO_X – Sulphur oxides

Sulphur oxides are formed in internal combustion engines, boilers and other systems using fuels containing sulphur. SO_X is measured in g/kWh.

On a local level, SO_X contributes to respiratory problems, acid attack on vegetation and limestone-based structures, and other problems. On a regional level it creates acid rain and over-fertilization of inland and coastal waters. There has been a strong focus on the reduction of SO_X-emission on a national and regional level, especially within the legislative frameworks of the EU and USA, while the efforts at an international level (IMO) has suffered from a reluctance to ratify MARPOL Annex VI.

The emission of SO_X in exhaust gases is wholly dependent on the sulphur content of the fuel utilised, and can be controlled by:

— "Upstream" measures such as limitations on the sulphur content used onboard
— "Downstream" technologies such as exhaust gas scrubbers
— In ports and where possible, using a shore side connection.

A great proportion of the operating cost of cargo ships in particular comes from bunker expenses. Many ship-owners therefore react to the requirement of limitations of the sulphur content of fuels used onboard vessels with **CLEAN**. It is important to emphasise this requirement early in the design phase, so that properly sized low-sulphur fuel tanks and an appropriate system arrangement can be provided onboard.

In order to prove that the vessel is operated in accordance with the Rules, operational procedures should:

a) Make sure only fuel with sulphur content less than the specified maximum limit is ordered. The Fuel Oil Management plan (or equivalent) should explicitly specify the maximum sulphur content to be used in general, and in ports and "SO_X-controlled area" in particular.
b) Ensure that the sampling regime conforms to the rules. In order for the master/owner to prove adherence to the maximum sulphur requirements, a fuel sample should be kept onboard for at least one year and the bunker receipt should be filed onboard for three years. Most vessels already have stringent sampling procedures in place in case they have received sub-standard fuel causing damages to machinery or poor engine performance.

The vessels must also be able to prove that they operate with low sulphur fuel in Sulphur Emission Control Areas (ECA) and ports. They must therefore have a procedure and log for the changeover from "high" to "low" sulphur fuels.

At Annual survey the bunker receipts and required logs will be checked to make sure the maximum sulphur limits have been complied with.

3.1.3 Refrigerants

Refrigerants used onboard in cargo refrigeration plants, air-conditioning plants and provision refrigeration/ freezing systems escapes to the atmosphere through system leaks and spillages during recycling/recovery. Requirements on GWP are intended also for Domestic type stand alone unit.

Refrigerants based upon halogenated carbon substances contribute strongly to the depletion of the Earth's ozone layer, causing increased ultraviolet radiation and subsequently increased risk of skin cancer. They also contribute to global warming. International legislation such as the Montreal protocol and various EU regulations have been adopted to phase out the unwanted substances and replace them with more environmentally friendly alternatives.

The Ozone Depleting Potential (ODP) of a substance is a measure of how potent it is with respect to destroying

high altitude ozone. The Global Warming Potential (GWP) is a measure of how strongly the substance acts with respect to retaining and returning heat radiation from the Earth's surface, the global warming effect. This is measured relatively to the effect of CO_2, over a 100 year life span (as most of these substances are destroyed in the atmosphere within a matter of years).

Refrigerants used onboard vessels with the Class Notation **CLEAN** must have an ODP of zero, and the GWP should be maximum 3500. In no case is chlorofluorocarbons (CFCs and HCFCs) allowed, but hydro fluorocarbons (HFCs) are allowed in addition to "natural" refrigerants such as ammonia (NH_3) and CO_2. For vessels with Class Notation **CLEAN DESIGN** the maximum GWP is 1890.

The refrigeration systems onboard should be of such a design as to easily facilitate the removal of the whole of the system "charge", the full volume of refrigerant, without spillage. A recharge valve/connection should be placed in a position where a receiver or tank can be connected and the system compressor can pump the refrigerant into the tank.

