

RULES FOR CLASSIFICATION

Ships

Edition July 2017

Part 6 Additional class notations

Chapter 7 Environmental protection and pollution control

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FOREWORD

DNV GL rules for classification contain procedural and technical requirements related to obtaining and retaining a class certificate. The rules represent all requirements adopted by the Society as basis for classification.

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CHANGES – CURRENT

This document supersedes the January 2017 edition of DNVGL-RU-SHIP Pt.6 Ch.7.

Changes in this document are highlighted in red colour. However, if the changes involve a whole chapter, section or sub-section, normally only the title will be in red colour.

Changes July 2017, entering into force 1 January 2018

Topic	Reference	Description
Optimization of the Documentation requirements	Sec.1 Table 2	Revised documentation requirements: - Arrangement plan for sampling points have been removed. Sampling points to be included in the S010 Piping diagram. - I220 Interphase description has been removed and information about remote and transfer control shall be included in the BWM plan. - Instrument and equipment list, piping diagram, data sheet, arrangement drawing and operation manual for filling procedures are removed from the specific components (BWM system technologies). The same information shall anyway be included in the Z161 operation manual for the ballast water treatment system. A piping diagram for electrolyzers and ozone systems or arrangement drawing for chemical systems and neutralization are still required and shall cover all necessary details. - a structural drawing is only required for chemical tanks containing hazardous chemical, and has thus been removed for neutralization systems which are always a non-hazardous chemicals. - Corrosion reports are covered by GESAMP final approval and is not the responsibility of the Society when the system is type approved. Information is required for the operation manual if corrosion issues are expected. - A hazardous area classification drawing is included as a requirement for ozone and chemical injection systems due to potential hazardous atmosphere. - New control system documentation requirements for safety system has been introduced based on the revised G8. - Requirements for a valid type approval certificate have been removed from Table 3 and inserted in a new Table 4. Pressure equipment product certificate has been included as a document requirement. Pt.4 Ch.7 shall still be used for defining pressure vessels.
Implementation revised G8, MEPC 279 (70)	Sec.1 [3.2.4]	Required on-board documentation included and aligned with G8. The vessel shall be provided with: - a ballast water record book - operation, maintenance and safety manual approved by the administration - type approval certificate of the BWMS - installation specifications (i.e. copy of approved drawings, P&ID) - an approved installation commissioning procedure specific to the BWM system - a copy of the approved ballast water management plan (developed according to the G4 guideline of the convention including details on the BWM system and operation of the BWM system).

Topic	Reference	Description
	Sec.1 [1.6]	Based on the requirement in Sec.1 [3.2.4] for commission test, the requirements for initial survey have been removed and replaced by Sec.1 [1.6] .
	Sec.1 [3.3.2.4]	Added new requirement from revised G8: Any moving parts, which are fitted in hazardous areas, shall be arranged so as to avoid the formation of static electricity.
	Sec.1 [3.3.1.3] , Sec.1 [3.4.3.2] , Sec.1 [3.4.3.8] , Sec.1 [3.4.4.10] and Sec.1 [3.4.5.3]	To be aligned with the requirement for a redundant safety system, all previous required independent and/or immediate shut downs are now defined as safety systems independent of the BWM control system.
	Sec.1 [3.4.4.6] , Sec.1 [3.4.3.7] , Sec.1 [3.4.3.10] , Sec.1 [3.4.3.11]	Based on G8 4.5 and to align with other requirements to chemicals, requirements for material, secondary containers, drip trays and leak detection has been implemented.
	Sec.1 [3.4.4.10] , Sec.1 [3.4.5.3] ,	Based on G8 4.5 two means of independent detection and shutdown are required.
	Sec.1 [4.5.5]	Based on G8 4.17, 7.2 and 7.3 Automation requirements has been updated.

Editorial corrections

In addition to the above stated changes, editorial corrections may have been made.

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SECTION 1 BALLAST WATER MANAGEMENT - BWM

1 General

1.1 Introduction

In 2016, the *International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM)* (hereafter called the Convention), was ratified; with entry into force on 2017-09-08. The Convention provides regulations for the prevention of transfer and introduction of harmful aquatic organisms and pathogens via ballast water. The requirements for the additional class notation **BWM** are supplementary to those given in the Convention.

1.2 Scope

The scope of the additional class notation **BWM** shall prevent the spread of harmful aquatic organisms from one region to another and to ensure safe installations of ballast water management systems.

1.3 Application

The additional class notation **BWM** may be applied to ships of any type whatsoever, operating in the aquatic environment. For special ship types like unmanned barges, special considerations will have to be done and other requirements may be relevant, before being assigned with class notation **BWM**. The requirements in [3.3] and [3.4] are applicable to all ships installing a ballast water management system.

1.4 Class notations

1.4.1 Ships complying with the requirements in this section may be given one of the additional class notations, or a combination of the notations as applicable:

BWM(E[m]) = Ballast water exchange, where **m** denotes the method for exchange that has been applied and shall be replaced by the letters in as defined in [1.4.2].

BWM(T) = Ballast water treatment, see [1.4.3].

1.4.2 The class notation **BWM(E[m])** is applicable to ships complying with the Convention by means of ballast water exchange. The exchange of the ballast water could take place either by the sequential method, flow through method or the dilution method. The applied method is indicated by the letters in the bracket:

- s** for sequential method
- f** for flow-through method
- d** for dilution method.

1.4.3 The class notation **BWM(T)** is applicable to ships complying with the Convention by means of a type approved system(s) for treatment of ballast water (by guideline G8 in the Convention).

1.5 Terminology and definitions

The definitions as stated in the Convention, its appendices and related IMO documents apply to these rules.

1.6 On-board inspection

The ballast water management shall be surveyed according to the Convention. For BWM-T, a commissioning test specific to the ballast water treatment system shall be carried out to the surveyor's satisfaction.

2 Ballast water exchange – BWM(E[m])

2.1 Application

The requirements given in this section are applicable to ships where ballast water exchange at sea is accepted as a process in lieu of treatment of ballast water.

2.2 Documentation requirements

2.2.1 The builder shall submit documentation as required by [Table 1](#). The documentation will be reviewed by the Society as a part of the class contract.

Table 1 Documentation requirements for BWM(E[m])

<i>Object</i>	<i>Documentation type</i>	<i>Additional description</i>	<i>Info</i>
Ballast system	S010 – Piping diagram (PD)	Overflow system	AP
	Z230 – Ballast water management plan	For BWM(E[s]) ; documentation showing stability and strength compliance shall be included	AP
AP = For approval			

2.2.2 For general requirements for documentation, including definition of the info codes, see [Pt.1 Ch.3 Sec.2](#).

2.2.3 For a full definition of the documentation types, see [Pt.1 Ch.3 Sec.3](#).

2.2.4

The vessel shall be provided with:

- a ballast water record book
- a copy of the approved ballast water management plan according to the G4 guideline of the convention.

2.3 General requirements

2.3.1 Strength

2.3.1.1 All strength requirements applicable to the ship shall be met during the ballast water management operation.

Special consideration shall be given to the following parameters, as relevant depending on the method:

- hull girder strength (bending, shear and torsion)
- sloshing in tanks
- bottom slamming
- overpressure in tanks.

2.3.2 Stability

2.3.2.1 All stability and trim requirements applicable to the ship shall be met during the ballast water management operation.

2.3.2.2 Free surfaces of ballast tanks that may become slack during the ballast water management operation process shall be accounted for.

Guidance note:

It is recommended to account for the maximum free surface effect of a tank even when the tank is nearly empty or nearly full.

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2.3.3 Visibility, propeller immersion and forward draught

2.3.3.1 The visibility requirements as set forth by SOLAS Ch.V, Reg.22 shall be observed during the ballast water management operation. The same applies for propeller immersion and minimum draught.

Guidance note:

In case any of the above limits are exceeded, the guidelines included in IMO MSC/Circ. 1145 *Precautionary advice to masters when undertaking ballast water exchange operations* should be followed.

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2.4 Requirements applicable to ships using flow-through method

2.4.1 Ballast water management plan

2.4.1.1 A table showing the volume of each tank, the available pumps and the estimated time for the flow-through of water, corresponding to a volume three times the tank volume, shall be included in the ballast water management plan. In cases the floating position changes due to using the flow-through method for partially filled tanks, the affected exchange steps shall be presented in the ballast water management plan as required by [2.6.1.1].

2.4.2 Piping and systems

2.4.2.1 The capability of the ballast water system to provide ballast water exchange by the flow-through method, without the risk of the tank being subject to a pressure greater than for what it has been designed, shall be demonstrated by water flow calculations, see Pt.4 Ch.6 Sec.4 [11.2.1].

2.4.2.2 The flow-through method, with water flowing over the deck, may not be permitted for ships with class notations referred to in Ch.6.

Guidance note:

The use of collecting pipes, internal overflow pipes or interconnecting pipe/trunk arrangements between tanks, may be used to avoid water flowing over the deck.

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2.5 Requirements applicable to ships using dilution method

2.5.1 Ballast water management plan

2.5.1.1 A table showing the volume of each tank, the available pumps and the estimated time for the exchanging of water corresponding to a volume, three times the tank volume, shall be included in the ballast water management plan.

2.5.2 Piping and systems

2.5.2.1 Level monitoring system shall be provided, where maintaining a constant level in a tank is essential to the safety of the ship during ballast water exchange.

2.6 Requirements applicable to ships using sequential method

2.6.1 Ballast water management plan

2.6.1.1 Detailed calculation, documenting compliance with stability requirements and strength limitations applicable to the ship, shall be presented for each step in the ballast exchange sequence. The following information at the start and end point of each step shall be included:

- ballast water volume for each tank
- involved pumps
- estimated time span
- strength values in relation to permissible values
- stability information under consideration of free surface effects during filling or discharging
- draught values at F.P., A.P. and heeling
- visibility and propeller immersion checks.

For vessels equipped with an approved loading computer covering all relevant stability and longitudinal strength requirements, detailed calculations need not be presented provided that clear instructions regarding planning of the ballast exchange sequence by use of the loading computer are included.

2.6.1.2 For tankers and bulk carrier with class notation **CSR**, the requirements and restrictions set by the respective rules shall also be observed.

2.6.1.3 If the sequential method is applicable for at least one tank, exchange sequences based on at least one of the following loading conditions included in the stability booklet shall be included:

- standard ballast condition
- if applicable, the heavy ballast and the emergency ballast conditions
- a critical loading condition with cargo and ballast water onboard, for one of the stages (departure, mid voyage, arrival) where the least safety margin(s) to the valid stability and/or strength limits occur.

Guidance note:

In case ballast water exchange is not possible to be performed on the critical loading condition within permissible strength and/or stability limits, such loading condition may be altered to a degree where compliance with the limits is possible. In such cases the altered departure and arrival conditions should be included in the ballast water management plan.

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3 Ballast water treatment - BWMT

3.1 Introduction

The ballast water management system shall comply with the safety requirements in [3.3] and [3.4] and the performance standard as set forth by regulation D-2 of the Convention and in [4].

3.2 Documentation requirements

3.2.1 Documentation shall be submitted as required by Table 2 and Table 3. Additional documentation may be required in special cases (e.g. as a result of the required Hazard analysis in chapter [3.4.2]).

Table 2 Documentation requirements related to functions for BWM(T)

<i>Object</i>	<i>Documentation type</i>	<i>Additional description</i>	<i>Info</i>
Ballast system	S010 – Piping diagram (PD)	Connection to and details of the ballast water treatment system (including main components). Details of ballast water sampling points	AP
	Z230 – Ballast water management plan	Details of components and operation of the BWM system. Description on transfer of control and external signals to be communicated between BWM system and alarm system and/or its remote control. Signals from external bypass valves to be detailed	AP
Ballast water treatment system	I080 – Data sheet with environmental specifications	If not TA by the Society; Environmental test report	AP
	Z030 – Arrangement plan	When all or part of the BWM system is required to be placed in a separate compartment: Accesses, emergency escapes, gas detectors, ventilation and air locks when relevant for the treatment system compartment	AP
	Z254 – Commissioning procedure	Procedure specific to the system installed onboard and in compliance with the G8 Guidelines	AP
	Z161 – Operation manual	Details of operation, maintenance, safety (hazard identification), environmental and human health impact and system design limitations in accordance with guideline G8 and approved by the administration	FI
	G010 – Hazard Analysis	If the BWM system or the storage tanks for process chemicals could emit harmful gases e.g. hydrogen or ozone	FI
	I020 – Control system functional description	Description of safety system, independent of the BWM control system	AP
	I030 – System block diagram	Diagram of safety system, independent of the BWM control system	AP
	I150 – Circuit diagrams	Diagram of safety system, independent of the BWM control system	AP
	H050 – Structural drawing	Foundation of the BWM system	AP
AP = For approval; FI = For information			
Chemical injection system	H050 - Structural drawing	Tanks containing potentially hazardous liquid chemicals.	AP
	Z030 – Arrangement plan	Filling arrangements, maintenance access, air pipes, sounding, drip trays and drain systems from drip trays, ventilation, gas detection, pressure and temperature monitoring for tanks containing potentially hazardous liquid chemicals. Fire fighting measures if relevant.	AP
	G080 - Hazardous area classification drawing	For BWTS components generating hazardous gases.	AP

<i>Object</i>	<i>Documentation type</i>	<i>Additional description</i>	<i>Info</i>
Neutralisation system	Z030 – Arrangement plan	Drip trays, filling arrangement, drainage from drip tray and maintenance access.	
Electrolysis unit	S010 – Piping diagram (PD)	Auxiliary systems, e.g. for ventilation of hydrogen with all detectors and sensors for hazardous gases generated by the process.	AP
	E170- Electrical schematic drawing	Emergency power supply to blowers for dilution of hazardous gas.	AP
Ozone system			AP
	G080 - Hazardous area classification drawing	For BWTS components generating hazardous gases.	AP
De-oxygenation system	S010 – Piping diagram (PD)	Auxiliary systems, e.g. for PV valves for ballast tank vent heads. Detectors for hazardous gases generated by the treatment process and/or oxygen detectors.	AP
Heat treatment	S010 – Piping diagram (PD)	Auxiliary systems, e.g. for heating arrangements.	AP
AP = For approval			

Table 3 Certification requirements for BWM-T

<i>Object</i>	<i>Certificate type</i>	<i>Issued by</i>
Ballast water treatment system	TA	Administration
Pressure equipment	PC	Society

3.2.2 For general requirements to documentation, including definition of the info codes, see [Pt.1 Ch.3 Sec.2](#).

3.2.3 For a full definition of the documentation types, see [Pt.1 Ch.3 Sec.3](#).

3.2.4

The vessel shall be provided with:

- a ballast water record book
- operation, maintenance and safety manual approved by the administration (reference in type approval certificate is sufficient)
- type approval certificate of the BWMS
- installation specifications (i.e. copy of approved drawings, P&ID)
- an approved installation commissioning procedure specific to the BWM system
- a copy of the approved ballast water management plan (developed according to the G4 guideline of the convention including details on the BWM system and operation of the BWM system).

3.3 Safety requirements for ballast water treatment systems

3.3.1 Piping

3.3.1.1 The BWM system installation shall be possible to be isolated from any essential ship system in case of an emergency. The BWM system must be provided with a by-pass or override arrangement.

Guidance note:

For the connection to other essential system, the by-pass or override arrangement should be possible from the station where the other essential system is operated or at least an instruction plate, explaining how/where to override or bypass the BWM system to make the essential system in operation, should be posted at each operation station for relevant essential system and the operation station for the BWM system.

For passenger ships and special purpose ships (SPS) ships, override or bypass of the BWM system from bilge system should be possible from above freeboard deck.

For passenger ships and SPS ships (with more than 60 persons on board) any equipment essential for operation of electrically powered remote controlled bilge valves (or valves to make bilge system in operation) should be power supplied from an emergency source.

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3.3.1.2 Pipes in the BWM system installation may be accepted without L3 testing (see [Pt.4 Ch.6 Sec.2](#) Non-essential systems) if the pipe is not part of the ballast piping system and the following measures are provided to prevent uncontrolled flooding of the spaces where the BWM system is located:

- Metallic isolation valves are fitted at the connections between the BWMS and the main ballast pipe. The isolation valves shall be remotely controlled valves from outside the space, e.g. fire control station, and the valve shall be a fail-safe-closing type valve.
- The pipes have low surface flame spread characteristics (see [Pt.4 Ch.6 Sec.2 \[1.7.1\]](#)).

3.3.1.3 Two layers of safety are required for any part of the BWM system installation which can be isolated and cause internal pressure or temperature increase. At least one of the layers shall have shutdown initiated by a safety system independent of the BWM control system.

Guidance note:

The layers of safety are any actions that do corrective changes to the process.

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3.3.1.4 Where a vacuum may occur in the ballast line due to the height difference, suitable protection means shall be provided, e.g. P/V valves or breather valves, and their outlets shall be led to safe area on open deck.

3.3.2 Automation and electrical installations

3.3.2.1 For instrumentation and automation, including computer based control and monitoring, the requirements in this sub-section are in addition to those given in [Pt.4 Ch.9](#).

3.3.2.2 The electric and electronic components of the treatment system shall comply with the environmental tests required by the G8 guidelines and [Pt.4 Ch.8 Sec.3](#).

Guidance note:

Electromagnetic compatibility (EMC) type tests could be omitted provided measures are taken to attenuate these effects on the distribution system, so the safe operation of the ship is assured, if necessary.

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3.3.2.3 The electrical installation of the BWM system shall comply with [Pt.4 Ch.8](#), general electrical safety.

3.3.2.4 Arrangements of electrical installations in hazardous areas shall comply with [Pt.4 Ch.8 Sec.11](#), based on area classification. Any moving parts, which are fitted in hazardous areas, shall be arranged so as to avoid the formation of static electricity.

Guidance note:

In case of oil recovery operation (OILREC), equipment for ballast water treatment unit not certified according to [Pt.4 Ch.8 Sec.11](#), but located in hazardous area, shall be disconnected in accordance with [Ch.5 Sec.11 \[5.8.3\]](#), and the relevant procedure shall be described in the ballast water management plan. This will restrict the ship to only operate in water under the jurisdiction of one party when in OILREC mode in order to be in compliance with the Convention.

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3.3.3 Location of ballast water management systems

3.3.3.1 Treatment systems intended to treat ballast water from ballast tanks adjacent to cargo tanks, containing liquid oil or chemicals with flash point of 60°C or below, shall be located within the cargo area. Exception is permitted in [\[3.3.3.2\]](#).

Guidance note:

The space for the BWM system when located in cargo area, shall be ventilated according to requirements in [Pt.5 Ch.5 Sec.6](#).

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3.3.3.2 For ships with cargo tanks containing liquid oil or chemicals with flash point of 60°C or below, treatment systems can be placed in gas safe area (i.e. the engine room) if any piping for ballast water treatment from gas safe area to the cargo area are led above deck and led through non-return arrangements. Non-return arrangements shall follow IACS UR M74. Exception is permitted in [\[3.3.3.6\]](#).

Guidance note:

Chemicals injected into the ballast water during discharges also regarded as part of the treatment.

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3.3.3.3 Where the BWM system is installed in a separate compartment that is not defined as a hazardous area and does not serve any ballast tanks considered to be hazardous, the compartment shall be fitted with an independent mechanical ventilation system providing at least six (6) air changes per hour, or as specified by the BWM system manufacturer, whichever is higher.

3.3.3.4 For BWM system making use of active-substances, additional requirements and restriction regarding installation location apply (see [\[3.4.3\]](#)).

3.3.3.5 If the BWM system is using a chemical addressed as non-hazardous by the material safety and data sheet (MSDS) with regards to storage (e.g. cleaning solutions), this can be stored in the engine room, but [\[3.4.4.3\]](#) to [\[3.4.4.9\]](#) applies.

3.3.3.6 Pipe penetration for pipes with small diameter (e.g. used for BWM system monitoring/control) from hazardous area to safe area (e.g. E/R) may be accepted on case-by-case consideration. In this case, additional safety requirements according to UR M74 3.1.7 will apply.

3.4 Additional safety requirements for ballast water treatment systems making use of active substances

3.4.1 Application

3.4.1.1 The requirements in this subsection are applicable to treatment systems using or generating hazardous gases, solids and/or liquid chemicals.

Guidance note:

Hazardous chemicals are defined as any chemical representing flammable, explosive, toxic, corrosive and/or oxidizing hazard. This section is applicable to systems which is using or generating hydrogen, chlorine gas, ozone, acids, chlorine dioxide or peroxide. For other chemicals, the international bulk chemical (IBC) code and material safety and data sheet (MSDS) can be used as a guidance to determine the hazard of the chemicals.

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3.4.2 Hazard analysis

3.4.2.1

A hazard analysis shall be a self-contained document addressing design and operational aspects of the BWM system and consider inter alia (refer to IMO MSC 83, INF2 and BWM.2/Circ.20 *Guidance to ensure safe handling and storage of chemicals and preparations used to treat ballast water and the development of safety procedures for risks to the ship and crew resulting from the treatment process*). The following shall be evaluated;

- BWM system installation location
- storage and handling of hazardous chemicals generated or used by the BWM system
- operation of the system (including alarms)
- fire hazards
- chemicals or preparations in treated ballast water
- ballast water tanks and its venting.

3.4.3 Arrangement of separate compartments for ballast water management systems

3.4.3.1 BWM systems shall be located in a separate treatment room. For treatment systems where separate components are used for storage, handling or generation of hazardous gases/liquids, the requirements for separate treatment room are only applicable for these separate components. BWM systems which fulfill [3.4.3.2] may be located outside of a dedicated treatment room.

3.4.3.2 Treatment equipment may be located outside a dedicated treatment room (e.g. in engine room) if all of the following items are met:

- The equipment or components are installed within normally manned spaces such as the engine room.
- The piping follow requirements set in [3.4.5].
- Gas detection equipment is fitted in all locations where dangerous gas could be present due to a leakage. An audible and visual alarm shall be given at a manned location and a shut down of the BWMS shall be initiated by a safety system, independent of the BWM control system.
- The manufacturer can demonstrate as in [3.4.2] that the amount of liquid chemicals or gases generated are far below the normally recognized thresholds for toxic, flammable, explosion or suffocating hazards.
- The system does not include any storage of hazardous chemicals.

3.4.3.3 The treatment room shall be a separate compartment surrounded by steel decks and bulkheads and have only access directly to open deck. If a secondary containment dimensioned to handle a full tank leak is arranged, the access may be through an air lock to other spaces below deck. The room shall be fitted with self-closing doors opening outwards and with a sill height of at least 300 mm.

Decks and bulkheads shall be without openings and pipe and cable penetrations etc. shall be sufficiently tight to prevent leaking of gas or liquid entering other rooms and spaces.

The compartment shall be positioned outside of any combustible, corrosive, toxic, or hazardous areas unless otherwise specifically approved.

3.4.3.4

If access through air lock is applicable, the requirements in Pt.5 Ch.6 Sec.3 [3.1.6] and Pt.5 Ch.6 Sec.10 [2] shall be met.

3.4.3.5

Fire integrity of the treatment room shall be equivalent to other machinery spaces.

3.4.3.6 The ventilation system for the treatment room shall be separated from other ventilation systems, shall be of the exhaust type and to give minimum six (6) air changes per hour or as specified by the BWM system manufacturer, whichever is higher. Additional requirements may apply for emergency ventilation (see [3.4.3.8]). If the gases stored, generated or evaporated from liquid state are heavier than air the ventilation exhaust shall be from the bottom of the treatment room.

3.4.3.7

The ventilation shall be arranged such that a single failure cannot cause any reduction in ventilation capacity.

3.4.3.8 The treatment room shall be provided with gas detection. Gas detection alarms shall be given locally and at a manned location.

A safety system, independent of the BWM control system, shall initiate the following actions upon gas detection:

- Shut down of the BWM system
- Start emergency ventilation system with ventilation capacity according to recognized standards, recommendations in material safety data sheet (MSDS) or manufacturers guideline.

Additional requirements for Ozone systems are given in [Pt.4 Ch.6 Sec.7 \[2.4.9\]](#).

3.4.3.9 All ventilation outlets from the treatment room shall have visible signs informing that the ventilation outlet may contain hazardous gas. The outlets shall be at safe locations with regard to:

- the hazards of possibly leaked gases in the ventilation air
- intake of ventilation air into other ventilation systems on the ship
- recycling between the ventilation outlets and intakes for the treatment room.

3.4.3.10 Thin-plate ventilation ducts for other spaces shall not be lead through the treatment room.

3.4.3.11 The compartment shall be arranged with a bilge system separated from the ship's main bilge system, and shall be operable from outside the compartment. The bilge system shall be compatible with the chemicals carried.

3.4.3.12 When containing gases or liquid chemicals used or generated during treatment having flash point of 60°C or below, or acids where the IBC code requires compliance with chapter [15.11.5]; the treatment compartment shall be considered as a hazardous area zone 1 as defined in IEC Standard 60092-502. The hazardous zone plan shall be created in accordance with requirements in [Pt.5 Ch.6 Sec.12](#).

3.4.3.13

For spaces where acids are stored and no secondary containment is installed, the floor shall be lined with suitable material to a height corresponding to a full tank leak.

3.4.4 Handling and storage of gas and liquid chemicals

3.4.4.1 The requirements for handling of liquid chemicals given in the IBC code and gases given in the IGC code shall be used as guidelines.

3.4.4.2 Drain water from sample units or from cleaning liquid containing active substances should be led back to the ballast line or neutralised before discharge. Alternative arrangements shall be approved on a case by case basis.

3.4.4.3 The chemical tanks shall be located in a well ventilated space.

3.4.4.4 Inspection and filling of the chemical tanks shall be easy and accessible.

3.4.4.5 Drip trays shall be arranged below the liquid chemical tanks, tank connections, flanges and pumps serving the tank. An efficient drain system from the drip tray shall be arranged.

3.4.4.6 The material of the chemical tank, secondary containments, drip trays and piping shall be suitable to the chemicals intended to be used.

Guidance note:

See also IACS UI CC6.

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3.4.4.7 The operation manual for the BWM system shall include a description of filling procedures, alarms, emergency procedures etc. including an MSDS sheet of the chemical stored. The manual shall include a procedure for handling small and large leaks and it shall be available onboard.

3.4.4.8 Signs on the chemical tank stating the content of the tank and simple and essential safety measures shall be available.

3.4.4.9 Handling and storage of chemicals and relevant personal protective equipment (PPE) shall be according to IBC code or MSDS. At least two sets of PPE shall be available in a well marked locker, close to the location or entrance of the chemical tank.

3.4.4.10 Chemical tanks shall be equipped with:

- Air pipes leading to safe area on open deck.
- Ventilation outlets shall not be located in places where personnel/passengers pass by or stay (i.e. close to filling station).
- Ventilation outlets shall be arranged to avoid water ingress.
- If the chemical is a liquid; a high level alarm in compliance with [Pt.5 Ch.6 Sec.13 \[2.2.2\]](#) is required.
- Monitoring measures to give alarm in case of any unfavourable chemical reactions that could emit dangerous gases/liquids or lead to increased pressure. Monitoring measures shall have at least two means of detection and give alarm. Safety measures must be considered case by case, but the IBC code shall be used as reference.
- In case any safety systems are dependent on power supply, the safety system shall be connected to UPS or emergency power (i.e closing of tank valves).
- Leak detection in the drip trays. When a leak is detected, an audible and visual alarm shall be given at a manned location and a shut down of the BWMS shall be initiated by a safety system, independent of the BWM control system.
- Any drainage of the drip trays shall be made of a material suitable for the chemical in the tank.

3.4.4.11 The construction of the chemical tank shall be approved by the Society in compliance with [Pt.2 Ch.4 Sec.8](#). The independent tank shall be leak and structure tested according to [Pt.2 Ch.4 Sec.8 Table 3](#).

3.4.4.12 Storage spaces dedicated for single components generating small amounts of flammable liquid chemicals or explosive gases shall be regarded as hazardous area zone 1 and shall be gas tight when installed in a gas safe area.

3.4.4.13 Safety, spillage and fire fighting measures will be considered on a case by case basis, depending on the products used.

3.4.5 Requirements to piping systems used for hazardous gas or liquid

3.4.5.1 All piping shall in general be in compliance with [Pt.5 Ch.6 Sec.6](#) if not specifically mentioned otherwise in these rules.

3.4.5.2 Any part of the BWM system installation which can be isolated and generate hazardous gases or liquids shall have detection and shut down of the BWMS in accordance with [\[3.3.1.3\]](#).

3.4.5.3 Piping systems containing hazardous gas or liquid diluted to concentrations below flammable, explosive, corrosive or significant toxic levels shall be according to the following requirements:

- Flange connections shall be minimized as far as possible.
- Gas pipes (i.e. ventilation pipes) shall always be ascending.
- To verify sufficient dilution, two independent means of detection shall be present (i.e. flow sensor and chemical gas/liquid detection sensor). Detection of insufficient dilution (i.e. gas concentration at 60% of LEL) shall initiate an audible and visual alarm at a manned location and a shut down of the BWMS shall be initiated by a safety system, independent of the BWM control system.
- Dilution fans (if relevant) shall be arranged with redundancy.
- One of the fans shall be connected to an alternative source of power (UPS or emergency power). A single failure shall not cause a complete dilution failure.
- Any electrical installations in contact with diluted flammable or explosive gas shall be certified safe for zone 1 in accordance with [Pt.4 Ch.8 Sec.11](#).
- Outlets from pipes leading to open deck shall have visible signs informing that the ventilation outlet may contain hazardous gas.

Guidance note:

Pipes leading to open deck should be routed to 2 m above deck away from and at least 4.5 m horizontal distance from ventilation inlets, openings to accommodation and service spaces. Outlets shall not be located in places where personnel/passengers pass by or stay.

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3.4.5.4 Piping systems containing hazardous gas or liquid at concentrations that is flammable, explosive or significant toxic (as identified in hazard analysis, see [\[3.4.2\]](#)) shall be according to the following requirements:

- Double walled pipes or equivalent (i.e. full penetrations butt welding).
- Flange connections may be accepted on case-by-case consideration. In this case, spray shield, a sensor for gas detection or equivalent shall be located in the vicinity of any flange.
- The extent of piping system shall be minimized, preferably in the same compartment or room.
- Piping systems shall be routed to avoid damage from dropped objects, and shall avoid routing close to the ship side or bottom to reduce the likelihood of pipe rupture in case of collision or grounding.
- Piping system shall be away from heat sources.
- Material of the piping system shall be suitable for the media flowing in it.
- Piping system shall not be located within the crew accommodation spaces, the navigating bridge or such that all accesses to the main engine room will be blocked in case of pipe rupture.

3.4.5.5 Piping systems containing hazardous gas or liquid shall be marked according to ISO14726 or equivalent. Ozone piping shall be marked with a distinct colour, separating it from other piping.

4 Statutory requirements and interpretations of the ballast water management convention

4.1 References

4.1.1 General

4.1.1.1 Reference is made to the convention and its guidelines.

4.2 Certificates

4.2.1 General

4.2.1.1 Ships complying with the requirements in this section will be given one of the below listed statements or certificates. The vessel can only receive an international certificate if the flag state of the vessel has signed the convention:

- statement of compliance ballast water exchange
- statement of compliance ballast water treatment
- certificate of compliance ballast water exchange
- certificate of compliance ballast water treatment
- International Ballast Water Management Certificate D1
- International Ballast Water Management Certificate D2.

4.3 Sediment management

4.3.1 General

4.3.1.1 The recommendations given in guidelines annex 3 of resolution MEPC.209(63) *2012 Guidelines on design and construction to facilitate sediment control on ships (G12)* shall be observed as far as practicable, e.g. by provision of scallops.

4.3.1.2 Sediment management shall follow the recommendations given in the guidelines to the convention.

4.3.1.3 Detailed sediment management procedures shall be included in the ballast water management plan.

Guidance note:

At least, manual sediment removal every 5 years during class renewal should be addressed.

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4.4 Ballast water exchange (D-1)

4.4.1 Application

4.4.1.1 Ballast water exchange will be phased out as an acceptable method for complying with the convention, depending on ballast water capacity and date of delivery of the ship. Thereafter, ballast water treatment will be the only remaining option for complying with the convention.

Guidance note:

The class notations **BWM(E[m])** may be withdrawn when the ballast water exchange has been phased out.

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4.4.1.2 The requirements given in this subsection shall be applied to ships where ballast water exchange at sea is accepted as a process in lieu of treatment of ballast water.

4.4.2 Sequential method

4.4.2.1 Where the sequential method is adopted, the requirements of [2.6.1] shall be observed. An exchange sequence based only on the standard ballast loading condition needs to be considered. Sea chests and shipside openings intended for ballast water exchange.

4.4.2.2 The relative positions of ballast water intake and discharge openings shall be such as to preclude, as far as practicable, the possibility of contamination of replacement ballast water by water which is being pumped out.

4.4.3 System arrangement

4.4.3.1 The internal arrangements of ballast tanks as well as ballast water piping inlet and outlet arrangements shall allow for required ballast water exchange and the clearing of sediments.

4.4.4 Control features

4.4.4.1 Remote control - ballast pumps, and all valves to be operated during ballast water exchange shall be provided with means of remote control from a central ballast control station.

Pump start/stop shall be included. Flow/speed control shall also be included, if part of the control system.

4.5 Ballast water management systems (D-2)

4.5.1 Supporting structure

4.5.1.1 A support structure for the foundation of the BWM system shall be provided, taking into consideration all operational conditions of the BWM system.

4.5.2 Sampling points

4.5.2.1 The ballast water system shall be provided with sampling facilities, arranged according to the provisions of the guidelines for ballast water sampling (G2 guidelines). Accordingly, the sampling point shall be arranged in the discharge pipe as close as possible at the shell.

4.5.3 Piping

4.5.3.1 Systems with combined ballast and cargo piping and pumping shall have provisions to thoroughly clean and flush the common pipeline before ballasting or discharge of ballast water. This shall be described in the *Ballast Water Management Plan*.

4.5.4 Treatment rated capacity

4.5.4.1 The BWM system is always to be operated within the approved flow range and not exceed the treatment rated capacity (TRC) specified in the flag administration type approval certificate.

In case the installed ballast water pump capacity is higher than the total TRC of the BWM system, flow control measures shall be installed.

Guidance note:

If the flow rate is higher than the TRC, a warning should be given and logged in the system. The warning should turn into an alarm if the high flow rate above the TRC continues (beyond the time approved during type approval process).

Gravity flow through the treatment system is allowed, given that this is specified in the type approval certificate.

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4.5.4.2 When treatment systems are duplicated to meet a specific ballast pumping capacity, the distribution of the flow between the different treatment units shall be done in such a way that the individual flow rate through each unit is within the range given in the type approval certificate.

Guidance note:

The following measures can be accepted;

- Flow control and flow measurement for each individual flow.
- Uniform flow proven by CFD modelling for the installed piping and BWM system.
- Flow measurements during commissioning.

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4.5.4.3 Alternative means of ballast water treatment where water is circulated in the ship and through a BWM system are in principle acceptable. Systems employing this method will be considered on a case by case basis. For in tank circulation, discharging the water before completed treatment will be regarded as a bypass. Means to control what water is treated or not shall be recorded in the control system. Detailed instructions shall be included in the ballast water management plan on the operation of the system.

Guidance note:

Operation according to type approval certificate, control and recording of status on valves, treatment sequence, stability and strength of the ship will be considered.

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4.5.5 Automation

4.5.5.1 In case of any failure compromising the proper operation of the treatment system, audible and visual alarm signals shall be given in all stations from which ballast water operations are controlled.

4.5.5.2 Any possible bypass of the treatment system shall activate an alarm by the BWM control equipment. The bypass event shall also be logged in the ballast water record book.

Guidance note:

Use of a ballast pump that is not connected to the treatment system is considered a bypass of the BWM system. Gravity uptake or discharge may be considered as a bypass for BWM systems installed in the ballast line. Discharge of untreated water may be considered as a bypass for in-tank systems.

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4.5.5.3 The BWM control equipment shall be able to log all general alarms, operational alarms, system design limitation parameters, any changes to system design limitation parameters and bypass alarms for 24 months in accordance with part 5 of the G8 guideline. If the BWM control equipment has been de-energized without the possibility to log any bypass alarms, the system shall log the time period for being out of operation when re-energized.

4.5.5.4 If internal transfer of ballast water within the ship, (e.g. anti-heeling operations) may affect compliance by the ship with the standard described in regulation D-2 (i.e for circulation or in-tank treatment), the internal transfer shall be recorded in the BWM control system as transfer operations.

4.5.6 Discharge of untreated ballast water trapped in piping

4.5.6.1 Means to discharge remaining untreated ballast water in the pipeline between the sea chest and the treatment system shall be provided. Detailed instructions on how this discharge is done shall be included in the ballast water management plan.

Guidance note:

Ships with treatment systems, where compliance with the D-2 standard of the Convention requires treatment during ballasting and discharge, should be provided with means to efficiently drain the ballast tanks such that remaining half treated water cannot be a contamination source.

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4.5.7 Semi-submersible ships

4.5.7.1 In cases ballast water uptake and discharge is done at the same location during loading/unloading of the ship, there is no transport of species to be considered from one location to another. However, remaining untreated water and sediments of the ballast water tank may be a contamination source in the next location. A description of the ballasting and discharge procedures in the same location and before voyage shall be submitted for approval.

Guidance note:

Port state control should be contacted for clarification of local regulations with regards to sediment management.

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SECTION 2 ENVIRONMENTAL CLASS - CLEAN

1 General

1.1 Introduction

The additional class notations **Clean**, **Clean(Design)**, **Clean(Tier III)** and **Clean(Design,Tier III)** set requirements for ship's design, operation and equipment reducing the environmental impact from emissions to air, discharges to sea, and deliveries to shore from vessels. The requirements for these additional class notations are in compliance with, or more extensive than those found in international standards currently in force.