A system of discovering system leakages at an early stage should be in place. This can either be in the form of detectors at suitable locations, or by checking the system for leaks and the liquid level at regular intervals. Leak detectors/ sniffers are often unsuitable where the refrigeration machinery and compressors are located in engine rooms where the air volume is large and the air change ratio is high, but can be useful when systems are located in enclosed spaces. Please note that such a system might be required by other Rules and regulations regarding safety.

The system and the inspection regime should be worked out in co-operation with the system manufacturer and must include a separate log for recording refrigerant levels and maintenance events. The operational procedures for the refrigeration systems must describe the corrective actions to be taken when the refrigerant level sinks below a pre-defined limit. The corrective actions must include leakage reducing measures.

The maximum annual leakage must be less than 10% of the total system charge. This should be documented by a Refrigerant Recharge log.

In cases where the refrigerant properties do not meet the requirements regarding the GWP, a case-to-case evaluation of the Total Equivalent Warming Impact (TEWI) can be undertaken by the supplier. A TEWI analysis considers the efficiency of the refrigerant and the system's energy consumption to show that the lowered CO_2-emission by systems providing energy to the refrigeration plant compensates for the higher impact of the refrigerant itself. The TEWI calculations should be sent to DNV, Høvik for approval.

3.1.4 Fire fighting substances

Fire fighting substances with an Ozone Depleting Potential are prohibited (see Refrigerants above). Maximum Global Warming Potential is to be 4000 for vessels with Class Notation **CLEAN**, 1650 for **CLEAN DESIGN**. This means that e.g. Halon is prohibited. CO_2, water fog, argon and other natural substances are acceptable.

3.1.5 Cargo evaporation

Volatile Organic Compounds (VOC) are contributors to the formation of low-level ozone, responsible in turn for amongst other things respiratory problems. They are also carcinogenic, and pose a great safety risk as they can ignite at the right concentrations. VOC are light fractions of oil cargoes evaporating especially during cargo loading and unloading.

Crude/product tankers and tankers carrying substances with flash point less than 60°C (Volatile Organic Compounds) should adhere to Class Notation **VCS-2**.

3.1.6 Other

Any incinerators installed should comply with MARPOL Annex VI Reg. 16(1), meaning that they should be approved with respect to MEPC.76(40), Standard specification for shipboard incinerators, with amendments MEPC.93(45) Amendments to the standard specification for shipboard incinerators.

Use of the incinerators should be noted in garbage record books and oil record books as applicable. It should be noted that the use of incinerators might be illegal under local legislation.

3.2 Discharges to Sea

3.2.1 Cargo residues:

The discharge of oil and chemical cargo residues has obvious negative impacts on the marine environment. The introduction of MARPOL Annex I has greatly reduced the discharge of oil from cargo and machinery spaces, while MARPOL Annex II controls the discharge of chemical cargoes.

For Class Notation **CLEAN**, the Rules aim to limit the discharge of oil cargo residues by the fulfilment of MARPOL Annex I, for both "old" and "new" tankers. In practice, all vessels delivered as newbuildings today will comply with Annex I.

An *oil record book* or *cargo record book* should be maintained, also recording the discharges to sea and deliveries to shore of cargo residues, wash water etc. Tankers must also have double skin and segregated spaces and piping for cargo and ballast water. An important reference is MARPOL Annex I Ref. 13F, "Prevention of oil pollution in the event of collision or stranding".

For Class Notation **CLEAN DESIGN**, the maximum allowable remaining chemical cargo quantities are 0.05 m^3 for pollution categories X, Y and Z. In addition to the requirements for double skin, cargo tanks must be designed with smooth surfaces and cargo wells for efficient stripping. Under-deck longitudinals of slab type are acceptable. Horizontal areas on stiffeners and brackets should be avoided. Horizontally corrugated bulkhead plating with maximum angle of 65°, with or without vertical girders, is acceptable. Crude Oil Washing efficiency should have coverage of minimum 96%, documented by shadow diagrams.

3.2.2 Cargo handling

The requirements for cargo handling arrangements and procedures aim to prevent spillage of all oil substances and chemicals during cargo operations.