1.2 Scope

The scopes of the additional class notations **Clean**, **Clean(Design)**, **Clean(Tier III)** and **Clean(Design,Tier III)** are to attain a vessel with controlled environmental standards of design and performance. Compliance with the rules shall be verified through inspection, measurements and sampling of defined environmental parameters in accordance with the requirements of the rules in this section and in compliance with identified standards and guidelines. Effects and parameters covered are described in [1.5] by reference to technical standards and installations, and their operation

1.3 Application

The additional class notations **Clean** and **Clean(Design)** applies to vessels complying with the requirements specified in Table 1:

Table 1 Requirements for vessels with class notation Clean and qualifier Design

Subject	Class notation with qualifier	
	Clean	Clean(Design)
Vessels ¹⁾ shall be enrolled in the Emergency Response Service (ERS) administered by the Society or similar service provided by another recognized organization.	Yes	Yes
Vessels shall hold class notation, NAUT(AW) or NAUT(OC) , see Ch.3 Sec.3 or NAUT(OSV) , see Ch.3 Sec.5 ²⁾ .	Not required	Yes
Vessels should hold class notation Recyclable ³⁾	Not required	Yes
Vessels shall have BWMS according to the International Convention for the Control and Management of Ships' Ballast Water and Sediment.	D-1 or D-2 Standard ⁴⁾	D-2 standard ⁵⁾
Vessels shall hold class notations VCS(2) ⁶⁾ (Ch.4 Sec.12). (vapour emission from cargo tanks)	Yes	Yes
Vessels shall hold class notation ECA(SOX-A) ⁷⁾ (Sec.3). (meeting requirements for emission control areas)	Not required	Yes
Statement of compliance with respect to MARPOL Annex V.	Yes	Yes

Subject	Class notation with qualifier	
	Clean	Clean(Design)
- Vessels less than 5000 GT and vessels designed for offshore operations with class notation SF or better damage stability do not need to meet this requirement. Gas fuelled vessels do not need to meet this requirement if not intended for carrying cargo with large pollution potential. NAUT(OSV-A) is applicable to offshore vessels, NAUT(AW) is applicable to passenger ships, tankers, bulk carriers, container ships, etc., NAUT(OC) is applicable for vessels largely operating on the high seas. - Statement of compliance for inventory of hazardous materials may be accepted as a replacement to class notation Recyclable. - Vessels shall have either class notations BWM(E[m]) or BWM(T) or statement of compliance/certificate of compliance with standard D-1 or D-2 of the international ballast water management convention. - Vessels shall have either class notations BWM(T) or statement of compliance/certificate of compliance with standard D-2 of the international ballast water management convention shall. - Applies to Tanker for Oil, Tanker for Oil Products or Tanker for Chemicals. - Gas fuelled vessels, ships continuously operating with low sulphur fuels [below 0.1% sulphur mass content] and vessels equipped with type approved exhaust gas cleaning system for SOx are accepted as equivalent to the ECA notation.		

1.4 Class notation and qualifiers

1.4.1 The class notation **Clean** identifies the basic requirements for controlling and limiting operational emissions and discharges. The requirements are specified in [2].

1.4.2 The class notation **Clean** with the qualifier **Design** identifies additional requirements for controlling and limiting operational emissions and discharges. In addition, this qualifier specifies design requirements for protection against accidents and for limiting their consequences. The requirements are specified in [3].

1.4.3 When vessels complying with requirements of either **Clean** or **Clean(Design)** class notations, the qualifier **Tier III** may be assigned for those vessels complying with the NOx emission requirements of Tier III according to MARPOL Annex VI, Regulation 13.

1.5 Definitions

Table 2 Definitions

Term	Definition
anti-fouling systems	a coating, paint, surface treatment, surface, or device used to control or prevent attachment of un-wanted organisms
ballast water	water with its suspended matter taken onboard a vessel to control trim, list, draught, stability or stresses of the vessel
ballast water treatment system	any system which processes ballast water such that it meets or exceeds the Ballast Water Performance Standard in Regulation D-2 in the Ballast Water Management Convention. The BWTS includes ballast water treatment equipment, all associated control equipment, monitoring equipment and sampling facilities

<i>Term</i>	<i>Definition</i>
bilge water tank	bilge water tank(s) in accordance with requirement at [3.3.6.6] includes: 1) bilge holding tank(s) 2) bilge Settling tank(s) 3) clean drain tanks (if fitted according to IBTS)
biofouling	the accumulation of aquatic organisms such as micro organisms, plants, and animals on surfaces and structures immersed in or exposed to the aquatic environment. Biofouling can include microfouling and macrofouling
cargo handling systems	cargo handling systems comprise: — cargo tank vents for tankers with cargoes where evaporation may occur during loading, transport and discharge. (e.g.: tanker for oil, tanker for chemicals, tanker for liquefied gas, tanker for oil products, offshore service vessels and well stimulation vessels) — pumping and piping systems for tankers carrying cargoes that may cause global or local pollution
clean drain tank	a tank which holds internal drains such as those resulting from the leakage of and condensate from equipment used for seawater, freshwater, steam, air conditioning etc. which are not normally contaminated by oil
deliveries to shore	delivery of potential pollutants to shore facilities, for controlling, disposal, recycling, etc.
discharges to sea	all discharges to sea which are caused by or needed for operation of the vessel, energy consumers, cargo, passengers, and crew onboard a vessel, and any toxic discharges caused by protection and conservation of vessel or cargo
emissions to air	all emissions to air which are caused by or needed for the operation of the vessel, energy consumers, cargo, passengers, and crew onboard a vessel, and any toxic emissions caused by operation, protection and conservation of vessel or cargo
food waste	any spoiled or unspoiled victual substances, such as fruits, vegetables, dairy products, poultry, meat products, food scraps, food particles and all other materials contaminated by such wastes, generated onboard ship, principally in the galley and dining areas
garbage	garbage includes all kinds of provisions, domestic and operational waste excluding fresh fish and parts thereof, generated during normal operation of the vessel and liable to be disposed of continuously or periodically except those substances excluded specifically. Cargo residues from dry cargo vessels are considered as garbage Sewage and waste oils are defined separately and not as garbage
global warming potential, GWP	the GWP values are based on CO ₂ as a reference substance over a time horizon of 100 years. The GWP values from the IPCC Fourth Assessment Report or latest IPCC publication shall be used
greywater	drainage from dishwasher, galley, shower, laundry, bath, washbasin drains and WC scuppers
macrofouling	large, distinct multicellular organisms visible to the human eye such as barnacles, tubeworms, or fronds of algae
microfouling	microscopic organisms including bacteria and diatoms and the slimy substances that they produce. Biofouling comprised of only microfouling is commonly referred to as a slime layer

Term	Definition
oil residue (sludge)	the residual waste oil products generated during the normal operation of a vessel such as those resulting from the purification of fuel or lubricating oil for main or auxiliary machinery, separated waste from oil filtering equipment, waste oil collected in drip trays, and waste hydraulic and lubricating oils waste oils may be dealt with onboard, or pumped ashore. Cargo oil residues in slop tanks (see <i>Residues of cargo oil and chemicals</i>) are considered separate from operational waste oils
oil residue (sludge) tank	a tank which holds oil residues (sludge) from which sludge may be disposed directly through the standard discharge connection or any other approved means of disposal
oily bilge water	water which may be contaminated by oil resulting from things such as leakage or maintenance work in machinery spaces. Any liquid entering the bilge system, bilge piping, tank top or bilge holding tanks is considered oily bilge water
oily bilge water holding tank	means a tank collecting oily bilge water prior to its discharge, transfer or disposal
parts per million (PPM)	PPM means parts of oil per million parts of water by volume
port	the vessel is considered in port from ordering stand by prior to entering port to ordering full ahead when leaving the port. The time will be confirmed by entries in the vessel's logbook
processed clean bilge water tank	a tank which holds processed water from the oil filtering equipment
refrigerants	refrigerant media used in cargo refrigeration plants, provision plants, air conditioning and refrigeration systems onboard all vessels
residues of cargo oil and chemicals	remains of cargo (oil or chemical contaminated water from cargo tank area, slop tanks and cargo pump room)
sewage (black water)	— drainage and other wastes from all toilets and urinals — drainage from medical premises (dispensary, sick bay) via wash basins, wash tubs and scuppers located in such rooms — drainage from spaces containing living animals, or — other waste waters when mixed with any of the drainage systems defined above.
SOx emission control area (ECA emission control area)	SOx emission control areas are defined in the revised MARPOL Annex VI and in the EU Sulphur Directive. 99/32/EC as amended (2005/33/EC) with proposed amendments

1.5.1 Abbreviations

Table 3 Abbreviations

CFC	chlorofluorocarbons
ECA	emission control areas
HCFC	hydrochlorofluorocarbons
HFC	hydrofluorocarbons
HFO	heavy fuel oil
IBTS	integrated bilge water treatment system
IHM	inventory of hazardous materials

IPCC	Intergovernmental Panel on Climate Change
IMO	International Maritime Organisation
ISO	International Organisation for Standardisation
MARPOL or MARPOL 73/78	International Convention for the Prevention of Pollution from Ships
MDO	marine diesel oil
MEPC	Maritime Environmental Protection Committee (IMO)
MGO	marine gas oil
MSC	Maritime Safety Committee (IMO)
ODP	ozone depleting potential (compared to CFC 11)
ODME	oil discharge monitoring equipment
SOx	oxides of sulphur
TBT	tributyltin
USCG	US Coast Guard
VOC	volatile organic compound

1.5.2 International recommendations, standards and references

1.5.2.1 International recommendations, standards and references have been used as foundation for the rules, although the rule requirements may be more stringent. When setting the emission and discharge limits, and determining the measuring procedure, due consideration has been given to technical and practical limitations inherent in the design and construction of different types of vessels.

1.5.2.2 International recommendations, standards and references with provisions used by the Society when developing the rules are reflected in the references specified in [1.5.2.3] to [1.5.2.12]. Unless a particular edition is explicitly referred to, the latest edition of each standard applies.

1.5.2.3 General references

Generally the rules refer to applicable parts of Annexes I, II, IV, V and VI of MARPOL 73/78. Other references for specific areas are given in [1.5.2.4] to [1.5.2.12].

1.5.2.4 Antifouling paint

Requirements for restrictions to use of tributyltin (TBT) in antifouling paint refer to *International Convention on the Control of Harmful Anti Foulings Systems*, adopted by IMO in October 2001 (AFS/CONF/26).

1.5.2.5 Ballast water

Requirements for restrictions to transfer of harmful organisms in ballast water refer to the Convention.

1.5.2.6 Cargo handling vapour emission control systems

Following references are used:

- IMO *Standards for Vapour Emission Control Systems*, MSC/Circ.585 and revised MARPOL Annex VI, Regulation 15
- USCG Title 46, CFR Part 39.

1.5.2.7 Marine diesel engines

IMO's *NOx Technical Code* (IMO MP Conf. 3/35 Res. 2).

1.5.2.8 Sulphur abatement technologies

If applicable, sulphur abatement technologies should be verified according to Resolution MEPC.184(59) adopted on 17th July 2009 *Guidelines for on board exhaust gas-SOx cleaning system*, taking into account local legislation (e.g. EU requirements) and amendments if any.

The sulphur abatement technology shall document thoroughly that any waste stream discharged into enclosed ports, harbours and estuaries have no impact on ecosystems, based on criteria communicated by authorities of port states to the IMO.

1.5.2.9 Refrigerants and fire fighting media

Refers to *Montreal Protocol on Substances that Deplete the Ozone Layer*.

1.5.2.10 Shipboard incinerators

Refers to IMO Resolution MEPC.76(40) on *Standard specification for shipboard incinerators*.

1.5.2.11 Bilge water separators

Refers to IMO Resolution MEPC.107(49) *Revised guidelines and specifications for pollution prevention equipment for machinery space bilges of ships*.

1.5.2.12 Sewage treatment plant

Refers to IMO Resolution MEPC.159(55) *Recommendation on standards for the rate of discharge of untreated sewage from ships*.

1.6 Procedural requirements

1.6.1 Documentation and certification requirements

1.6.1.1 Documentation shall be submitted as required by [Table 4](#).

1.6.1.2 For general requirements to documentation, see [Pt.1 Ch.3 Sec.2](#).

1.6.1.3 For a full definition of the documentation types, see [Pt.1 Ch.3 Sec.3](#).

1.6.1.4 Documentation required with respect to class notation **BWM(E[m])** and **BWM(T)** is given in [Sec.1](#). Required documentation is the same for corresponding statement of compliance/certificate of compliance. Documentation required with respect to class notation **Recyclable** is given in [Sec.4](#). Required documentation is the same for corresponding statement of compliance.

Documentation required with respect to class notations **NAUT(OC)**, **NAUT(AW)** and **NAUT(OSV)** is given in [Ch.3 Sec.3](#) and [Ch.3 Sec.5](#) respectively.

Documentation required with respect to class notation **VCS(2)** is given in [Ch.4 Sec.12](#).

1.6.1.5 In addition to marine equipment required to be certified according to statutory requirements in MARPOL, the following certificates given in [Table 4](#) are required for **Clean(Design)** class notation.

Table 4 Certificates required

Object	Certificate type	Issued by	Certification standard	Additional description
Bilge water separator	Type approval certificate (TA)	Society	DNVGL-CP-0208	5 ppm separator
Bilge alarm (oil-content meter)	Type approval certificate (TA)	Society	DNVGL-CP-0485	5 ppm alarm
Ballast water treatment system	Type approval certificate (TA) ¹⁾	Society ¹⁾	DNVGL-CP-0209	

<i>Object</i>	<i>Certificate type</i>	<i>Issued by</i>	<i>Certification standard</i>	<i>Additional description</i>
1) Ballast water treatment systems type approved by other recognized organizations according to IMO guidelines for approval of ballast water management systems (G8), Res. MEPC.174(58), may be accepted.				

1.6.2 In-service requirements

1.6.2.1 If approved arrangements, equipment or procedures are altered or modified, documentation shall be either resubmitted for approval or accepted by the attending surveyor at annual surveys.

1.6.2.2 The environmental performance of systems covered by the rules in this section shall be verified by inspection, measurements, and sampling, or by other equivalent means in accordance with the requirements of the rules in this section and in compliance with identified standards and guidelines. Data shall be gathered and kept onboard in appropriate logbooks for review during periodical surveys as defined in [Pt.7 Ch.1 Sec.6 \[16\]](#).

Table 5 Documentation requirements

<i>Object</i>	<i>Documentation type</i>	<i>Additional description</i>	<i>Info</i>	<i>Clean qualifiers</i>
Fuel and lubrication oil systems	H210 – Protected tank location drawing	Applicable for all tanks containing oil or oil based liquids	AP	Design
Fuel oil system	Z160 – Operation manual	Including bunkering procedures and management plan for control of SOx emissions	AP	All
Biofouling	Z160 – Operation manual	Biofouling management plan	AP	Design
Sewage system	S010 – Piping diagram		AP	All
	Z160 – Operation manual	Sewage management plan including sewage discharge log	AP	All
	Z100 – Specification	Capacity calculation of holding tanks for sewage and greywater	FI	Design
Garbage disposal system	Z160 – Operation manual	Garbage management plan with garbage record book	AP	All
Greenhouse gas handling	S010 – Piping diagram	Refrigeration and air conditioning systems.	AP	All
	Z100 – Specification	Fire fighting systems, including data sheet for extinguishing media	FI	All
	Z110 – Data sheet	Refrigerants	FI	All
	Z160 – Operation manual	Refrigerant management procedures	AP	All
Oil pollution prevention	Z180 – Maintenance manual	Template of the oil consumption log for oil/water interfaces and monitoring procedures	FI	All

<i>Object</i>	<i>Documentation type</i>	<i>Additional description</i>	<i>Info</i>	<i>Clean qualifiers</i>
	Z030 – Arrangement plan	Cargo and non-cargo manifold areas, including drip trays and oil spill prevention arrangements	AP	All
	Z231 – Bilge water and sludge management plan		AP	Design
Sludge tanks	H050 - Structural drawing		AP	Design
Stern tube	Z100 - Specification	Double barrier seal	AP	Design
Cargo piping system	Z030 – Arrangement plan	Side view of manifold arrangement. Including relevant data requested by OCIMF Standard Sec.1 and 2. Applicable for tankers for oil or chemicals	AP	All
	Z030 – Arrangement plan	Means to support hoses in way of ship's side abreast of manifolds. Applicable for tankers for oil or chemicals	AP	All
Cargo storing arrangements	H210 – Protected tank location drawing	Applicable for all tanks containing oil or oil based liquids, Applicable for tankers for oil or chemicals	AP	Design
Cargo compartments cleaning system	S110 – Shadow diagram	Applicable for tankers for oil or chemicals	AP	Design

2 Class notation Clean

2.1 Introduction

2.1.1 General

2.1.1.1 The rules in this section give requirements for reducing emissions to air from energy producers, cargo-handling systems and service systems onboard the vessel. References are made to national and international recommendations, standards and guidelines on emission criteria in relation to the protection of the environment.

2.1.1.2 The rules in this section give requirements for limiting discharges to sea from energy producers, lubrication and hydraulic systems, cargo/passenger handling systems, waste/sewage systems, underwater antifouling systems and ballast water systems onboard vessels. References are made to national and international recommendations, standards and references on discharge criteria in relation to protection of the environment.

2.1.1.3 All ships shall comply with applicable MARPOL convention requirements and *International Convention on the Control of Harmful Anti Fouling Systems* (AFS/CONF/26) regardless of any exemption(s) granted by flag state or other authorities.

2.2 Emissions to air

2.2.1 General

2.2.1.1 Fuel oil management and control shall be carried out in accordance with a fuel oil management plan and fuel oil log.

2.2.1.2 The fuel oil management plan shall include description of the fuel oil quality, sulphur content in the fuel used onboard and shall document the qualities of the fuel ordered and the qualities of the received fuel as described by the bunker delivery note, see MARPOL, Annex VI, Regulation 18.5 and 18.6, and 99/32/EU with amendments.

2.2.1.3 The fuel oil management plan shall incorporate adequate fuel change over procedure to ensure that the fuel utilised at the time when entering a SOx restriction area is of the required quality. Relevant log books shall provide proof that the fuel of the required quality has been utilized in the relevant areas.

2.2.2 Cargo evaporation

2.2.2.1 Tanker for oil or oil products and tanker for chemicals shall hold a valid class notation **VCS(2)**, see Ch.4 Sec.12.

2.2.3 Refrigerants

2.2.3.1 The requirements in this section shall apply to all refrigeration systems having more than 10kg initial charge of a refrigerant including but not limited to cargo refrigeration plants, centralised air conditioning systems, provision plants, MGO chiller units. Domestic type stand-alone air conditioning units and refrigerators do not fall into requirements of this section.

Guidance note:

Domestic type stand-alone units are typically cabin refrigerators, water coolers, ice machines, small air-conditioning units, vending machines, etc.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.2.3.2 The use of ozone depleting substances is not permitted, ODP=0. The refrigerant may be any of the following:

- HFC
- natural refrigerants such as NH3 or CO2.

2.2.3.3 A list of all refrigerant systems onboard defined in [2.2.3.1] shall be included in the refrigerant management plan.

2.2.3.4 Refrigerant systems shall have suitable means of isolation to allow maintenance without releasing any bulk quantity of the refrigerant to the atmosphere. Isolating valves shall be provided to permit compressor removal and replacement without losing the refrigerant charge. A suitable permanent valve for a recovery connection should be provided on all appliances.

Unavoidable minimum releases associated with recapture or recycling are acceptable provided recovery units are installed for the evacuation of the system.

2.2.3.5 For refrigerant recovery, compressors shall be capable of evacuating a system charge into a liquid receiver.

When the condenser itself shall be repaired the refrigerant shall be transferred to:

- other condenser(s) inside the system: if the system has two or more condensers, when one of them shall be repaired, the others shall have enough capacity to hold the entire charge of the refrigerant system
- outside of the refrigerant system: a dedicated container of sufficient volume is used to house the largest refrigerant circuit of the unit. This container shall be available and permanently located close to the unit. The procedure for how to use the recovery unit shall also be provided onboard.

Additionally, recovery units and associated equipment shall be provided to facilitate evacuation of the system either into existing liquid receivers or into suitable reservoirs.

These requirements do not apply to systems using R717 (ammonia) as refrigerant due to safety reasons.

2.2.3.6 Annual refrigerant leakage shall be as small as possible but not more than 10% of the total refrigerant charge for each system. The leakage shall be documented through recorded consumption figures. The figures shall include topping up due to leakage, as well as renewal of refrigerant during repairs or overhauls. The refrigerant log shall at least include: date, system type, refrigerant type, type of failure, initial system charge, refrigerant added, refrigerant recovered, signature type of inspection performed and corrective actions.

If leakage is observed, corrective measures as detailed in the refrigerant management procedure shall be implemented.

2.2.3.7 Where different types of refrigerants are used, measures shall be taken in order to avoid mixing of these substances.

2.2.3.8 Refrigerants in refrigeration systems shall be controlled in a manner suitable for detection of all types of leakage.

One or more than one of the following methods for leak detection shall be used:

- an automatic detection system with sufficient sensitivity for refrigerants
- logging refrigerant volumes at regular intervals. As a minimum once per week or
- weekly control of leakages by portable refrigerant detector.

Guidance note:

The chosen solution may be in addition to, or in combination with, safety requirements specified in [Pt.4 Ch.1](#). The requirements in this section do not replace requirements in [Pt.4 Ch.1](#).

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2.2.3.9 The chosen method for detecting leakage shall be described in refrigerant management plan and justified to be suitable for the refrigeration system which is applied. Refrigerant management plan shall include the following procedures: :

- how to monitor the refrigerant system with respect to possible leaks
- how often any such monitoring shall take place
- limits for when corrective actions shall be initiated
- procedures detailing the means to control leakage, venting and disposal of refrigerants
- log sheet for logging refrigerant volumes.

2.2.3.10 The log sheet shall include the following:

- 1) In case regular monitoring of the refrigerant's volumes are used: type of system, date, time, volume, temperature and pressure of the refrigerant, % of leakage, corrective actions taken and signature of the responsible person.
- 2) In case portable refrigerant detectors are used: type of system, date, time, whether leakage is detected or not, location of leakage, corrective action taken and signature of the responsible person.

2.2.4 Fire fighting substances

2.2.4.1 Natural substances used in fixed fire fighting systems and extinguishers, are not considered damaging to the atmosphere. If other substances are used in fixed fire fighting systems that may have a global warming potential, the used substance shall comply with:

- GWP < 4000
- ODP = 0.

Guidance note:

The GWP values from the IPCC *Fourth Assessment Report* or latest IPCC publication should be used. Natural substances: Natural substances: e.g. argon, nitrogen, water spray, high expansion foam, CO₂. Note that CO₂ in this context is considered a natural substance without ODP or GWP since it will utilise CO₂ already present in the atmosphere.

Other substances: E.g. industrial substances including Hydrofluorocarbons (HFC) and Sulphur fluorides.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.3 Discharges to sea

2.3.1 General

2.3.1.1 Compliance with the rules in [2.3] shall be verified by means and measures as identified in [1.6]. Actual discharges shall be recorded as specified in [2.3.2] to [2.3.8].

2.3.2 Cargo handling

2.3.2.1 On tankers for oil or tankers for chemicals, all cargo manifolds shall be fitted with drip/spill trays with adequate means for closed drainage to a deck collecting tank or slop tank.

The drip/spill trays shall have the following minimum dimensions:

- length: beyond forward and aft ends of the manifold
- width: at least 1.8 m, though such that the spill tray extends at least 1.2 m outboard of the end of the manifold flange
- depth: minimum depth 0.3 m.

2.3.2.2 For the collection of possible oil spills during cargo operations on tankers for oil the tank deck area shall be fitted with a closed drainage system with discharge to a deck collecting tank or a slop tank. The drainage system may be arranged either with a manually operated valve, or with an automatic deck scupper drainage system. The drainage shall be used during cargo operations where spillage may occur, and shall not affect normal deck drainage when at sea. When at sea, drainage from the deck area shall be ensured to avoid free surface effects with negative impact on the vessel's stability.

2.3.2.3 Tankers for oil or tankers for chemicals shall have fitted means to adequately support hoses in way of vessel's side abreast of manifolds. The support shall preferably be arranged as a horizontal curved plate or pipe section.

2.3.2.4 Tankers for oil or tankers for chemicals shall have fitted a closed sounding system and an overflow alarm which is independent of the closed sounding systems.

2.3.2.5 Other vessels carrying oil-containing liquids in bulk shall be equipped with arrangements as specified under Oil bunkering arrangements in [2.3.3].

This requirement does not apply to tanks carrying oily liquids during emergency operations only, e.g. tanks for oil recovered from oil spills at sea.

Guidance note:

This applies to e.g. supply vessels and other vessels carrying fuel oils and oil-based mud.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.3.3 Arrangements for fuel oil bunkering and other oil filling stations

2.3.3.1 All fuel oil bunker tanks shall be equipped with high level alarm to prevent overfilling. High level alarms need not be fitted to fuel oil bunker tanks that are provided with an overflow line to another fuel oil storage/service tank, which is fitted with a high level alarm. If vessel is fitted with a fuel oil overflow tank, there shall be a level alarm installed at low level of the fuel oil over flow tank as well.

Guidance note:

Alarm boxes located in the overflow line between fuel oil tanks and fuel oil overflow tanks may be accepted as equivalence to the level alarm required inside fuel oil overflow tanks.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

Guidance note:

High level alarms required in [2.3.3.1] may be triggered from the remote sounding system.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.3.3.2 The alarm signal shall be given where the person in charge of the bunkering or transfer operation will normally be located. The time between the high level alarm and the overfill level of the tank shall be at least 2 minutes.

2.3.3.3 Fuel oil, lubricating oil and other oil bunkering stations and other areas where spillage may occur shall be fitted with spill/drip trays to prevent oil escaping to sea. Minimum capacity: 80 litres for vessels less than 1600 GT, 160 litres for vessels equal to or larger than 1600 GT. Any spills at the bunker station shall have a reasonable chance of being trapped by the spill/drip tray.

2.3.3.4 Vent and overflow pipes for fuel oil tanks, lubricating oil tanks, hydraulic oil tanks and overflow tanks shall be fitted with spill/trays with the following minimum capacity: 40 litres for vessels less than 1600 GT, 100 litres for vessels equal to or larger than 1600 GT.

Volume for the pipes shall be deducted from the tray capacity in the volume calculations.

One spill/drip tray can be used for several vent and overflow pipes and the capacity shall minimum be as required for one pipe.

Coaming height shall be minimum 15% of the largest horizontal dimension.

Drawings showing spill/drip trays dimensions and volume calculations shall be submitted for approval.

2.3.3.5 Tanks with no risk of causing environmental contamination due to overfilling need not comply with [2.3.3]. Typically this applies to those small internal tanks which will be filled up locally from oil drums or their overflow vent pipes end up in engine room area.

2.3.4 Ballast water

2.3.4.1 Ballast water discharges from vessels shall comply with the D-1 (exchange method) or D-2 (treatment method) standard of the Convention with amendments and guidelines.

2.3.5 Bilge water

2.3.5.1 The vessel shall be arranged with a bilge holding tank with facilities for delivery ashore.

2.3.5.2 Fail-safe arrangements to avoid any discharge in case of bilge water separator malfunction shall be provided. The following requirements shall be fulfilled:

- The alarm is always activated whenever clean water is used for cleaning or zeroing purposes.

- The alarm is always activated whenever no flow of sample through the oil-content meter is detected by the flow sensor.
- Any alarm will activate the automatic stopping device and lead to re-circulation.
- The overall response time (including the response time of the bilge alarm) between an effluent discharge exceeding 15 ppm oil and to the automatic stopping device preventing the overboard discharge is less than 20 s.
- By-passing the bilge alarm during normal operation shall by no means be possible.
- Every access of the alarm (beyond check on instrument drift, repeatability of the instrument reading, and the ability to re-zero the instrument) requires the breaking of a seal.

2.3.6 Garbage

2.3.6.1 The vessel shall be provided with a garbage management plan. It shall be approved in accordance with Res. MEPC.220(63) *2012 Guidelines for the development of Garbage Management Plans*.

Guidance note:

Statement of compliance with respect to MARPOL Annex V does not require garbage management plan to be approved, but class notation **Clean** requires both approval of garbage management plan and issuance of statement of compliance for MARPOL Annex V after successful survey onboard.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.3.7 Sewage

2.3.7.1 The vessel shall be equipped with a type approved sewage treatment system in accordance with MEPC.159(55).

Guidance note:

Passenger ships operating within a special area should have a type approved sewage treatment system in accordance with MEPC.227(64) from 2016 (new passenger ships) or 2018 (existing passenger ships).

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.3.7.2 All sewage shall be treated by the type approved sewage treatment system prior to discharge.

2.3.7.3 Bio waste (sewage sludge) which is produced during the sewage treatment operation can be discharged overboard according to MARPOL criteria, i.e. at a distance more than 12 nautical miles and at moderate rate when the ship is en route and proceeding at not less than 4 knots. The rate of discharge shall be according to recommendation on standards for the rate of discharge on untreated sewage given in MEPC.157(55)

2.3.7.4 Overboard discharge pipes for excess bio waste (sewage sludge) should be separated from overboard discharge pipes of treated sewage or an appropriate cleaning of the discharge pipe shall take place after each use of the sludge pump, e.g. flushing. The procedures shall be written in sewage management plan.

2.3.8 Oil/water interfaces

2.3.8.1 Anywhere lubricating oil or grease can leak to the sea shall be considered as oil/water interfaces. For example at:

- stern tube bearing
- rudder bearings (grease or oil)
- bow thrusters and azimuth thrusters
- fin stabilisers
- sea water cooled engines
- deck machinery
- hydraulically operated equipment.

2.3.8.2 Oil/water interfaces oil consumption shall be monitored. If evidence of leakage is found, corrective action shall be initiated and recorded in the oil/water interface log.

Guidance note:

The method for monitoring oil/water interface oil consumption may be automatic, or manual (at least once per week). Follow up should be such that smaller leaks are discovered to enable implementation of corrective action in case such leak is discovered.

This requirement is in addition to the low level alarm for the stern tube lube. oil header tank, see Pt.4 Ch.4 Sec.1 Table 10.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.3.8.3 Where non-fossil-base-oil lubricated type bearings are used, no monitoring is required.

2.4 Other aspects

2.4.1 Environmental responsibilities

2.4.1.1 All vessels shall have a responsible environmental officer onboard. Name/position of the officer in charge and relevant duties shall be listed in the required manuals. This person shall be responsible for the following:

- compliance with current environmental regulations
- management and control of the procedures and activities relevant to the requirements of this section
- implementation and use of relevant procedures
- upkeep of relevant logs
- training of personnel in relevant environmental practices.

The environmental officer may delegate tasks to other personnel but will remain responsible for the environmental conduct of the vessel.

2.4.2 Operation manuals

2.4.2.1 The requirements in this section are mainly technical but also supported by operation manuals on how to achieve the environmental benefits from the technical arrangements.

2.4.2.2 The operational manuals shall be readily available onboard and can be either a stand alone document, or be parts of the vessel's SMS (safety management system) documentation, or be compiled in a clean class manual (or any combinations thereof).

2.4.2.3 The **Clean** class manual shall at least contain the following as independent chapters (any chapter may be exchanged to a reference on where to find elsewhere):

- 1) Fuel oil management plan (including bunkering procedures, sampling procedures, change-over procedures and safety aspects related to switch from heavy fuel oil (HFO) to marine gas oil (MGO)).
- 2) Ballast water management plan.
- 3) Biofouling management plan (for **Clean(Design)** only).
- 4) Sewage management plan (including piping diagram of the sewage system, sewage discharge log and capacity calculation of holding tank(s) for sewage and grey water).
- 5) Refrigerant management plan (including piping diagram of the refrigeration and air conditioning systems, data sheets of the refrigerants used and data sheets for extinguishing media in the fire fighting systems).
- 6) Bilge water and sludge management plan (including maintenance manual) (for **Clean(Design)** only).
- 7) Garbage management plan.
- 8) Template of the oil consumption log for oil/water interfaces.

3 Additional requirements for the qualifier Design

3.1 Introduction

3.1.1 General

3.1.1.1 The rules in this section give requirements for reducing emissions to air and limiting discharges to sea similar to or more stringent than those described in [2.1.1]. In addition certain aspects of the design of the vessel are prescribed.

All vessels shall comply with the requirements in [2], unless specifically required otherwise by this section.

3.1.1.2 For vessels complying with the requirements in this section the qualifier **Design** will be added to the class notation **Clean** (meaning **Clean(Design)**).

3.2 Emissions to air

3.2.1 General

3.2.1.1 Compliance with the rules shall be verified by means and measures as identified in [1.6].

3.2.2 Cargo evaporation

3.2.2.1 The criteria for emissions from cargo evaporation apply for tankers carrying crude oil, petroleum products or chemicals with flash point less than 60°C. These emissions are defined as volatile organic compounds, VOC.

3.2.2.2 In order to reduce the amount of VOC generated, tankers fitted with mast risers for release of cargo vapour during loading shall be provided with means to maintain an overpressure in cargo tanks during loading. The same or a similar system shall be provided to maintain an overpressure and reduce the need for manual pressure release on laden voyage. The system shall consist of an in-line automatic pressure control valve arranged in a by-pass to the mast riser isolation valve. The automatic pressure control valve and by-pass shall have the same capacity as required for the common cargo tank venting/inert gas piping system to which it is connected and be so designed that the individual P/V-valves for each cargo tank do not open when the in-line pressure control valve is activated. Unless the maximum loading rate takes into account the setting of the in-line pressure control valve, it shall be provided with lockable means of closing when loading with vapour return to shore. The setting of the in-line pressure control valve shall be marginally below the setting of the individual P/V-valves fitted to each cargo tank, but not more than 0.03 bar below such a setting. The in-line pressure control valve shall have a low blow-down. I.e. the lowest pressure after opening (including closing pressure) shall not be more than 0.03 bar below the opening pressure.

3.2.2.3 For tankers provided with a vapour recovery process system, the in-line pressure control valve capacity may be designed for release of vapour during laden voyage only.

Guidance note:

The in-line automatic pressure control valve can be of power operated pressure control type, mechanical type (e.g. weight loaded) or similar.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3.2.3 Refrigerants

Refrigerants used shall be either a natural refrigerants (e.g. NH₃ or CO₂), or alternatively an HFC complying with:

GWP ≤ 2000.

Guidance note:

The GWP values from the IPCC *Fourth Assessment Report* or latest IPCC publication should be used.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3.2.4 Fire fighting substances

3.2.4.1 Natural substances used in fixed fire fighting systems are not considered damaging to the atmosphere. If other substances are used in fixed fire fighting systems that may have a global warming potential, the used substance shall comply with:

GWP < 2000

ODP = 0.

Guidance note:

Natural substances: Natural substances: e.g. argon, nitrogen, water spray, high expansion foam, CO₂. Note that CO₂ in this context is considered a natural substance without ODP or GWP since it will utilise CO₂ already present in the atmosphere.

Other substances: E.g. industrial substances including Hydrofluorocarbons (HFC) and Sulphur fluorides.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3.2.4.2 Fire extinguishing foam containing more than 0.001 percent by mass of perfluorooctanesulfonic acid and its derivatives (PFOS) are prohibited according to EU (Directive (EC) no. 757/2010/Directive amending the Directive (EC) no. 850/2004 - POP directive).

3.2.5 Shipboard incinerators

3.2.5.1 An incinerator for burning oil sludge and solid waste shall be installed onboard unless the vessel will have enough capacity for 100% delivery to shore.

Guidance note:

The amount of domestic, operational and cargo waste can be based on the following table:

Domestic and operational waste	All types of vessels	3.0 kg/person/day
Cargo associated waste	Bulk carriers/obo-carriers	8.2 kg/day
	Container vessels	1.4 kg/day
	Ferries	2.0 kg/person/day
	General cargo vessels and OSV	49.3 kg/day
	Reefers	22.2 kg/day
	Tankers	0.01 kg/day

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3.3 Discharges to sea

3.3.1 General

3.3.1.1 Compliance with the rules in [3.3] shall be verified by means and measures as identified in [1.6]. Actual discharges shall be recorded as specified in [3.3.2] to [3.3.10].

3.3.1.2 Vessels with class notation **Tanker for chemicals** shall have integral tanks, type a2 or independent tanks complying with Pt.5 Ch.6 Sec.1 [2.4.3] to Pt.5 Ch.6 Sec.1 [2.4.6].

3.3.1.3 Vessels with class notation **Tanker for oil** with the deadweight of less than 5000 tonnes shall as a minimum have a double skin arrangement in the cargo area complying with the dimensions given in MARPOL, Annex I, Regulation 19.6. Single skin cargo wing tanks are not accepted.

3.3.1.4 Hull arrangement including cargo tanks for other vessels carrying oil-containing liquids in bulk shall comply with requirements in [3.4.1].

Guidance note:

This applies to e.g. supply vessels and other vessels carrying fuel oils and oil-based mud.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3.3.2 Cargo handling

3.3.2.1 Tankers for oil or chemicals shall have fitted and implemented means and arrangements to reduce the likelihood of cargo spill on deck reaching the sea.

Gutter plates on both sides of the cargo deck shall be increased in height from a point 0.2 *L* forward of midship to a termination at the aft end of the cargo deck with the minimum heights given in Table 6.

Table 6 Cargo deck gutter plates, minimum heights

Vessels greater than 100 000 tonnes DW	forward of 0.2 <i>L</i> :	0.25 m
	aft end:	0.30 m
Vessels smaller than 100 000 tonnes DW	forward of 0.2 <i>L</i> :	0.10 m
	aft end:	0.30 m

To avoid cargo flowing around the accommodation/poop deck, a transverse fishplate shall be arranged at the aft end of the cargo area. At the outer end the transverse fishplate shall have the same height as and be connected to the aft end of the gutter plate.

3.3.3 Crude oil washing -COW

3.3.3.1 The COW efficiency shall be such that coverage of minimum 96% is obtained, as documented by shadow diagrams. Guidelines for the assessment of shadow diagram given in IMO Resolution A.446(XI), as amended by resolution A.497(XII) shall be followed.

3.3.4 Arrangements for fuel oil bunkering and other oil filling systems

3.3.4.1 The high level alarm requirements given at [2.3.3.1] shall be applied to lubricating oil, hydraulic oil and other oil filling tanks as well.

3.3.4.2 Tanks with no risk of causing environmental contamination due to overfilling do not need to comply with [3.3.4.1]. Typically this applies to those small internal tanks which will be filled up locally from oil drums or their overflow vent pipes end up in engine room area.

3.3.4.3 Refuelling stations for helicopter or auxiliary vessels such as life boats, tenders or rescue boats shall be provided with arrangements whereby fuel spillage may be collected and drained to a safe location.

3.3.4.4 Spill/drip trays for oil bunkering arrangements shall be fitted with closed drainage to a deck collecting tank or a sludge tank. If the spill/drip tray is combined with the cargo manifolds area, this requirement is not applicable.

3.3.4.5 The fuel sampling equipment and procedures shall comply with the IMO guideline for sampling, Resolution MEPC.182(59).

3.3.5 Ballast water and biofouling

3.3.5.1 Ballast water discharges from vessels shall comply with the D-2 (treatment method) standard of the Convention with amendments and guidelines.

3.3.5.2

Vessels shall be provided with a biofouling management plan. It shall be approved that the plan is in accordance with MEPC.207(62).

3.3.6 Bilge water and oil residues (sludge)

3.3.6.1 All parts of the bilge water system and sludge system, including pipes, valves, pumps and oil water filtering/separating equipment shall be fitted with labels/colour codes in order to easily identify the different piping systems in accordance with ISO 14726:2008.

3.3.6.2 The bilge alarm shall be calibrated every 2.5 years at IOPP or class certificate intermediate and renewal surveys and set to 5 ppm. Calibration report for 5 ppm bilge alarm shall be available onboard for inspection all the time.

3.3.6.3 Bilge water separator and bilge alarm combined with an automatic stopping device shall be provided for all vessels irrespective of size in a way that no overboard effluent contains more than 5 ppm of oil products and oil burning contaminants. The overall response time (including the response time of the bilge alarm) between an effluent discharge exceeding 5 ppm oil and to the automatic stopping device preventing the overboard discharge shall be less than 20 s.