3.2.3 Oil bunkering arrangements

This requirement applies to fuel oil, lubricating oil, hydraulic oil and all other oily substances which can be filled from a source without the vessel's crew attending. provided enough and proper spill tray and high level alarm. In practice, this means that oil filled by hand pumps or pneumatic pumps from oil drums on deck are exempt from the requirements, while some cargo substances like oil based mud, oil for both cargo and consumption purposes (as is often the case on e.g. platform supply vessels) are included. This is for practicability, as the systems for cargo and bunkering often use the same piping and tanks, or at least have the filling points and vent heads placed close together.

All points where oil spills may occur must be fitted with spill trays. This means that both fill points and vent heads must have trays. The trays must be designed to catch spills coming through vents at high speeds.

Tanks are required to have high level alarms to prevent overfilling.

Bunker operations procedures must be submitted to ensure that spill protection is considered during bunker operations.

Systems and tanks for recovered oil on ships equipped for oil spills at sea only are exempt from the requirements, as such operations are considered as emergency operations.

3.2.4 Ballast water

One of the emerging environmental considerations nationally and internationally is the transfer of harmful micro-organisms in the ship's ballast water. The introduction of invasive species can result in depletion of stocks of native species, unwanted algal blooms etc, and can have extreme local ecological and financial consequences.

To prevent this, a vessel can either

a) Treat the ballast water mechanically or chemically to kill off the unwanted organisms,

b) Exchange the ballast water far from shore, as theoretically the species living in coastal waters will not survive the conditions in deep sea waters and vice versa. This may be done

   i) by continuous flow-through of at least 3 x the total ballast water volume or to some pre-determined volumetric efficiency, but the efficiency of this method is being debated

   ii) by sequentially emptying and filling each ballast tank in turn, this imposes severe stresses on the hull structure and cannot be undertaken in heavy weather conditions

Requirements based on alternatives a) and b) will be phased in accordance with the International Convention for the Control and Management of Ships' Ballast Water and Sediments. In particular for CLEAN:

Ballast water discharges from ships shall comply with the D-1 or D-2 standard of the International Convention for the Control and Management of Ships' Ballast Water and Sediment with amendments and Guidelines.

While for **CLEAN DESIGN** Ballast water discharges from ships shall comply with the D-2 standard of the International Convention for the Control and Management of Ships' Ballast Water and Sediment with amendments and Guidelines.

In any case, the vessel must carry a Ballast Water Management Plan which is approved separately by other units within DNV. The approval of this plan is outside the scope of the approval work for Class Notations **CLEAN** and **CLEAN DESIGN**.

3.2.5 Bilge water

Bilge water from machinery spaces contains various amounts and qualities of oil from maintenance operations, minor leaks, machinery "sweating" etc, but also other substances such as detergents. The bilge water must run through a bilge water separator and an oil content monitor, automatically shutting off the discharge if the oil content exceeds 15 ppm (parts per million).

For **CLEAN**, the discharge of bilge water is regulated by MARPOL Annex I.

For **CLEAN DESIGN** the vessel must have bilge water holding tank(s) which means that they must have required capacities dependent on the engine rating. The machinery space bilges must not be discharged to sea, but be discharged to shore. This requirement should be explicitly expressed in the bilge water management plan. **CLEAN DESIGN** requires oil content to be less than 5 ppm. In addition it is required that Oil water separator and alarm have the DNV Type approval for 5 ppm equipment.

Bilge water from non-machinery spaces is to be treated separately from the machinery space bilges. Wash water and slop from cargo spaces is defined as "Residues of cargo oil or chemicals" and is covered by Pt.6 Ch.12 Sec.2 C200 and Pt.6 Ch.12 Sec.3 C200.

3.2.6 Garbage

Waste produced onboard vessels can seriously harm the marine environment, especially sea-living mammals, reptiles, birds and bottom-dwelling animals, and is extremely unsightly when littering beaches, tidal zones, mud-flats etc. It can also be harmful to shipping, especially smaller vessels. Handling and disposal of garbage is regulated by MARPOL Annex V.

Garbage is divided into six categories according to its constituent material and hazard potential. The various categories can be treated onboard, and can be disposed of at sea at various distances from nearest land. The exception is plastics, which under no circumstances can be dumped at sea. Various onboard treatment options include grinding, incineration, compaction, shredding, pulping and so on.

For **CLEAN**, the vessel must comply with MARPOL Annex V, and have in place a Garbage Management Procedure showing the various garbage treatment options onboard. The discharge criteria should also be explicitly expressed in the plan. Incinerators are not compulsory, but if installed they must be approved with respect to MEPC.76(40), Standard specification for shipboard incinerators, with amendments MEPC.93(45) Amendments to the standard specification for shipboard incinerators.

Regarding waste management, recycling of the garbage is considered as better sustainable practice than discharge overboard or incineration. Hence **CLEAN DESIGN** intention is to encourage and implement waste recycling onboard the vessel by separating recyclable and non-recyclable wastes onboard. Environmental awareness of crew with respect to minimizing generation of waste and separating of the waste is important in order to succeed in fulfilling the purpose of DNV Environmental class notation **CLEAN DESIGN** for garbage handling. It should be noted that disposal of garbage is allowed for vessels having **CLEAN DESIGN** notation in the condition of compliance with MARPOL Annex V discharge criteria. In all cases a Garbage Record book must be kept.

Food waste handling onboard a ship is an area **CLEAN DESIGN** requires additional requirements. Although larger food scraps may be discharged beyond 12 nautical miles according to MARPOL Annex V, but it is recommended that comminuters are used even outside this limit because they hasten assimilation into the marine environment. Ground food shall not be discharged into sewage treatment plant in order to be treated either by black or grey water. **CLEAN DESIGN** is requiring having a holding tank for ground food in order to be able to either deliver it to shore based facilities or temporary storage of it when vessel is below the discharge limit.

Passenger vessels with the Class Notation **CLEAN DESIGN** must store all garbage onboard prior to delivery on shore, or incinerate it. Only comminuted (ground) food waste can be disposed of at sea.

Please note that there might be local restrictions on the use of incinerators in some areas, like for instance the Baltic Sea where the use of incinerators is prohibited.

3.2.7 Sewage

Sewage is defined as drainage from toilets, medical bays, spaces containing living animals or any drainage mixed with any of these. This is also known as black water. In addition, grey water can be defined as drainage from wash basins, showers, galleys, dishwashers, in short "domestic" drainage which does not pose a health risk due to contamination by pathogens (bacteria, virus etc). It may still contain detergents, food waste, grease and other pollutants.

Biologically active sewage poses a threat to human health by transmitting diseases to people swimming in the sea, or via eating fish and shellfish contaminated with sewage. Vessels trading in inland waters might

contaminate drinking water by discharging sewage. It also introduces nutrients to inland and coastal waters causing eutrophication or algal blooms.

The treatment and discharge of sewage is controlled by MARPOL Annex IV, which is in force from autumn 2003. Annex IV is only concerned with black water.

For **CLEAN**, vessels must either

a) Have in place an approved sewage treatment plant, or
b) Discharge comminuted (ground) and disinfected sewage at a distance from shore of no less than 4 nautical miles, or

For option b the sewage must have been comminuted and ground prior to settling in a storage tank, and if discharged at sea, must be discharged at a moderate rate and while the vessel is *en route* i.e. at a normal trade at a speed of at least 4 knots.

For all the options above, any discharge of sewage should be recorded with date, location and quantity. This can be entered into the ship's log book, or noted in a dedicated Sewage discharge log.

Please be aware that more stringent local legislation might apply, such as for the Great Lakes or the Baltic Sea and the Black Sea area.

For **CLEAN DESIGN** all vessels must have a sewage treatment system and must also treat grey water.

3.2.8 Anti-fouling

The use of various bio-toxic compounds has proved an effective way of limiting marine growth on ships' hulls, thereby lowering friction losses and fuel consumption. One of the most effective ingredients has been found to be a group of chemicals called tributyl-tin, TBT. However, the TBT released into the marine ecosystems has been found to cause a number of problems such as reproduction problems in marine organisms. TBT-based anti-fouling systems are therefore not allowed to be applied on vessels from 1 January 2003, and must be removed from ships' hulls or sealed properly within 1 January 2008.