3.3.6.4 Procedures for handling drainages from machinery spaces and other spaces where the oil contaminated water may be present, such as thruster rooms, steering gear rooms, pump-rooms and spaces containing hydraulic power packs shall be included in bilge water and sludge management plan.

Guidance note:

For tankers, oily water transferred to slop tanks (subject to requirements to prevention of backflow of cargo vapour) may be discharged overboard through the ODME. For other oily water tanks, the discharge overboard shall be through a 5 ppm content meter with alarm with auto-stop.

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3.3.6.5 The effluent for the 5 ppm bilge alarm should be capable of being returned to the bilge water tank (recycling line).

3.3.6.6 The minimum total capacity of the bilge water tank(s) shall be as given in [Table 7](#).

Table 7 Capacity of bilge water tanks

Main engine rating (kW)	Minimum capacity (m ³)
Up to 1000	4
Above 1000 up to 20 000	$P/250$
Above 20 000	$40 + P/500$
P = main engine rating in kW For non-conventional propulsion systems (e.g. diesel-electric propulsion) without main engines, P can be considered as sum of the all auxiliary engines or the heaviest loading condition (e.g. normal sea going condition, dynamic positioning, loading, etc.).	

For ships adopting IBTS and having statement of fact for compliance with MEPC.1/Circ.511, the required capacity of oily bilge water tanks may be reduced.

3.3.6.7 Bilge system of the vessel shall contain bilge settling tank in addition to bilge holding tank. Means for surface decanting leading through a hopper into the sludge tank shall be provided.

3.3.6.8 Separate tank(s) shall be provided for the collection of washing water used for soot cleaning of boilers and economizers. The water inlets to the tanks shall be provided with soot collecting filter bags or equivalent arrangement. The tanks shall be provided with piping connections as follows:

- for direct discharge to reception facility
- for transfer of surface soot and oily surface to a sludge tank or equivalent
- for transfer of settled clean water to bilge holding tank or bilge settling tank
- for discharge of settled clean water overboard.

3.3.6.9 If overboard effluent through 5 ppm bilge alarm come from multiple sources (bilge water separator, processed clean bilge water pump, etc.) then interlock shall be provided for all these sources in such a way that only one source is able to discharge overboard at one time.

3.3.6.10 The oil being discharged from the oil water separator shall be directed to an oil residue (sludge) tank.

3.3.6.11 In case any of the sludge tanks is used for evaporation of water in oil residue by means of heating, it shall be fitted with exhaust fan for ventilating the water vapour.

3.3.6.12 The sludge tanks shall be below the heavy fuel oil and lubricating oil purifiers, if installed. The pipelines from purifiers shall, wherever possible, be straight or fitted with a large radius elbow. Drain lines from sludge tanks below purifiers to the bilge tank (or, as an alternative, to the sludge tank) shall be provided with self-closing valves and hoppers.

3.3.6.13 Drain oil shall be collected through fixed drainage arrangement directly to the sludge tanks. If necessary a sludge transfer pump may be used to pump the drain oil to the sludge tank. Drip trays and coamings of sufficient height shall be provided under *all* equipment where oil spill may be present, such as diesel engines, burners, hydraulic motors, pumps, heaters, coolers, filters and tanks in order to collect spillage of oil.

3.3.6.14 The drip trays and coamings for equipment not fitted with closed drainage to the sludge tanks shall be collected in the oil residue collecting tank and this emptying procedure shall be incorporated into the bilge water and sludge management plan.

3.3.7 Garbage

3.3.7.1 The vessel shall be equipped and arranged for sorting, collecting, minimising and storing garbage prior to incineration or delivery to shore. Vessels shall have sufficient capacity to allow 100% delivery to shore, or incineration where permitted.

3.3.7.2 Food waste, in any form, shall not be discharged into a vessel's sewage treatment plant. It is required that ground food waste be directed to a holding tank when the vessel is operating within an area where discharge is prohibited. If any design can show that systems can handle black/greywater contaminated with ground food, it will be acceptable as alternative to the discharge into a vessel's sewage treatment plant.

Vessels with class notations **Passenger ship** or **Ferry(A)** (or **Ferry(B)**) shall not dispose any waste to sea except for food waste when having passed through a grinder or comminutor for food waste and where permitted by international and local legislation.

3.3.8 Sewage

3.3.8.1 The vessel shall be provided with holding tanks for sewage with facilities for delivery ashore. The tanks shall have sufficient capacity for the number of persons onboard and for the anticipated time of port stay.

For estimating necessary tank capacity a minimum wastewater volume of 70 litres/day/person shall be used. For vessels using vacuum systems, a minimum wastewater volume of 25 litres/day/person shall be used. The duration of port stay shall not be assumed less than 4 days.

3.3.8.2 Ballast tanks are not allowed to be used as holding tanks for treated sewage. In no case shall ballast tanks be used as holding tanks for untreated sewage.

3.3.8.3 Sewage system ventilation pipes shall be independent from other ventilation piping systems.

3.3.8.4 Drain from the galley shall be fitted with a grease trap. For vessels where the total number of crew and passengers normally are more than 30, drain from the galley shall be fitted with a grease trap, connected to the sludge tank or other suitable collecting tank. In cases of long distances between the grease trap and the sludge tank, heat tracing and adequate slope shall be provided.

3.3.8.5 All vessels shall have procedures included in the garbage management plan for how the grease trap is emptied, either to the sludge/collecting tank and/or sent ashore.

3.3.9 Greywater

3.3.9.1 Greywater shall be treated in the vessel's sewage treatment plant(s) unless the vessel treats greywater with a system that meets the following standard:

- 1) The discharge shall satisfy the minimum level of effluent quality specified in USCG 40 CFR §133.102;
- 2) The geometric mean of the samples from the discharge during any 30-day period may not exceed 20 fecal coliform/100 millilitres (ml) and not more than 10% of the samples may exceed 40 fecal coliform/100 ml; and
- 3) Concentrations of total residual chlorine may not exceed 10.0 micrograms per litre (µg/l).

Guidance note:

Reference to US environmental protection agency's *Vessel General Permit for Discharges Incidental to the Normal Operation of the Vessels (VGP)* 2013 item 5.1.1.1.2.

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3.3.9.2 The vessel shall be provided with holding tanks for greywater. The tanks shall have sufficient capacity for the number of persons onboard and for the anticipated time of port stay. For estimating necessary tank capacity a wastewater volume of 110 litres/day/person may be used. The duration of port stay shall not be assumed less than 4 days.

3.3.9.3 Ballast tanks are not allowed to be used as holding tanks for greywater. Combined treated sewage and greywater holding tanks are accepted.

3.3.9.4 Dedicated sewage and greywater holding tank(s) shall be fitted with high level alarm.

3.3.10 Stern tube lubricant and seal design

3.3.10.1 For stern tubes, other than water lubricated, the design of the stern tube seal shall safeguard that the lubricant cannot get in contact with water.

If a biodegradable oil is used, an arrangement shall be in place to keep the water content of the oil under control and it shall be ensured that seal materials are compatible with the biodegradable oil.

If fossil-based-oil is used, an effective, monitored double barrier seal system shall be in place to safeguard against oil leaks to the sea.

3.3.10.2 All relevant drawings documenting the installation of lubricated stern tube arrangement shall be submitted for approval.

3.4 Construction and design

3.4.1 Oil tank protection

3.4.1.1 The requirements in [3.4.1] and [3.4.2] apply to tanks for fuel oil, lubricating oil, hydraulic oil and waste oil (sludge), including overflow tanks. Tanks with capacity below 10 m^3 can be located in the double bottom provided that the total capacity of these unprotected tanks will be less than 40 m^3 .

The requirements also apply to cargo tanks on vessels coming under regulation 2.2 of MARPOL Annex I.

3.4.1.2 A reduction of the required height of the double bottom under the sump tank under the main engine(s) is acceptable, if motivated by the technical design.

3.4.1.3 Individual tanks shall not have a capacity of over 1500 m^3 .

3.4.1.4 Tanks shall be located above the moulded line of the bottom shell plating nowhere less than the distance h as specified below:

$$h = B/20$$

or

$$h = 2.0 \text{ m, whichever is the lesser.}$$

The minimum value of $h = 0.76 \text{ m}$.

In turn of the bilge area and at locations without a clearly defined turn of the bilge, the oil fuel boundary line shall run parallel to the line of the midship flat of bottom as shown in Figure 1.

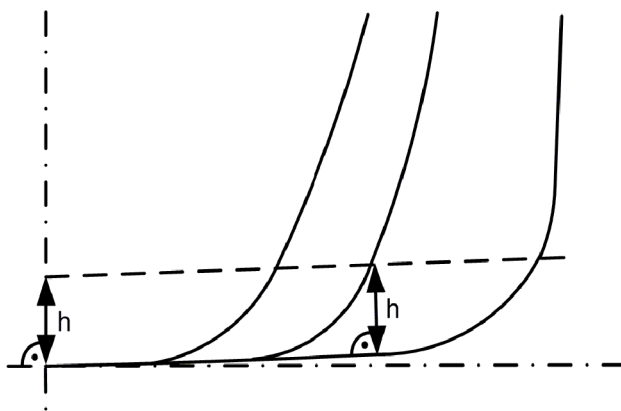


Figure 1

Guidance note:

For semi-submersible offshore units, it is acceptable to use B as the breadth of pontoon 1+2, i.e. $B = B_{p1} + B_{p2}$.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3.4.1.5 For vessels having an aggregate oil tank capacity below 5000 m³ tanks shall be located inboard of the moulded line of the side shell plating, nowhere less than the distance w which, as shown in Figure 2, is measured at any cross-section at right angles to the side shell, as specified below:

$$w = 0.4 + 2.4 C/20000 \text{ m}$$

Where C is the vessels total volume of fuel oil tanks, in m³, at 98% tank filling.

The minimum value of $w = 1.0$ m, however for individual tanks with an oil capacity of less than 500 m³ the minimum value is 0.76 m.

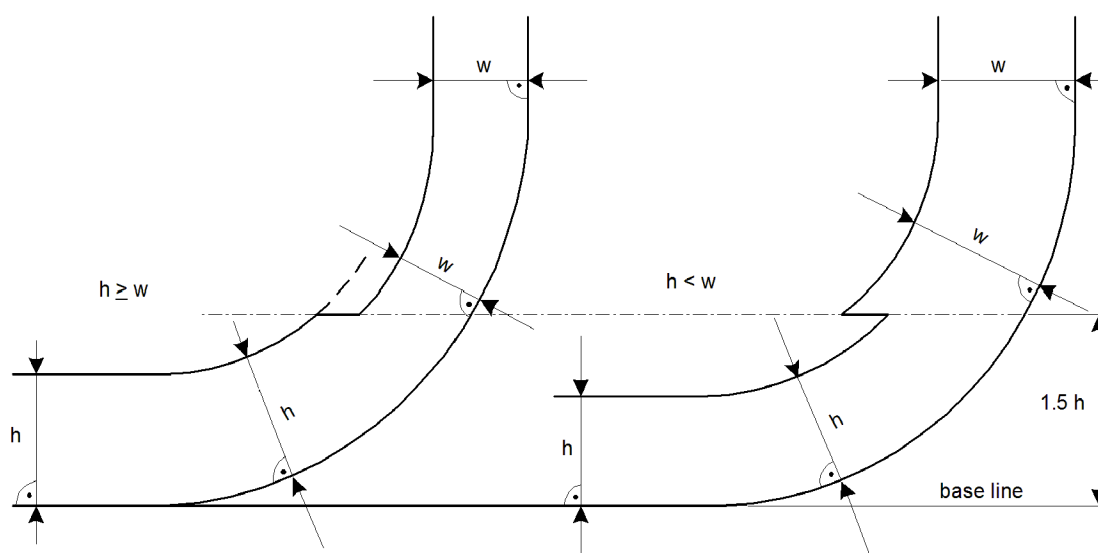


Figure 2

3.4.1.6 For vessels with an aggregate oil tank capacity of 5000 m³ and over, tanks shall be located inboard of the moulded line of the side shell plating, nowhere less than the distance w which, as shown in Figure 2, is measured at any cross section at right angles to the side shell, as specified below:

$$w = 0.5 + C/20000$$

or

$$w = 2.0 \text{ m, whichever is the lesser.}$$

The minimum value of $w = 1.0$ m.

Where C is the vessels total volume of fuel oil tanks, in m³, at 98% tank filling.

3.4.1.7 Combined fuel oil and water ballast tanks shall not be arranged.

3.4.1.8 The skeg shall not be considered as offering protection for the oil tanks.

3.4.1.9 For the area within the skag's width the distance h shall be measured perpendicular to a line parallel to the baseline at the intersection of the skag and the moulded line of the bottom shell plating as indicated in Figure 3.

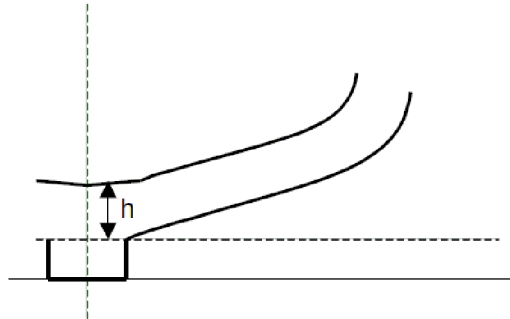


Figure 3

3.4.1.10 For vessels designed with a permanent trim, the baseline should not be used as a reference point. The distance h should be measured perpendicular to the moulded line of the bottom shell plating at the relevant frames where fuel tanks shall be protected.

3.4.1.11 For vessels designed with dead rising bottom, the distance $1.5h$ should be measured from the moulded line of the bottom shell plating but at right angle to the baseline, as indicated in Figure 4.

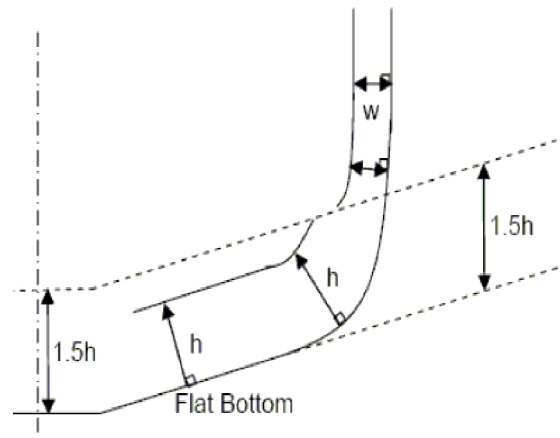


Figure 4

3.4.2 Sundry

3.4.2.1 Lines of oil piping located at a distance from the vessel's bottom less than h , as defined in [3.4.1.3], or from the vessel's side less than w , as defined in [3.4.1.4] and [3.4.1.5] shall be fitted with valves or similar closing devices within or immediately adjacent to the tank. These valves shall be capable of being brought into operation from a readily accessible enclosed space the location of which is accessible from the navigation bridge or the propulsion machinery control position without traversing exposed freeboard or superstructure decks. The valves shall close in case of remote control system failure (fail to close) and shall be kept closed at sea at any time when the tank contains oil except when they may be opened during transfer operations.

3.4.2.2 Suction wells in oil tanks may protrude into the double bottom below the boundary line defined by the distance h provided such wells are as small as practicable and the distance between the well bottom and the bottom shell is not less than $0.5 h$.

3.4.3 Sludge tanks

3.4.3.1 Sludge tanks shall be fitted with heating arrangements to facilitate the pump-ability and discharge of the tank content.

Guidance note:

This is applicable to ships operating with HFO, marine diesel oil (MDO) and MGO but may not be applied to gas-filled ships.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3.4.3.2 Sufficient man-holes should be provided such that, taking into consideration the internal structure of the oil residue (sludge) tanks, all parts of the tank can be reached to facilitate cleaning.

3.5 Other aspects

3.5.1 Ship recycling

3.5.1.1 All vessels shall hold and maintain an inventory of hazardous materials as required by *The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships* (SR/CONF/45) and any subsequent additions or amendments hereto adopted at the relevant time. The Inventory of Hazardous Materials shall be prepared using the most recent guidelines Resolution MEPC 197(62).

Vessels shall hold class notation **Recyclable**, see [Sec.4](#) to fulfil this requirement.

Guidance note:

For newbuilding projects, if prior to delivery, IHM is ordered to be developed and certified according to ships in operation procedure, this requirement is fulfilled and **Recyclable** shall be assigned prior to next renewal survey.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

SECTION 3 FUEL AND LUBRICATION OIL SYSTEMS AND ARRANGEMENT FOR MEETING REGULATIONS IN EMISSION CONTROL AREAS - ECA

1 General

1.1 Introduction

The additional class notation **ECA** sets requirements to vessels fuel and lubrication oil systems and arrangement for meeting regulations in emission control areas.

1.2 Scope

The scope of the additional class notation **ECA** shall verify that the vessel is arranged to enable vessels machinery components (main propulsion plant, power generation plant and steam/thermal oil plant, inert gas plant etc.) to change between residual oil and marine distillate fuel and operate for longer periods on marine distillate fuels with very low viscosity and very low sulphur content.

1.3 Application

The additional class notation **ECA** applies to vessels arranged and equipped as required by the rules in this section. Vessels with the additional class notations **ECA** may be appended by one of the mandatory qualifiers **SOx-A** or **SOx-P** where:

- **ECA** - denotes that the vessel is adapted to operate within Emission Control Areas.
- **SOx** - denotes that the vessel is adapted to comply with **SOx** regulations within emission control areas as per Annex VI of MARPOL 73/78 and can operate specific machinery components on marine distillate fuels with very low viscosity and sulphur content for a minimum of 4 operating days reflecting the consumption specified in [2.1.1.1].
- **A** - denotes that the vessel is designed to operate all machinery components on marine distillate fuel.
- **P** - denotes that the vessel is designed to only operate machinery components used in port on marine distillate fuel.

A vessel designed to operate all machinery components e.g. main propulsion plant, power generation plant, steam/thermal oil plant, etc. on marine distillate fuel may be given class notation: **ECA(SOx-A)**. This class notation is relevant for vessels operating e.g. within an ECA as of 1 July 2015 as per Annex VI of MARPOL 73/78.

A vessel designed to operate machinery components used in port e.g. power generation plant, steam/thermal oil plant, etc. on marine distillate fuel may be given class notation: **ECA(SOx-P)**. This class notation is relevant e.g. for vessels calling EU ports and thus required to comply with the EU low sulphur directive 2005/33/EC.

The rules are also applicable to vessels that will continuously operate on marine distillate fuels and vessels provided with approved abatement technology capable of cleaning emissions to a marine distillate fuel equivalent standard.

1.4 Definitions

1.4.1 Marine distillate fuel shall be taken to mean a fuel oil with a sulphur level not exceeding 0.10% and with a viscosity not less than 2 cSt at 40°C.

Guidance note:

Marine distillate fuel is considered equivalent to marine gas oil grade DMA and DMZ as given in ISO 8217 (latest revision), except for the sulphur and viscosity limits as stated in [1.1.2.1].

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1.4.2 Residual oil shall be taken to mean heavy fuel oil (ISO 8217 marine residual fuels).

1.5 Documentation requirements

1.5.1 Documentation shall be submitted as required by Table 1.

Table 1 Documentation requirements

<i>Object</i>	<i>Documentation type</i>	<i>Additional description</i>	<i>Info</i>
Fuel tanks	S030 – Capacity analysis		AP
Fuel oil system	Z300 – Declarations	From manufacturers of machinery components ability to use marine distillate fuels e.g. engines, boilers and any fuel oil pump. Also include relevant pages from the operations and maintenance manual	AP
	Z265 – Calculation report	Confirming the viscosity of the marine distillate fuel at the inlet of machinery components (including fuel pumps). Also indicate viscosity versus temperature variations	AP
	Z161 – Operation manual	Fuel oil change-over. See Sec.4	AP
	Z268 – Assessment report	Hazard identification study	FI
Sea and fresh water systems	S010 – Piping diagram (PD)	Chiller system for fuel cooling	AP
AP=For approval; FI=For information			

For general requirements for documentation, including definition of the info codes, see [Pt.1 Ch.3 Sec.2](#).