Vessels with the Class Notations **CLEAN** or **CLEAN DESIGN** must carry a "Statement of Compliance with International Convention on the Control of Harmful Anti-Fouling Systems".

3.2.9 Oil and or water interfaces

The oil consumption and or leakage from various oil and or water interface is to be monitored. Logging of oil levels in lubrication oil tanks for tailshafts, rudder bearings, sea water cooled engines, hydraulically operated equipment and others will ensure that any leakages are discovered at an early stage. Any possible corrective actions must be detailed.

For sterntube and **CLEAN DESIGN** notation it is required to have oil water based or biodegradable lubricants.

3.2.10 Environmental responsibilities

The vessels shall have identified a designated Environmental Officer on board, responsible for compliance with regulations, implementation of procedures, relevant logging and training of personnel.

3.3 Ship recycling

Ships will inevitably at some stage come to the end of their service lives. In order to take advantage of the resources that a ship represents, the recycling of ships is an environmentally advantageous end-of-life option. A ship might contain hazardous materials that can be integrated in the vessel structure and in the onboard systems or components. Since these materials may represent a hazard both for humans and nature, information about onboard occurrence shall be established for the purpose of safeguarding crew, workers and the environment during operation, demolition and recycling of ships.

In May 2009, the 'Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, 2009' (SR/CONF/45) was adopted. A fundamental requirement of the Convention is the development of an Inventory of Hazardous Materials (IHM) which must be kept on board each ship. The inventory addresses the use of materials which is prohibited or restricted and locates hazardous materials which are known to represent a potential hazard to people and the environment.

According to Rules for Classification of Ships Pt.6 Ch.12 Section 1 and 3 ships shall hold and maintain an Inventory of Hazardous Materials developed in accordance with the Hong Kong Convention for the Safe and Environmentally Sound Recycling of Ships, 2009' (SR/CONF/45) and the appurtenant Guidelines Resolution MEPC.179(59). The IHM must be approved separately followed by an initial survey before a Statement of Compliance with the Hong Kong Convention is issued. The SoC must be submitted as proof of compliance with **CLEAN DESIGN** rules.

Vessels that holds class notation **RECYCLABLE** fulfils this requirement.

3.4 Protective design – CLEAN DESIGN only

The requirements for Protective Design are valid for the Class Notation **CLEAN DESIGN** only, and are aimed at limiting the probability and consequences of accidents resulting in discharge of harmful substances.

3.4.1 Fuel oil tank arrangements

Fuel oil is very often heavy oil fractions extremely harmful to the environment. Heavy fuel oil will not evaporate, it disperses poorly in sea water, often forms sticky emulsions, and due to not evaporating or dispersing, it often reaches shore and fouls beaches and kills wildlife. By ensuring fuel oil tanks are protected by a double hull, the likelihood of discharge when an accident occurs will decrease.

3.4.2 Alternate means of propulsion

By offering redundancy in propulsion and steering systems, the vessel should be able to reach a safe haven even if one propulsion or steering system is out of order. This reduces the probability of accidents. Separate engine rooms and propellers, drop-down thrusters or "take-me-home-devices" ensure that at least one main engine can fail with the vessel still being able to manoeuvre.

Vessels with the Class Notation **RP** (redundant propulsion) fulfil the criteria. Class Notation **RP** is, however, not required.

4. Documentation

See Rules for Classification of Ships Pt.6 Ch.12 Sec.1 Table C1.

4.1 Plans and or particulars

See Rules for Classification of Ships Pt.6 Ch.12 Sec.1 Table C1.

The plans and particulars of the vessel are to be examined and approved or taken for information as appropriate. They will help to gain understanding of the vessel design, as well as offering details of design to be approved.

4.2 Certificates and or Documents of Compliance

See Rules for Classification of Ships Pt.6 Ch.12 Sec.1 Table C1.

Certificates and DoC's as listed in the references shall show compliance with certain parts of the Rules.

Dry cargo vessel less than 3 000 GT and vessels designed for offshore operations with class notation **SF** or better, damage stability do not need to meet ERS requirement.

4.3 Operational procedures

See Rules for Classification of Ships Pt.6 Ch.12 Sec.1 Table C1.

All vessel owners and management companies are different, and one must expect a vast variety of approaches to vessel operational procedures. Some vessel operators prefer to have free-standing "CLEAN-procedures" while others prefer to adjust existing procedures without creating a mass of additional paperwork. What is important is that Operational procedures must be included in the vessel operations manual system, and that it can be verified at annual surveys that the procedures are being followed. It is required that the procedures for the Environmental Class Notations form an integral part of the everyday manual system. A ring binder left on the shelf never in use does not meet the requirements in the rules, and this will be revealed at Annual survey.

Environmentally friendly vessel operation is ensured by changing the operational procedures onboard the vessels to incorporate requirements of the rules:

1) *Fuel Oil Management plan:* In order to control the emission of SOx the vessel procedures must specify the maximum sulphur content of fuel to be used in various areas. A fuel oil log must be in place to document the qualities of fuel ordered. Sampling of fuel, and the retaining of samples and bunker delivery notes should be specified. Sampling should comply with DNVPS guidelines "Marine Fuel Management". A fuel changeover procedure for switching to low sulphur fuel before entering SECA and ports must also be included.
2) *Bunkering procedure:* This should reflect all precautions made to prevent spillage at bunkering operations. It should also make provisions for the sampling of bunker at transfer.
3) *Refrigerant management procedure:* In order to prevent leakage of refrigerants to the atmosphere, provisions should be in place for checking and logging refrigerant levels at regular intervals. This must be recorded in a log and the procedure should detail the limits for when action must be taken, what actions should be taken and responsible personnel. Maintenance is also to be recorded. If a leak detection system

is installed, the procedures must include means to use this system efficiently for leak detection with environmental issues in mind.

Whenever refrigerants are drained or added, this should be noted in the refrigerant log so that it can be verified that the annual leakage is less than the 10% stipulated in the rules.

4) *Garbage management plan:* Handling of garbage is regulated by MARPOL Annex V. A procedure for onboard handling of waste categories defined in MARPOL must be in place. This should include discharge criteria, responsibilities and logging in Garbage record book. Any onboard waste management devices such as incinerators, compactors, shredders etc., should be taken in to consideration by the plan. For CLEAN DESIGN option for recycling shall be taken into account and reported in the garbage management plan.

5) *Sewage management plan:* Handling of sewage is regulated by MARPOL Annex IV. Discharge criteria, responsibilities and discharge logging procedures should be laid down in the sewage management procedure.

6) *Ballast water management plan:* The ballast water management plan is approved separately from the Class Notations **CLEAN** and **CLEAN DESIGN**. Proof of approved ballast water management plan must be submitted.

7) *Bridge and engine room operation control procedures.* These will show compliance with the technical requirements for Class Notations **NAUT-AW** (**CLEAN DESIGN** only) or **NAUT-OSV(A)**. These must be approved by authorised personnel. If vessel has any of the Class Notations, the procedures need not be submitted for **CLEAN**.

4.4 Other technical compliance

Documentation needed to prove that the vessel conforms to the requirements shall be submitted.

4.5 Special interest

The Environmental Class Notations are in some cases ordered by the yard or owner at a late stage in the building process, or even after the vessel has been delivered. This can present a number of challenges, as technical features required by the Rules for Environmental Class Notations have not been considered at the design stage. In such cases it is important to undertake a preliminary assessment to identify issues presenting problems, and to convey the findings quickly and clearly to the customer.