For a full definition of the documentation types, see [Pt.1 Ch.3 Sec.3](#).

1.5.2 If abatement technology is used to ensure compliance, the documentation requirements are subject to special consideration.

2 Systems and arrangements

2.1 Fuel oil tank arrangements

2.1.1 Arrangement of fuel oil storage tanks

2.1.1.1 The vessel shall be arranged with minimum one dedicated storage tank for each (e.g. low and/or high sulphur) marine distillate fuel grade carried.

The total storage tank capacity for marine distillate fuel shall be sufficient for:

- For vessels with qualifier **A** as given in [1.1.3.1], operating the vessel on a minimum of 4 days at 75% MCR of the main engine and for auxiliary engines, normal seagoing load as specified in Pt.4 Ch.8 Sec.2 [2.1.1] but also including load due to operation of thrusters not forming part of the main propulsion or steering, mooring, cargo handling gear and refrigerators for air conditioning. For tankers, the fuel oil capacity shall also be sufficient for the carriage of heated cargoes (if applicable) as well as minimum one cargo discharge operation (fully loaded vessel).
- For vessels with qualifier **P** as given in [1.1.3.1], operating the auxiliary engines for a minimum of 4 days on normal seagoing load as specified in Pt.4 Ch.8 Sec.2 [2.1.1] but including load due to operation of mooring, cargo handling gear and refrigerators for air conditioning. For tankers, the fuel oil capacity shall also be sufficient for the consumption needed to maintain the temperature of heated cargoes (if applicable) as well as minimum one cargo discharge operation (fully loaded vessel).

Guidance note:

The fuel oil capacity for one cargo discharge operation should include boiler consumption for steam turbine driven cargo pumps, additional consumption due to increased power demand during cargo discharging operations (e.g. ballast pump operation, hydraulic power packs etc.), as well as additional consumption due to inerting of cargo tanks.

Any marine distillate fuel settling tank capacity may be included in the total storage tank capacity.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.1.1.2 Tanks for storage of marine distillate fuel shall not be located adjacent to heated tanks unless the calculations required in [2.2.1.1] confirm that viscosity in way of machinery components (including fuel oil pumps) is not below that specified in [1.1.2.1].

2.1.2 Arrangement of fuel oil settling and service tanks

2.1.2.1 Dedicated service and settling tanks shall be arranged for marine distillate fuels. Each service tank shall have a capacity for at least 8 hours operation. Provided that the marine distillate fuel from storage tanks are arranged for separation prior to transfer to service tanks, settling tanks for marine distillate fuels are not required.

2.1.2.2 Service and settling tanks for marine distillate fuel shall not be located adjacent to heated tanks.

2.2 Fuel oil system arrangements

2.2.1 General

2.2.1.1 Calculations shall be performed to confirm that the viscosity of the marine distillate fuel in way of machinery components (including fuel pumps for marine distillate fuel) is not lower than that specified in [1.1.2.1]. The calculations shall indicate viscosity as well as temperature. Calculations shall be carried out for the operational loads given in [2.1.1.1] as well as during change-over from residual oil to marine distillate fuel and vice-versa. The calculations shall take into account the environmental conditions in Pt.4 Ch.1.

2.2.2 Fuel oil service piping systems

2.2.2.1 Auxiliary engines for electric generators shall for each consumer have separate fuel oil service system piping (including required pumps, filters, etc.) from service tanks for residual oils and marine distillate fuel.

2.2.2.2 Boiler fuel service system piping (including required pumps, filters, etc.) from service tanks for residual oils and marine distillate fuel to boilers may be accepted as common provided it can be documented that the change-over time from residual oil to marine distillate fuel is less than 4 hours (taking into account minimum viscosity and maximum sulphur levels for marine distillate fuel).

2.2.2.3 For vessels with qualifier **A** as given in [1.1.3.1], main engine fuel service system piping (including required pumps, filters, etc.) from service tanks for residual oils and marine distillate fuel to main engines may be accepted as common provided it can be documented that the change-over time from residual oil

to marine distillate fuel is less than 4 hours (taking into account minimum viscosity and maximum sulphur levels for marine distillate fuel).

2.2.2.4 Separate supply pumps for marine distillate fuel shall be arranged with redundancy. If residual oil pumps are declared suitable for pumping marine distillate fuels at required pressure and capacity, then separate marine distillate pumps are not required.

2.2.2.5 All fuel oil heaters shall be provided with by-pass arrangements. Heat tracing arrangements shall be provided with means for shut-off when operating common systems with marine distillate fuel.

2.2.2.6 Fuel oil return system shall be arranged so that it is possible to return fuel from any machinery components to both marine distillate and residual oil tanks.

Guidance note:

The fuel return into clean marine distillate tanks should be active only if it is ensured that any fuel mixture is already flushed into residual tanks and clean marine distillate will flow into marine distillate tanks.

Any pollution from high sulphur residuals or fuel mixtures into the clean marine distillate tanks with very low sulphur content should be avoided.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.2.2.7 The installation of freshwater coolers or chiller systems in the fuel oil service systems are required in order to maintain the marine distillate fuel viscosity above the minimum level as specified in [1.1.2.1]. Cooling systems shall comply with the requirements of Pt.4 Ch.6, including redundancy requirements. Where the fuel system pressure exceeds the cooling system pressure, means for detection of leakage shall be provided e.g. high level alarms in expansion tanks.

Guidance note:

The requirement to install freshwater coolers or chiller systems will be waived when evidence is provided that the marine distillate fuel viscosity is kept above the minimum level without this arrangement.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.2.2.8 Arrangements shall be provided to prevent excessive heating of marine distillate fuel when a machinery component is in e.g. stand-by mode.

2.2.2.9 Pump relief valves shall not discharge to the suction side of pumps.

2.2.3 Fuel oil treatment piping systems

2.2.3.1 Fuel oil treatment system piping (including pumps, separators etc.) from settling to service tanks for residual oils and marine distillate fuel oils shall be separated. Separate separator supply pumps for marine distillate fuel shall be arranged with redundancy. If residual oil separator pumps are declared suitable for pumping marine distillate fuels at required pressure and capacity, then separate marine distillate pumps are not required.

2.2.4 Fuel oil transfer piping systems

2.2.4.1 Fuel oil transfer system piping (including pumps etc.) from storage tanks to settling tanks for residual oils and marine distillate fuel oils shall be separated. If residual oil pumps are declared suitable for pumping marine distillate, then separate marine distillate pumps are not required.

2.2.5 Fuel oil tanks air and overflow systems

2.2.5.1 Each air and overflow pipe from residual oil tanks and marine distillate fuel tanks are self-draining and be arranged with loops of sufficient height or equivalent arrangement, to prevent cross contamination during overflow.

2.3 Lubrication oil system arrangements

2.3.1 Lubrication oil

2.3.1.1 Vessels with cylinder lubricated engines shall be provided with two cylinder oil storage tanks. Further, for engines with a cylinder oil service tank arrangement, two cylinder oil service tanks shall be provided for each cylinder lubricated engine. The two service tanks shall be joined before the engine flange via a change-over valve.

2.3.1.2 If the equipment manufacturer specifies that system lubrication oils need to be changed when using marine distillate fuel, then the vessel shall be equipped with storage capacity for two types of system lubrication oil.

2.3.1.3 Alternative arrangements like blending with additives are acceptable, subject to special approval.

2.4 Instrumentation

2.4.1 General

2.4.1.1 The fuel oil piping systems and machinery components shall be provided with arrangements for monitoring the critical parameters in connection with change-over and operation on residual oils and marine distillate fuel. Alarms, indications and automatic controls as required for main class, as well as class notation **EO** (as applicable), shall be provided. In addition the monitoring functions in [Table 2](#) are required. Systems for automatic change-over between fuel oils are not required, but are subject to approval if provided. Such automatic control systems need also to be arranged with means for manual operation and shall be fitted with by-pass arrangements.

2.4.1.2 Alarms that are only relevant when operating on marine distillate fuel shall be inhibited when operating on residual oil and vice-versa.

Table 2 Monitoring functions

<i>Parameter</i>	<i>Alarm</i>
Temperature or viscosity at machinery component inlet	High (temperature) or Low (viscosity)
Level in expansion tanks in marine distillate fuel cooling systems	High/low
Temperature in marine distillate fuel service tanks (only when marine distillate cooling is not provided).	High
Pressure differential fuel filters	High
Level in fuel de-gassing/mixing tanks	High/low

2.4.1.3 Fuel coolers shall have automatic temperature control. Means for manual operation shall be provided.

2.4.1.4 Oil fired boiler/thermal oil heater instrumentation and control systems shall comply with the requirements of [Pt.4 Ch.7 Sec.6](#). It shall be ensured that they can safely be run on marine distillate fuel without impairing the required boiler steam/thermal oil capacity. Operation on the different fuels shall not require manual override of or switching off the automatic control.

2.4.1.5 Oil fired burners shall be provided with a flame monitoring system that is capable of detecting the operation of any burner when operating on both residual oil and marine distillate fuel.

3 Machinery components

3.1 General

3.1.1 Machinery components

3.1.1.1 The manufacturer of machinery components shall declare that the machinery component (main engine(s), auxiliary engines, boiler(s), inert gas plant and any fuel oil pump) is capable of continuous operation on marine distillate fuel for the minimum number of operating days. Such declarations shall include details on the required modifications including details on additional equipment and arrangements, control or safety systems, as well as any possible conditions/limitations. Conditions or limitations that impair the efficiency of the change-over or impair the operation of the machinery components are not acceptable. The manufacturers' declarations and required detailed information is subject to approval.

- Conditions/limitations related to e.g. maximum temperature increase/decrease of fuel (°C/min) to protect fuel equipment from thermal shock (expansion problems) are considered acceptable.
- Conditions/limitations related to e.g. viscosity which are in conflict with [1.1.2.1] are not acceptable
- Conditions/limitations requiring continuously reduced power, machinery component load or pressure or flow when operating on marine distillate fuel are not acceptable.
- Conditions/limitations requiring substantial and time-consuming modifications to machinery components and equipment e.g. replacement of gaskets, pumps, nozzles, etc. during fuel switching are not acceptable.
- Conditions/limitations requiring changing between residual oil and marine distillate fuel burner lances are considered acceptable.

3.1.1.2 The capability of operating on marine distillate fuel with the minimum viscosity specified in [1.1.2.1] and associated conditions or limitations are also to be reflected in the machinery component's operations and maintenance manuals.

4 Operational requirements

4.1 General

4.1.1 Hazard identification

4.1.1.1 For new designs or solutions, a hazard identification study shall be carried out with representatives from equipment manufacturers. The analysis shall cover all machinery components and the entire fuel system and shall include control systems. A report from the hazard identification shall be submitted to the Society.

Guidance note:

The requirement to a hazard identification study will be waived when evidence is provided that new designs or solutions do not pose any unforeseen hazards.

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4.1.2 Fuel oil change-over manual

4.1.2.1 An approved fuel oil change-over manual shall be available onboard and shall consist of three parts as specified below:

4.1.2.2 Part I shall cover procedures for safe and efficient change-over from marine distillate to residual oil and vice versa for all relevant machinery components and associated piping systems. It shall include the machinery component manufacturers' instructions and declarations as well as calculations documenting

the minimum obtainable viscosity/maximum obtainable temperature of marine distillate fuel in the fuel oil systems. The procedures shall include schematic fuel oil piping diagrams and specific pipelines, valves, fuel oil equipment and machinery components. Part I is also to include procedures for safe testing of the vessels capability to operate on marine distillate fuel and in particular starting and low load operation. For the propulsion plant testing should also include manoeuvring on marine distillate fuel.

The following shall be included in a summary:

- change-over time as a function of machinery components load, and temperature differences between residual oil and marine distillate fuel during change-over
- minimum allowable viscosity of marine distillates and associated maximum allowable temperatures of marine distillate fuel in way of machinery component inlets
- maximum machinery component load at change-over from residual oil to marine distillate fuel, including duration of any load reduction
- other approved conditions/limitations given in manufacturers' declarations
- procedures related to selection of lubrication oil based on sulphur level of fuel oil used. For cylinder lubricated engines procedures shall include e.g. feed rate reductions or change between cylinder lube oils with different total base numbers.

4.1.2.3 Part II shall cover calculations of change-over time to ensure that the fuel oil being consumed by machinery components has a sulphur content not exceeding 0.10%. This part is only relevant for vessels where the piping system for residual oil and marine distillate fuel are common.

The following parameters shall be taken into account:

- volume of piping systems (including fuel de-gassing/mixing tank) where mixing of marine distillate fuel and residual oil will occur
- residual oil sulphur content (variable)
- marine distillate fuel sulphur content (variable but not above 0.10% sulphur)
- machinery component fuel consumption during change-over
- return oil flow to fuel de-gassing /mixing tank if relevant (increasing dilution time when changing from residual oil to marine distillate fuel)
- change-over time is defined as the time from start of change-over, until the sulphur level in the fuel oil entering into machinery components is below 0.10%. If the change-over time is shorter than that presented in part I, the change-over times in part I shall still apply.

4.1.2.4 Part III shall include the following:

- contingency procedures in case of poor marine distillate fuel quality, or incompatibility between marine distillate fuel and residual oil
- contingency procedures are also to be developed for failures due to vapour lock (gasification) in the event of improper change-over sequence to distillate fuel oil
- procedures for maintaining machinery readiness for emergency departures with marine distillate fuel
- methods for monitoring cylinder condition and injection pump internal leakage after switching from residual oil to marine distillate fuel
- procedures for onboard testing of compatibility between residual oil and marine distillate fuel.

Guidance note:

It is recommended that vessels subscribe to a fuel oil testing programme with an accredited fuel testing laboratory for the purpose of verifying critical fuel oil quality parameters for marine distillate fuel and residual oils as per ISO8217 latest edition.

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4.1.2.5 Vessels fitted with an automatic control system for change-over between fuel oils shall include a technical specification of the system in the fuel oil change-over procedures.

4.1.2.6 For ships fitted with abatement technology the scope of the procedures will be specially considered.

5 Surveys and testing

5.1 General

5.1.1 Surveys and testing

5.1.1.1 The systems and arrangements are subject to survey and function testing after installation onboard.

5.1.1.2 A functional test shall be carried out in the presence of a surveyor to confirm safe and efficient change-over from residual oil to marine distillate fuel and continuous operation of machinery components on marine distillate fuel. The test shall confirm that the marine distillate fuel viscosities are in accordance with the calculations required in [2.2.1.1], i.e. does not exceed the min. viscosity as specified by the machinery component manufacturers. This can either be verified through viscosity measurements onboard or by verifying that the temperature before machinery components does not exceed 40°C or the value as given by maker recommendations.

The test shall as far as practicable cover all machinery components at different loads and using a marine distillate with viscosity in accordance with [1.1.2.1]. For all machinery components the test shall include a minimum of 4 starts as well as continuous operation on marine distillate fuels, including low load operation at 25% MCR. The duration of the test shall be sufficient to achieve steady state conditions for all operational parameters but not less than 1 hour. For reversible propulsion engines the starting test shall include manoeuvring (2 starts ahead and 2 starts astern).

Guidance note 1:

If marine distillate fuel with viscosity as per [1.1.2.1] is not available, it may be accepted that the temperature of the marine distillate diesel oil available is increased in the system to give a viscosity as per [1.1.2.1] at the machinery component inlet.

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Guidance note 2:

Where it is impracticable to test all machinery components on low viscosity fuel as specified in [5.1.1.2], it may be acceptable that such functional testing is carried out by the crew and the result reported to the society. The report should include:

- specification of marine distillate fuel used
- machinery components tested
- scope of testing (see [5.1.1.2])
- machinery component loads (see [5.1.1.2])
- marine distillate fuel viscosities and temperatures at machinery component inlet
- confirmation of satisfactory result of testing.

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5.1.1.3 It is required that a marine distillate fuel bunker sample is taken, tested with an accredited fuel testing laboratory and the results submitted to the society. The fuel test shall cover the quality parameters specified in ISO8217 latest edition.

5.1.1.4 For vessels where marine distillate fuel and residual oil systems are common, a functional test shall be carried out by the crew to confirm that the sulphur level before machinery components does not exceed the sulphur level of the marine distillate fuel as bunkered. The test shall be carried out after completion of change-over, see [4.1.2.3]. It is required that fuel samples are taken immediately before machinery components upon completion of change-over. The samples shall be tested with an accredited fuel testing laboratory. The fuel tests shall cover the quality parameters specified in ISO8217 latest edition. Test results shall be submitted to the Society for verification.

SECTION 4 RECYCLING - RECYCLABLE

1 General

1.1 Introduction

A vessel contains hazardous materials. These may be found in the vessel structure and in the onboard systems and components. These materials may represent a hazard both for humans and nature. The HKC [1.4.1.1], in particular its IHM guidelines and the EU SRR [1.4.1.4] and its guidelines set requirements to the building, operation, repair, conversion and recycling practices for a vessel. The Inventory of Hazardous Materials (IHM) sets requirements to the documentation of the on board occurrence of hazardous materials and shall be established for the purpose of safeguarding crew, workers and the environment during the building, operation, and recycling of vessels. The additional class notation **Recyclable** covers the requirements for the development of the IHM part I for new and existing vessels for both regulations the HKC and EU SRR.

1.2 Scope

The scope of the recycling rules is to provide for identification and demonstration of the presence of hazardous materials on board. The additional class notation **Recyclable** will assist in early implementation of IHM part I.

1.3 Application

1.3.1 New vessels and existing vessels complying with the requirements in [2; 3] of this section may be given a compliance declaration for IHM part I and / or the additional class notation **Recyclable** providing the requirements of [1.5.2] are met.

1.3.2 Existing vessels may be given a compliance declaration for *Ready for Recycling* providing the requirements of [1.5.2.5] are met.

1.3.3 The application of the recycling rules follows the below Table 1.

Table 1 Application

	<i>IHM</i>		<i>Ready for recycling</i>
Applies to:	New vessels	Existing vessels	Existing vessels
Documentation requirements:	[1.5.1.1]	[1.5.1.3]	[1.5.1.4]
Rules:	[2] ; [3]	[2]; [3]	[1.5.1.4] ; [3]
Survey requirements:	[1.5.2.1]	[1.5.2.2]	[1.5.2.5]

1.4 Reference documents, terms and abbreviations

1.4.1 Reference documents

1.4.1.1 The HKC: *The "Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, 2009"* SR/CONF/45.

1.4.1.2 IHM guidelines: *Guidelines for the Development of the Inventory of Hazardous Materials - Resolution MEPC.269(68)*.

1.4.1.3 Survey and certification guidelines: *Guidelines for the survey and certification of ships under the Hong Kong Convention - Resolution MEPC.222(64)*.

1.4.1.4 EU SRR: *Regulation (EU) No 1257/2013 of the European Parliament and of the Council of 20 November 2013 on ship recycling and amending Regulation (EC) No 1013/2006 and Directive 2009/16/EC*

1.4.1.5 Pt.1 Ch.3 *Documentation and certification requirements, general*.

1.4.1.6 Pt.7 Ch.1 Sec.6 [35] *Fleet in Service, Survey requirements for fleet in service*.

1.4.1.7 Ship recycling plan guidelines: *Guidelines for the Development of the Ship Recycling Plan - Resolution MEPC.196(62)*

1.4.1.8 EMSA IHM guideline: *EMSA Best Practice Guidance on the Inventory of Hazardous Materials*

1.4.1.9 EU SR guideline: *Technical Guidance Note under Regulation (EU) No 1257/2013 on Ship Recycling, 2016/C 128/01*

1.4.2 Terms

Table 2 Terms

<i>Term</i>	<i>Definition</i>
Existing vessel*	a vessel which is not a new vessel*
Hazardous material	any material defined in Appendix 1 of the IHM guidelines and Annex II of the EU SRR
Hazmat expert	an expert or expert party who has the knowledge and experience on hazardous materials, ships structure and equipment, and how to develop inventory of hazardous materials in line with the HKC and EU SRR requirements
New vessel*	a vessel that is not delivered*
*These terms are used as long as the regulations are not applicable.	

1.4.3 Abbreviations

Table 3 Abbreviations

<i>Abbreviations</i>	<i>Description</i>
IHM	inventory of hazardous materials
MD	material declaration
SDOC	suppliers declaration of conformity

<i>Abbreviations</i>	<i>Description</i>
VSCP	visual sampling check plan
AP	for approval
FI	for information
DASR	document of authorization ship recycling
SRF	ship recycling facility
IGS	IHM green server software tool for the web-based IHM preparation and maintenance

1.5 Procedural requirements

1.5.1 Documentation requirements

1.5.1.1 For new vessels, documentation shall be submitted as required in [Table 4](#) for verification and issuance of the IHM compliance declaration / class notation **Recyclable**.

Table 4 Documentation requirements for new vessels

<i>Object</i>	<i>Documentation type</i>	<i>Additional description</i>	<i>Info Code</i>
Materials use	M080 - Inventory of hazardous materials (IHM), Part I	IHM should be signed by the originator.	AP
	M100 - Material declaration collection	Applies to all components on board, as a minimum those listed in Table 5 . Forms are available on DNV GL website. For IGS projects, it is equivalent with "Component Details Report" generated through IGS software tool.	FI
	M110 - Supplier's declaration of conformity relating to use of hazardous materials (SDOC) collection	SDOC from suppliers. Forms are available on the DNV GL website	FI
	Z090 - Equipment List	Component and equipment description which is used in the vessel's construction including the suppliers information.	FI
	Z250 - Procedure	IHM maintenance manual. Instructions for record keeping after change, replacement, or repair of structure and components, including a template for updating the IHM.	FI

1.5.1.2 The documentation type M100 includes the items listed in [Table 5](#).

Table 5 Documentation requirements for component M100

<i>Object</i>	<i>Additional description</i>
Paint and coating systems	Paint applied to structure and hull, including primer, anti-fouling, fluorescent paint

<i>Object</i>	<i>Additional description</i>
Thermal insulation	Insulation of equipment, minimum including refrigerant and exhaust piping, boilers, air conditioning ducts and liquefied gas tanks
	Insulation of structure, in ceilings, walls, floors, doors and bulkheads
	Insulation of hatches, watertight doors and fire doors
Refrigeration systems	Including provision plant and insulation foams
Firefighting and fire detection systems	
Batteries	Including uninterruptible power supply (UPS)
Deck machinery	Minimum including cranes, winches, and davits
Process equipment	E.g. heat exchangers, bilge water separators, sludge purifiers, ballast water treatment units, sewage treatment units, selective catalytic reduction systems and incinerators
Gaskets and brake linings	
Electrical cables and cable penetration material	Including sealings, mastic, putty
Electric equipment	E.g. generators, transformers, condensers, capacitors, switchgear, control gear, electric motors, distribution boards, breakers, frequency drives, junction boxes, rectifiers, chargers, cabinets and enclosures
Light fittings and fixtures	
Instrumentation	E.g. gauging equipment, thermometers electronic components, PLCs, actuators, sensors, gauges, cabinets and enclosures.
Engines and boilers	For propulsion and auxiliary use
Thrusters	
Piping systems	Including piping, GRP pipes, PVC pipes, flanges, vales, pumps and compressors
Other components containing hazardous materials	Including but not limited to; supply units, booster units, navigation systems, automation and remote control systems, alarm system, power management system, etc.

1.5.1.3 For existing vessels, the documentation shall be submitted as required in Table 6 for the verification and issuance of the IHM compliance declaration / class notation **Recyclable**.

Table 6 Documentation requirements for existing vessel

<i>Object</i>	<i>Documentation type</i>	<i>Additional description</i>	<i>Info Code</i>
Materials Use	M080 - Inventory of hazardous materials (IHM), Part I	IHM should be signed by the originator	AP
	Z250 - Procedure	Instructions for record keeping after change, replacement, or repair of structure, and components, including a template for updating IHM	FI
	M120 - Hazardous materials location plan	Sections of vessels GA Plan with markings of the found hazardous materials	FI

<i>Object</i>	<i>Documentation type</i>	<i>Additional description</i>	<i>Info Code</i>
	Z268 - Assessment Report	Hazmat inspection report including; scope and methodology, accredited laboratory results, estimation of the quantity of hazardous materials, hazmat expert qualifications, results and conclusions	FI
	M085 - Hazardous materials documentation	Visual sampling check plan (VSCP) - substances listed in IHM guidelines appendix 1 and / or Annex II of the EU SRR	FI
	Z281 - Vessel certificate	Statement of compliance with the international convention on the control of harmful anti-fouling systems on ships, 2001 edition	FI
	Z010 - General arrangement plan	depicts the division and arrangement of the ship (side view, plan views of most important decks and cross-sections)	FI
	Z100 - Specification	Documents such as stated in IHM guidelines appendix 5, Chapter 2.1	FI

1.5.1.4 For existing vessels, the documentation shall be submitted as required by [Table 7](#) for the issuance of a compliance declaration for *Ready for Recycling*.

Table 7 Documentation requirements for existing vessels

<i>Object</i>	<i>Documentation type</i>	<i>Additional description</i>	<i>Info Code</i>
Materials use	M081 - Inventory of hazardous materials (IHM), Part I, II and III	IHM should be signed by the originator	AP
	M100 - Material declaration collection	Applies to all components on board, as a minimum those listed in Table 5 . Forms are available on DNV GL website. For IGS projects, it is equivalent with "Component Details Report" generated through IGS software tool	FI
	M110 - Supplier's declaration of conformity relating to use of hazardous materials (SDOC) collection	SDOC from suppliers. Forms are available on the DNV GL website	FI
	M120 - Hazardous materials location plan	Sections of vessels GA plan with markings of the found hazardous materials	FI
	Z268 - Assessment report	HazMat inspection report including; scope and methodology, accredited laboratory results, estimation of the quantity of hazardous materials, HazMat expert qualifications, results and conclusions	FI
	Z010 - General arrangement plan	depicts the division and arrangement of the ship (side view, plan views of most important decks and cross-sections)	FI
	Z100 - Specification	Documents such as stated in IHM guidelines appendix 5, Chapter 2.1.	FI

Object	Documentation type	Additional description	Info Code
	M140 - Ship recycling plan	Developed in accordance with ship recycling plan guidelines and approved by the competent authority of the ship recycling facility (SRF).	FI
	Z300 - Declaration	Document of authorization to conduct ship recycling (DASR) issued by the competent authority of the ship recycling facility (SRF).	FI

1.5.1.5 For general requirements to documentation types, including definition of the Info codes, see [1.4.1.5].

1.5.2 Survey requirements for new vessels and existing vessels

1.5.2.1 An initial survey for new vessels shall be conducted before the compliance declaration for IHM Part I is issued according to the survey and certification guidelines [1.4.1.3].

1.5.2.2 An initial survey for existing vessels shall be conducted before the compliance declaration for IHM part I is issued according to the survey and certification guidelines [1.4.1.3].

1.5.2.3 A renewal survey shall be conducted according to the survey and certification guidelines [1.4.1.3].

1.5.2.4 An additional survey shall be conducted according to the survey and certification guidelines [1.4.1.3].

1.5.2.5 A final survey shall be conducted according to the survey and certification guidelines [1.4.1.3].

Guidance note:

Please see [1.4.1.6] as well.

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2 Class notation recyclable

2.1 General requirements

2.1.1 The IHM part I shall be maintained and updated by the ship owner during the operational life of the vessel reflecting changes in the structure and equipment. Maintenance shall follow implemented procedures according to the vessels' management requirements, the HKC and IHM guidelines. The certificate may become invalid if IHM part I is not properly maintained and updated.

2.1.2 The stamped and verified IHM part I shall be kept on board documenting the required maintenance of the IHM together with the provided compliance declaration.

2.1.3 The IHM part I should contain an identification / verification number of reference or report number on the front page.

2.1.4 The IHM part I has to be signed by the originator.

2.1.5 Please note in the IHM guidelines chapter "3.3 Exemptions - Materials not required to be listed in the Inventory" are listed.

2.2 Requirements for new vessels

2.2.1 The IHM part I shall be prepared in accordance with Regulation 5.1 of the HKC and chapter 4.1 of its IHM guidelines.

2.2.2 The IHM preparation should start not later than 6 months before delivery to ensure preparation on time.

2.3 Requirements for existing vessels

2.3.1 The IHM part I shall be prepared in accordance with Regulation 5.2 of the HKC and chapter 4.2. of its IHM guidelines.

2.3.2 The scope of the onboard assessment and the material sampling should be decided based on the quality and completeness of available documentation.

2.3.3 It is required to identify as far as practicable, hazardous materials listed in Table B of appendix 1 of the IHM guidelines and annex II of the EU SRR. As far as practicable means possible under reasonable circumstances.

2.3.4 The sampling shall be conducted by a qualified hazmat expert in accordance with the VSCP. The samples shall be analysed at an accredited laboratory.

3 Requirements of the EU SRR

The EU SRR entered into force on 30 December 2013. In addition to the HKC requirements, European ships, and non-EU ships that are calling at a port or anchorage of a member state, should consider the IHM requirements of EU SRR. In particular, the declaration of two additional hazardous materials is required as listed in the annex II of the EU SRR. Moreover EU flagged vessels have to be recycled only in SRFs listed on the EU list for approved SRFs. The EU SRR guidelines provide details on the IHM preparation and recycling of vessels. For further guidance see [\[1.4.1.4; 1.4.1.8; 1.4.1.9\]](#).

SECTION 5 ELECTRICAL SHORE CONNECTIONS - SHORE POWER

1 General

1.1 Introduction

The additional class notation **Shore power** sets requirements for design, installation, and verification of electrical shore connections intended for regular use in harbour for all types of vessels. Typical design intention is vessels following regular routes with frequent visits to the same ports, with port calls lasting sufficiently long to utilise an electrical shore connection.

1.2 Scope

The scope of the additional class notation **Shore power** provides requirements for the design of electrical shore connections, the ship side installation of necessary equipment and the verification of the installations. The system design comprises the following aspects:

- system functionality of the electrical shore connection as a total system. In addition, requirements to circuit breakers, earthing switches and protective functions are given
- control systems and control system interface between the shore and the vessel. Requirements are given for necessary functionality. However, the physical installations on shore are not covered by these rules
- ship side electrical equipment and installations. However, only specific requirements related to electrical shore connections are given. Generally, equipment and installations shall comply with relevant parts of [Pt.4 Ch.8](#).

Shore side electrical equipment and installations, apart from the functional requirements to the installation, are governed by national regulations, and are not a part of these rules.

1.3 Application

A ships may be assigned the additional class notation **Shore power** if it has an electrical shore connection designed and verified in compliance with the rule requirements of this section.

The additional class notation **Shore power** requires that the installation on board the vessel have been verified and tested. However, compliance towards a specific shore side installation is not required.

Type approval certificates may be issued for shore connection components based on the requirements to system design given in this section, without any specific ship or harbour being part of the type approval.

1.4 References

1.4.1 Requirement to electrical installations are in general described in [Pt.4 Ch.8](#).

1.4.2 Requirement to control and monitoring systems are in general described in [Pt.4 Ch.9](#).

1.5 Limitations and clarifications

1.5.1 Operational features with respect to power availability during loading and unloading are not considered as scope of this section. The system description shall clarify the vessel's load balance and the available power from shore for each port where the system shall be used.

1.5.2 The availability of the shore power supply depends on the utility systems onshore. However, these rules require that a stand-by generator on-board is automatically started and connected upon loss of power from shore.

These rules do not require that discriminative protection in the vessel's electric distribution system is functional while powered by a shore connection. A short circuit in the vessel's electric distribution system may therefore, in worst case, result in a black-out. Hence, use of shore power supply during loading and unloading operations in port shall be evaluated with respect to criticality of electric power supply.

1.5.3 These rules assume that the vessel will stay safe in case of a power interruption.

1.6 Procedural requirements

1.6.1 Verification and certification

1.6.1.1 When the additional class notation **Shore power** shall be assigned, the electrical shore connection system and the on-board equipment shall be verified and tested in compliance with these rules.

1.6.1.2 An electrical shore connection is not deemed safe to use unless the compatibility between the vessel and the shore side installation is verified for each port where the connection shall be used. Such verification is an operational matter, and not covered by this class notation. The electrical shore connection system shall be constructed in accordance with documentation approved by the Society. The electrical shore connection system shall be documented as described in [1.6.2].

1.6.1.3 When the additional class notation **Shore power** shall be assigned, electrical equipment installed on-board for the electrical shore connection are regarded as important equipment, and shall be delivered with the Society's product certificates as described in Pt.4 Ch.8 Sec.1 [2.3]. Control and monitoring system for the electrical shore connection shall also be regarded as important, and be delivered with the Society's product certificate as described in Pt.4 Ch.9 Sec.1 [1.2.2].

1.6.1.4 Documentation required to be submitted in conjunction with product certification is given in Pt.4 Ch.8 Sec.1 [2.2.2].

1.6.1.5 On-board survey shall be performed as part of the verification process as described in [1.6.3].

1.6.2 Documentation requirements

1.6.2.1 The builder shall submit the documentation required by Table 1. The documentation will be reviewed by the Society as a part of the class contract.

Additional documentation may be required, depending on the chosen technical solution.

1.6.2.2 For standard designs, the case by case approval may be replaced by the type approval scheme.

1.6.2.3 Electrical equipment required to be delivered with the Society's product certificate shall be documented as described in Pt.4 Ch.8 Sec.1 [2.2.2].

1.6.2.4

Table 1 Documentation requirements

<i>Object</i>	<i>Documentation type</i>	<i>Additional description</i>	<i>For info 1)</i>
Electric shore connection systems	E010 - Overall single line diagram	Including system earthing for the electric shore connection	AP
	E050 - Single line diagrams/ consumer list for switchboards	Electrical documentation of switchboards and switchgear installed as part of the electrical shore connection system and the cubicle in the main switchboard associated with the electrical shore connection. (Including switchboard layout and arrangement drawings, and schematics with information on protection, synchronisation, breaker interlocks, undervoltage trips, remote control circuits as relevant)	AP
	E040 - Electrical load balance	Design values for power consumption and available power for operational modes utilising the electrical shore connection The load balance shall reflect the operational modes stated in the system philosophy	AP
	E220 - Electrical system philosophy	An overall description of the electrical shore connection system and operating philosophy for all relevant operating modes	FI
	E200 - Short circuit calculations	The design values for the maximum and minimum short circuit power from the shore side shall be described	FI
	E080 - Discrimination analysis	The selectivity on board the vessel while fed from the electric shore connection shall be described	FI
	E210 - Harmonic distortion calculations	Voltage tolerances, waveform and harmonic content in the supply voltage, when the electrical shore connection is powered by a frequency converter	FI
	E100 - Voltage drop calculations	Upon request and when a motor rated above 30% rated power of the electrical shore connection is started direct on line	FI, R
	Z030 - Arrangement plan	Including locations of on-board equipment and main cable routing for the electrical shore connection system	FI
	I020 - Control system functional description	Functional description including description of instrumentation, interlocks, monitoring and alarms	AP
	Z160 - Operation manual	A document intended for regular use on board, providing information on: operation modes, operating instructions, procedures, and details of the user interface	FI
	Z253 - Test procedure for quay and sea trial		AP
AP = For approval; FI = For information; R = On request			

1.6.2.5 For general requirements for documentation, including definition of the info codes, see [Pt.1 Ch.3 Sec.2](#).

1.6.2.6 For a full definition of the documentation types, see [Pt.1 Ch.3 Sec.3](#).

1.6.3 Survey and testing requirements

1.6.3.1 When the additional class notation **Shore power** shall be assigned, the on-board installation and equipment shall be verified as described in section [2.6].

1.6.3.2 Tests additional to the ones described in the approved test program may be required in order to ensure the safety of the installation, deemed on the actual installation.

2 Technical requirements

2.1 General

2.1.1 Stand-by power

2.1.1.1 While the electric shore connection is supplying power to the vessel, at least one of the vessel's generators shall be in standby. I.e. this generator shall be automatically started and connected to the main switchboards in case of blackout (loss of power supply from shore).

2.1.1.2 In order to transfer power between the vessel's supply and shore, means for synchronization shall be arranged in the vessel's main switchboard.

2.1.2 Voltage and frequency

2.1.2.1 When a vessel is powered by shore power supply, the system voltage and frequency of the shore utility supply shall match the system voltage and frequency of the vessel unless the design is made to enable different voltages and frequencies to be used.

Guidance note:

A system design where parts of the vessel's consumers are powered by a shore connection with a different frequency than the nominal frequency of the vessel is acceptable (e.g. reefer load powered by 50 Hz shore power on a 60 Hz vessel). Also a system design with two electrical shore power connections, one with 50 Hz, and one with 60 Hz, is acceptable.

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2.1.3 System earthing and protective earthing

2.1.3.1 The vessel's designed earthing system shall be maintained in electrical shore connection operation. The selected design solution shall be described in the system documentation.

Guidance note:

IEC Publication 80005-1 *Utility connections in Port - Part 1: High Voltage Shore Connection (HVSC) Systems - General requirements* may be referred to with regard to compatibility assessments between ship-and-shore, coordination of safety interlocks, protection and general guidance.

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2.1.3.2 A separate conductor for protective earthing shall be connected between the hull's vessel and the shore ground. Earth fault protection shall disconnect the shore power supply, both the shore side circuit breaker and the vessel's main switchboard circuit breaker.

2.1.3.3 Conductors used for system earthing or protective earthing shall be dimensioned so that they can carry the current that will flow in a worst case failure scenario.

2.1.4 Galvanic isolation

2.1.4.1 For high voltage electrical shore connections, the shore side distribution system and the vessel's distribution system shall be galvanically separated. When this separation is performed by a transformer, the transformer shall have separate windings for the primary and the secondary side. The transformer can be installed either on shore, or on board.

2.1.4.2 If a power transformer is installed on board for adaptation of the electric shore connection system voltage and the main switchboard voltage, the transformer shall include overvoltage protection, protecting the vessel against lightning impulse over voltages.

2.1.4.3 It is recommended that the same safeguards against overvoltage are applied when the transformer is installed on shore.

Guidance note:

Direct earthing of the lower voltage system, or the use of voltage limitation devices, are considered adequate protection. Alternatively, an earthed screen between the primary and secondary windings may be used.

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2.1.5 Short circuit strength

2.1.5.1 All circuit breakers and cables used for the electrical shore connection shall be rated for the prospective short circuit currents that may appear at their location in the installation. Interlocks shall be provided in switchboards against simultaneously feeding from the ship's own generators and the electrical shore connection when the parallel connected short circuit power exceeds the switchboards' short circuit strength. A short time parallel feeding as a "make before break" arrangement is accepted when arranged with automatic disconnection of one of the parallel feeders within 30 s.

2.1.5.2 The electrical shore connection system may only be used when the short circuit power from shore supply network gives prospective short circuit currents that are less than the rated short circuit making and breaking capacities for switchgear installed in the ship's distribution system.