The following requirements are known to present particular challenges for the assignment of Environmental Class Notations, and should be subject to particular scrutiny:

4.5.1 Oil tankers

— High level alarms on bunker tanks and lubrication oil tanks are not necessarily specified in the vessel design. In some cases these have had to be retrofitted.
— Sulphur content in fuel: During approach, manoeuvring and cargo discharge in port, the vessels are required to use fuel with low sulphur content, to run boilers and engines for propulsion, cargo discharge and ballast pumps. This presents an additional cost to the vessel operator, and in some cases it has been found that the low-sulphur fuel tanks have been designed too small to provide enough fuel for a complete discharge.

4.5.2 Passenger vessels

— Nautical safety (**CLEAN DESIGN** only): If the vessel is not ordered with Class Notation **NAUT-AW** or equivalent, the compliance with technical requirements for this Class Notation must be proven, and a Statement of Compliance issued. The approval work, survey and testing for this Class Notation is extremely laborious, and must be undertaken by the responsible unit.

4.5.3 Supply vessels

— Spill trays for bunker systems and cargo systems for oil based substances (excluding recovered oil from emergency operations (ORO) on ships equipped for recovery of oil spills at sea): Fill points, vents and valves for bunker and cargo systems are often situated in the cargo rail at the side and or front of the cargo deck area. The cargo rail is crammed with pipes and fittings, and it is often difficult to fit spill trays in a manner which is both practicable for the crew and efficient in catching spillages. There are also restrictions with regard to spill tray areas and stability; if a large area on deck is closed off without drainage, sea wash will be trapped, adding weight on the side of the vessel. Requirements regarding deck drainage must therefore also be taken into consideration.
— High level alarms on bunker tanks, lubrication oil tanks and cargo systems for oily substances are not necessarily specified in the vessel design. The whole system including overflow tanks must be considered.
— Cargo systems for non-oily substances such as brine are sometimes also used for mud or base oil. Any system which can be used for carrying oily substances must conform to Rules regarding oil spill prevention measures.

— Pumps and piping systems have a high degree of redundancy, as crossovers are often used, fitted with blank-off valves which are normally closed. It must be specified that under normal operational circumstances these valves must be closed to prevent unintentional contamination by oily substances.

4.6 Other

Operational procedures are often worked out by the vessel operator in co-operation with the yard. It is often not clear which party is responsible for these procedures. The procedures are therefore sometimes not implemented by the time the vessel leaves the yard and enters into operation. It is therefore important that the outstanding documentation is covered by a CC to ensure its submittal.

4.7 Special considerations

The following is subject to special considerations and MUST be approved by competent personnel at DNV Høvik, Norway:

— Technical Compliance with related Class Notations:

  — **NAUT-AW or NAUT-OSV(A)**
  — **RP**
  — **BWM-E** or **BWM-T**
  — **RECYCLABLE** notation

— protective location of fuel oil tanks (**CLEAN DESIGN** only)
— systems for reducing NO_x- and SO_x-emission
— ballast water treatment systems
— any unconventional systems and solutions to be implemented onboard.

5. Special interest, Ship in Operation (SiO) phase

Sections 5.1, 5.2 and 5.3 show areas of special interest that generate a lot of questions in the newbuilding and SiO phases. The list is by no means an exhaustive checklist for NB or SiO surveys.

At Annual survey, the following should be verified to be onboard and in use to the extent possible.

5.1 Modifications

Any vessel modifications must be verified to be in accordance with Rules for Environmental Class.

When vessel is subject to bottom survey in dry dock, the absence of TBT-based anti-fouling should be verified as applicable.

5.2 Certificates

As listed in the SiO Survey Report. The following should be noted in particular:

— *EIAPP Certificate:* The vessel must carry an equivalent statement of compliance with the NO_x technical code.
— *Anti-fouling certificate:* Statement of Compliance with the International Convention on the Control of harmful Anti-fouling Systems, where this requirement applies.
— *Type approval certificates:* These are assumed OK unless modifications or changes in equipment have been made.
— *Sewage certificate:* For **CLEAN**, if a sewage system is installed, a Type Approval Certificate must be issued. For **CLEAN DESIGN**, MARPOL certificate (ISPPC) or equivalent (USCG) must be in place.

5.3 Operational procedures and logs

As listed in the Survey Report/Checklist. The following should be noted in particular:

— *NO_x-emission control procedure:* Check that the Technical File is kept in order. For NO_x-reduction equipment (DWI, SCR etc) check that operational procedures including manufacturer's specifications are in place and have been followed. For DWI-systems, the ratio of water to fuel oil must be specified. For SCR-units, the dosage of urea (or other reactant) must be specified. Logs showing the amounts of water or urea consumed must be filled in. It must be verified that the water/fuel oil ratio, or urea dosage, as recorded, results in a NO_x-emission which is in accordance with approved operational procedures. For instance, if a vessel has operational procedures approved where the main engines by the use of DWI will emit 2 g NO_x per kWh, the manufacturer's instructions together with the DWI-log must confirm that this emission factor has been achieved during operation.
— *Fuel oil management plan and logs:* The sampling regime as set up in the fuel oil management plan and/or bunkering procedure should be verified followed. The bunkering receipts must be checked, and the sulphur content of the fuel onboard verified within requirements. In addition, the fuel oil log (or equivalent) must be checked to verify that the limitations on sulphur contents have been followed in ports and restricted

areas. The exact time and corresponding vessel position for when the switch between high and low sulphur fuels has been made, must be recorded.
— *Refrigerant management procedures:* The refrigerant recharge log must be checked to verify that the annual leakage is less than the maximum 10% of the total system charge. If the operational procedures contain provisions for an inspection regime, the inspection log must be checked. This log should contain records of leak detection routines, maintenance and level measurements, as applicable.
— *Oil record book:* Check that the oil record book is filled in, and that entries for the discharge of bilge water have been made. The oil record book is a general requirement under MARPOL Annex I.
— *Garbage record book:* Check that the garbage record book has been filled in, and that discharge of garbage is in accordance with the approved garbage management plan.
— *Sewage discharges:* Check that discharge of sewage has been logged, and that the discharge criteria specified in the approved sewage discharge plan has been adhered to.
— *Ballast water management plan:* This must be in use, the ballast water record book shall show ballast water taken in and discharges. The plan must be used within the strength and stability requirements laid down for the ship.

6. References

Reference is made to the following documents:

Rules for Classification of Ships:

— Pt.6 Ch.12 Environmental Class
— Pt.1 Ch.1 General Regulations
— Pt.7 Ch.1 Sec.6 Sub-section P - Optional Class Notation Surveys Clean Ships
— Pt.6 Ch.2 Redundant Propulsion (Class Notation **RP**)
— Pt.6 Ch.8 Nautical Safety (Class Notation **NAUT-AW**)
— Part 6 Ch.27 Recycling (Class Notation **Recyclable**)

Regulations:

— MARPOL 73/78
— EU Directive 99/32/EC (EU Sulphur Directive)
— IMO NO_x Technical Code
— US EPA air emission standards proposal Tier 2
— IMO Resolution MEPC.46(30) Measures to control adverse impacts associated with the use of Tributyl-tin compounds in anti-fouling paints
— International Convention on the Control of harmful Anti Fouling Systems.
— International Convention for the Control and Management of Ships' Ballast Water and Sediments.
— IMO Standards for Vapour Emission Control Systems, MSC/Circ.585 and MARPOL Annex VI, reg. 15
— IMO Resolution MEPC.76(40) on Standard specification for shipboard incinerators
— USCG 46, CFR 39 on cargo handling vapour emission control systems
— USCG 33 CFR 159 on marine sanitation devices
— Montreal Protocol on substances that deplete the ozone layer
— ISO 8217, Petroleum Products - Fuels (Class F)
— ISO 3170/ISO 3171 (or equivalent national standard), Code of practice for bunkering by bunker barges/ tankers
— ISO 8754, test method, fuel sulphur content
— ISO 7934/ISO 7935/ISO 11632, test method, emission sulphur content
— DNV Petroleum Services Guidelines, “Marine Fuel Management”
— MEPC.182(59) Guidelines for the sampling of fuel oil for determination of compliance with the revised MARPOL Annex VI
— Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, 2009 (SR/CONF/45).