2.1.6 Selectivity / discriminative disconnection

2.1.6.1 The short circuit protection of equipment and cables between the shore-side supply circuit breaker and the main switchboard's shore power incoming circuit breaker shall be performed by short circuit protection on both sides of the electrical shore connection. (Short circuit protection in both shore side supply and the main switchboard incoming circuit breaker.)

2.1.6.2 These rules do not require that the vessel's distribution system has full discrimination during electrical shore power supply. Limitations in the selectivity shall be described in the system philosophy.

Guidance note:

A vessel's electrical distribution system is designed for a maximum short circuit current with respect to mechanical strength and circuit breaker rating. The system's discriminative properties (i.e. that the circuit breaker closest to a short circuit will trip, leaving the healthy part of the vessel's electrical distribution system operational) depends on maximum and minimum values of the prospective short circuit current of the electric generation and distribution system on board. In order to maintain discriminative protection in the vessel's distribution system, the shore power supply should have a short circuit capacity within the max and min values of the vessel's network. Typically when a frequency converter is used, the short circuit level may be too low to achieve full discrimination.

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2.2 Switchgear and interlocks

2.2.1 Flexible shore to ship connection

2.2.1.1 Equipment enabling efficient cable handling and connection shall be installed.

2.2.1.2 The shore connection cable shall be connected by plug and socket connection. Plugs and sockets shall be designed in such a way that incorrect connection is not possible.

2.2.1.3 Connection or opening of the plug and socket with power on shall not be possible.

2.2.1.4 The plug and socket system shall be of a type tested design, suitable for marine use.

2.2.1.5 The plug and socket system shall include a pilot contact for verification of correct connection of the plug and socket. This pilot contact shall be used for interlocks in the circuit breaker control.

2.2.1.6 The flexible cable shall be terminated close to the ship's side, and not be used as a part of the fixed cable installations in the vessel.

2.2.1.7 A separate ship-side circuit breaker is not required where the flexible cable is terminated.

2.2.2 Cable management system

2.2.2.1 A cable management system shall be installed, which ensures that the mechanical tension in the shore to ship cable is maintained within the design parameters of the cable. The cable shall never become so slack that it may be chafed, nor stretched beyond its design limits.

2.2.2.2 The cable management system shall give alarm at high cable tension to a manned position. At high-tension, the shore connection shall be automatically disconnected. Automatic release of the plug and socket connection is not required.

2.2.3 Switchgear

2.2.3.1 Electrical shore connection systems shall be equipped with circuit breakers suitable for isolation and interruption of possible short circuit currents.

2.2.3.2 The circuit breakers shall be equipped with under-voltage, overcurrent and short circuit trip functions.

2.2.3.3 High voltage electrical shore connection systems shall be equipped with earthing switches at both sides of the cable connecting the shore to vessel enabling safe discharge of the cable and safe handling of the plug and socket.

2.2.3.4 The earthing switches shall not be opened before healthy connection of plug and socket is confirmed, and closed if the healthy signal is lost.

2.2.3.5 Closing of the circuit breakers shall not be possible unless the earthing switches are confirmed open.

2.2.4 Interlocks

2.2.4.1 Circuit breakers that are part of the electrical shore connection system, inclusive on board circuit breakers for generators, earthing switches and others, shall have necessary interlocks preventing any hazardous switching operations. These interlocks shall be described in the functional descriptions.

2.2.4.2 The incoming shore power circuit breaker in the main switchboard shall be interlocked against closing unless a check synchronising relay accepts closure, or all generator circuit breakers in the main switchboard is in open position.

2.2.4.3 The incoming shore power circuit breaker in the main switchboard and the shore side supply circuit breaker shall be provided with the following interlocks:

- a) Automatic opening of both shore-side and ship-side circuit breakers:
 - upon high-high mechanical tension of shore connection cable
 - by missing confirmation of healthy protective earthing connection
 - by missing pilot contact confirmation that the plug and socket is properly connected
 - by emergency disconnection signal
 - short circuit and overcurrent detection on either side of the shore connection cable
 - earth failure detection (May be selective towards disconnection of earth failures in the on-board distribution system)
 - under-voltage detection on either side of the electrical shore connection.
- b) Operation of the plug and socket:
 - when the plug and socket is manually operated, an attempt to open the plug shall automatically initiate opening of the circuit breakers in both ends of the connection.

2.2.4.4 There shall be an interlock preventing closing of shore circuit breaker unless plug and socket is correctly connected and eventual earthing switches on both shore-side and ship-side are opened.

2.2.4.5 An attempt to insert or withdraw the plug shall initiate opening of circuit breakers. For automatically operated plug and socket, the same feature shall be implemented in the control system.

2.2.4.6 Closure of circuit breakers shall not be possible if confirmation of proper protective earthing connection is not confirmed. If proper earthing connection is lost, the breakers shall open.

2.2.4.7 Activation of protective functions (including high cable tension and emergency disconnection) shall give an alarm to a continuously manned location.

2.3 Emergency disconnection

2.3.1 General

2.3.1.1 An independent system for emergency disconnection shall be arranged with emergency stop push buttons.

2.3.1.2 There shall be one emergency stop button in each of the following locations:

- at the ship's side where the electrical shore connection is located,
- where the cable management system is handled,
- at the shore connection switchboard, and at a continuously manned location.

2.3.1.3 Activation of emergency stop shall result in disconnection of circuit breakers and closing of earthing switches.

2.3.1.4 Opening, or release, of the plug and socket may be a manual operation.

2.4 Control and monitoring

2.4.1 General

2.4.1.1 A control system shall be arranged on-board the vessel for the electric shore connection system.

2.4.1.2 This system shall trip both shore side circuit breaker and main switchboard incoming circuit breaker in case of:

- earth fault
- short circuit/overcurrent
- shore side under voltage
- cable break.

2.4.1.3 The control system shall prevent the shore side circuit breaker to close until the ship's operator manually gives permission. This permission shall not be possible to send unless correct protective earthing, plug/socket connection, and open on-board earthing switch are verified.

2.4.1.4 On the ship side of the electric shore connection systems, at the control position for the shore power incoming circuit breaker, the following instrumentation shall be installed:

- phase sequence indicator
- frequency meters for ship and shore power
- voltmeter
- ampere meter in each phase or fitted with ampere meter switch
- synchronisation equipment.

2.4.1.5 At all locations from where the electrical shore connection or cable management system may be controlled, the following alarms and controls shall be available:

- high and high-high tension of the flexible cable
- loss of shore power
- emergency disconnection
- activation of protective functions as earth fault, overcurrent and short circuit.

2.5 Installation

2.5.1 General

2.5.1.1 The on board electrical installations for the electrical shore connection system shall comply with the installation requirements given in [Pt.4 Ch.8 Sec.10](#).

2.5.1.2 All high voltage equipment shall be marked with high voltage warning sign.

2.5.1.3 A flexible shore connection cable can be arranged either on board the vessel or situated at the quay. In both situations a cable handling system shall be arranged.

2.5.1.4 All cables installed on board shall be type approved or case by case approved by the Society.

2.6 Survey and testing

2.6.1 Survey and testing requirements

2.6.1.1 Before an electrical shore connection installation is put into service or considered ready for operation, it shall be inspected and tested. The aim for this testing shall verify that the physical installation is correct. The installation shall be verified in accordance with relevant documentation. There shall be no hazard to personnel, no inherent fire hazard, and the installation shall function as required for the safe operation of the vessel. This also applies after modifications and alterations.

2.6.1.2 It shall be verified that all equipment is suitably installed with respect to ventilation, ingress protection and accessibility.

2.6.1.3 All equipment shall be verified with respect to proper installation with respect to external wiring and protective earthing.

2.6.1.4 After installation, with termination kit applied, high voltage cables shall be subject to high voltage tests as described in [Pt.4 Ch.8 Sec.10 \[4\]](#).

2.6.1.5 All outgoing power circuits from switchboards (cables and consumers) connected during installation shall undergo insulation resistance testing to verify its insulation level towards earth and between phases where applicable (i.e. switchboards assembled on-board.). The insulation resistance tests (megger tests) shall be carried out by means of a suitable instrument applying a DC voltage according to [Pt.4 Ch.8 Sec.10 Table 5](#).

2.6.1.6 Function tests shall be performed in order to evaluate that the installation complies with the requirements in these rules. The function testing shall verify that required interlocks are working properly, and shall cover both the ship-side installation and the shore-side installation.

SECTION 6 UNDERWATER NOISE EMISSION - SILENT

1 General requirements

1.1 Introduction

For some vessels hydro-acoustic transducers are important tools for operating the vessel efficiently. For all vessels noise emission is considered an environmental disturbance. The additional class notation **Silent** ensures that vessels with a need for a controlled underwater noise emission can be designed and tested towards technically realistic requirements.

1.2 Scope

The additional class notation **Silent** specifies requirements, operating conditions and measuring methodology for vessels that need to demonstrate controlled underwater noise emission for operational purposes or in order to reduce environmental disturbance.

1.3 Application

The additional class notation **Silent** applies to underwater noise radiation from vessels to ensure a low environmental impact and/or to ensure hydro-acoustic operational capability for vessels relying on hydro-acoustic equipment as an important part of their operation.

1.4 Class notations

1.4.1 Vessels fulfilling the requirements and which are classed with the Society may be given the additional class notation **Silent**, where qualifiers for the type of requirements satisfied, will be placed in brackets after the class notation. The requirements differ depending on required operational capability and/or controlled environmental noise emission.

Guidance note:

Vessels fulfilling the requirements in this section, but is not classed with the Society may be given a certificate of compliance.

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1.4.2 The requirements for underwater noise levels are specified for four types of operations; Acoustic, Seismic, Fishery, Research and controlled Environmental noise emission.

1.4.3 Acoustic (**A**), requirements for vessels using hydro-acoustic equipment as important tools in their operation, e.g. survey vessels, ocean research vessels, pipe layers, diving vessels, various offshore support vessels, naval vessels, etc.

1.4.4 Seismic (**S**), requirements for vessels carrying out seismic surveys using acoustic streamers.

1.4.5 Fishery (**F**), requirements for vessels engaged in fishing.

1.4.6 Research (**R**), requirements for research and particularly noise critical operations (see ICES 209).

1.4.7 Environmental (**E**), requirements for any vessel demonstrating a controlled environmental noise emission.

1.4.8 A vessel satisfying the requirements for several of the class notations may have a combination of qualifiers, e.g. **Silent(AE)** denotes a **Silent** class for underwater noise class for acoustical operations as well as having a controlled environmental noise emission.

Silent(A)	= vessel using hydro-acoustic equipment
Silent(S)	= vessel engaged in seismic research activities
Silent(F)	= vessel performing fishery activity
Silent(R)	= vessel engaged in research or other noise critical operations
Silent(E)	= any vessel wanting to demonstrate a controlled environmental noise emission.

1.5 Definitions

1.5.1 Definitions

1.5.1.1 Sound pressure level:

$$L_p = 10 \log_{10} \left(\frac{P_{r.m.s.}}{P_{ref}} \right)^2 = 20 \log_{10} \left(\frac{P_{r.m.s.}}{P_{ref}} \right) \text{ dB re. } 1 \mu \text{ Pa}$$

where:

$P_{r.m.s.}$	= Root mean square sound pressure (Pa)
P_{ref}	= Reference r.m.s. sound pressure (1 μ Pa).

1.5.1.2 Apparent Source Level: $L_{p\ 1m} = L_p$ at 1 meter (usually back calculated from a level measured at a known distance) dB re. 1 μ Pa

1.5.1.3 Spectrum Level:

$$L_{ps} = L_p - 10 \log_{10} \Delta f \text{ dB re. } 1 \mu \text{ Pa } 1 \text{ Hz}$$

where:

Δf = the bandwidth of the measured data in Hz.

1.5.1.4 Source spectrum level:

$$L_{ps1m} = L_{p1m} - 10 \log_{10} \Delta f \text{ dB re. } 1 \mu \text{ Pa } 1 \text{ Hz } 1 \text{ m}$$

1.5.1.5 Distance Correction: Correction added to a measured level to derive an apparent source level at 1 m from the source:

$$X \log_{10} \left(\frac{r}{r_{1m}} \right) \text{ dB}$$

where:

X	= is 20 for perfect spherical spreading, is 10 for cylindrical spreading.
r	= distance between source and hydrophone in meters.

r_{1m} = 1 meter reference distance.

Guidance note:

X will in practical measurement cases attain a value depending on the actual acoustic field.

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1.5.1.6 Acoustical centre: Position of assumed point source location. On a vessel this point is defined to be at the 0.7 propeller radius when the blade is pointing upwards.

1.5.1.7 Closest point of approach (cpa): Shortest distance between hydrophone and vessel acoustical centre during a pass-by test.

1.5.1.8 1/3 octave bands: The logarithmic frequency interval between a lower frequency f_1 and a higher frequency f_2 when $f_1/f_2 = 2^{1/3}$. For practical purposes the bandwidth of a 1/3 octave band is equal to $0.23 f_c$, where f_c is the centre frequency of the band. Preferred 1/3 octave band centre frequencies are defined in IEC 61260.

1.6 Procedural requirements

1.6.1 Documentation requirements

1.6.1.1 Documentation shall be submitted for approval as required by [Table 1](#):

Table 1 Documentation requirements

Object	Documentation type	Additional description	Info
Noise	Z255 – Measurement procedure	For underwater noise, including: - Geographical location for planned measurements (several alternatives may be presented) - Description of depths at measuring site and bottom condition (nautical draft/map or similar) - Description of planned measurement set-up. i.e. location of hydrophone(s), planned sailing path(s) for vessel and details of instrumentation to be used - Description of the expected operating profile for the vessel, i.e. expected time at different operating conditions when in normal service - Detailed intended operating conditions for the vessel during the measurements, i.e.: Rotational speed, pitch and load of any propeller / thruster at test condition. Rotational speed and load of any engine to be used during the test. Estimated vessel speed through water - If the vessel will be towing an object, type of object, calculated towing force and method of calculation of towing force - Description of method(s) to be used for monitoring operating conditions - Expected loading condition during the measurements and normal range of loading conditions for the vessel - Description of any intended deviations from the required measuring procedure, operating conditions or loading conditions	AP

Object	Documentation type	Additional description	Info
	Z241 – Measurement report	For underwater noise including: Measured source levels plotted against the criterion in graphical form Measured source levels in numerical form for each 1/3 octave band and overall apparent source level for the seismic Underwater Noise Class notation Detailed observed operating conditions during the tests, i.e. rotational speed, pitch and load of any propeller / thruster in use. Rotational speed and load of any engine in use. Vessel speed over ground and through water. Depth at the measuring site. Weather conditions Graphical description of measuring site and location of hydrophone(s)	AP
AP = For approval			

1.6.1.2 For general requirements to documentation, including definition of the info codes, see [Pt.1 Ch.3 Sec.2](#).

1.6.1.3 For a full definition of the documentation types, see [Pt.1 Ch.3 Sec.3](#).

1.6.2 Normative references.

1.6.2.1 This section contains references to the following publications:

- IEC 6120 Electro acoustics – Octave-Band and Fractional-Octave-Band Filters, International Electrotechnical Commission.
- ICES Cooperative Research Report no. 209. Underwater noise of research vessels, review and recommendations. ISSN 1017-6195, May 1995.

These normative references are cited at appropriate places in the text. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document including any amendments applies.

2 Underwater noise

2.1 General

2.1.1 Rule applications

2.1.1.1 The rules specify requirements for maximum underwater noise emission for a given set of operating conditions. The rules specify different requirements for specific vessel groups as shown in [Figure 1](#) – [Figure 5](#) and also stated in numerical form below each figure and summarised in [Table 2](#). Compliance with the rules shall be demonstrated by measurements following the procedures specified in this section.

Guidance note:

Deviations from the requirements may be accepted upon assessment by the Society. Accepted deviations will be noted in the appendix to the class certificate or in the certificate of compliance.

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2.2 Underwater noise requirements

2.2.1 General

2.2.1.1 The maximum allowable noise levels for the various operations are shown in Figure 1 – Figure 5 and summarised in Table 2. The operating conditions for which the maximum noise levels apply are given in [3.1.3] – [3.1.7].

2.2.1.2 Compliance with the rules shall be verified through measurements.

2.2.1.3 The noise limits are stated in 1/3 octave bands.

Guidance note:

It is recommended to carry out calculations at an early project stage in order to ensure that the design includes necessary low noise features and that noise control measures are integrated in the construction if necessary.

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2.2.2 Acoustic (A) requirements

2.2.2.1 Maximum allowable noise levels are specified in Figure 1 for two conditions, one thruster condition, and one light survey condition:

Guidance note:

Air bubbles will reduce the efficiency of acoustical equipment through added attenuation. Deteriorated performance due to air bubbles is not considered by these rules.

Extreme operational conditions are not covered by these rules.

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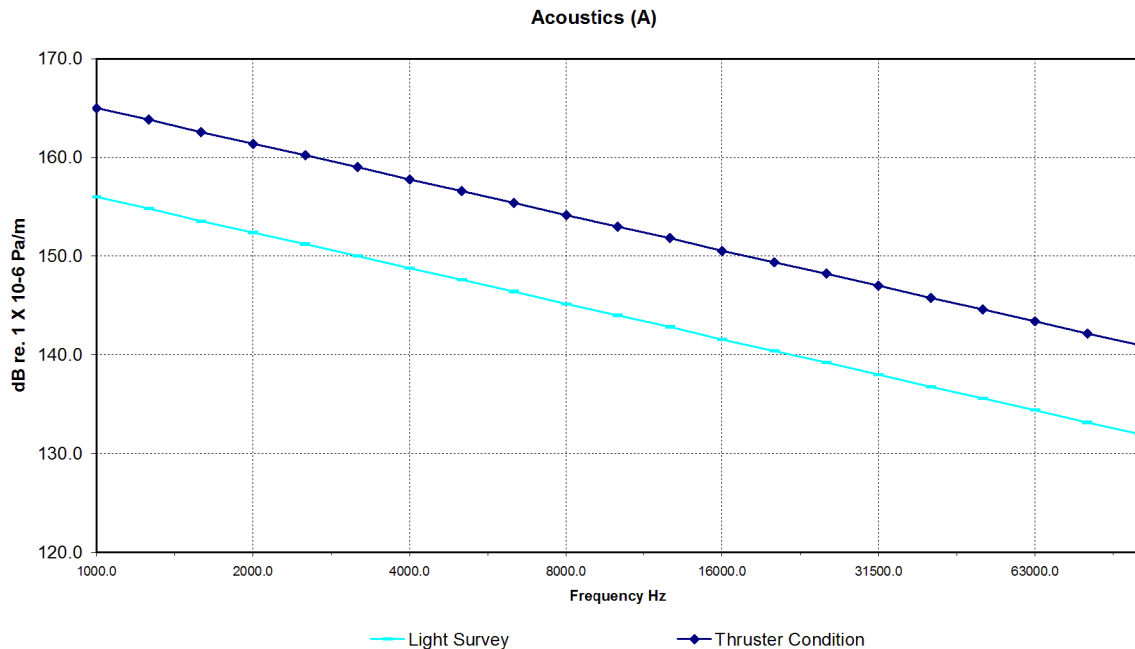


Figure 1 Maximum allowable noise levels in 1/3 octave bands for acoustic operations Silent(A).

2.2.3 Seismic (S) requirements

2.2.3.1 For vessels with power > 3 000 kW / shaft, the allowable noise level for class assignment shall be increased by 20 log (distance in meters to first hydrophone group/250) dB when the distance to the first hydrophone group exceeds 250 m.

Guidance note:

The appendix to the class certificate will state the minimum spacing between vessel and streamer used to derive the allowance.

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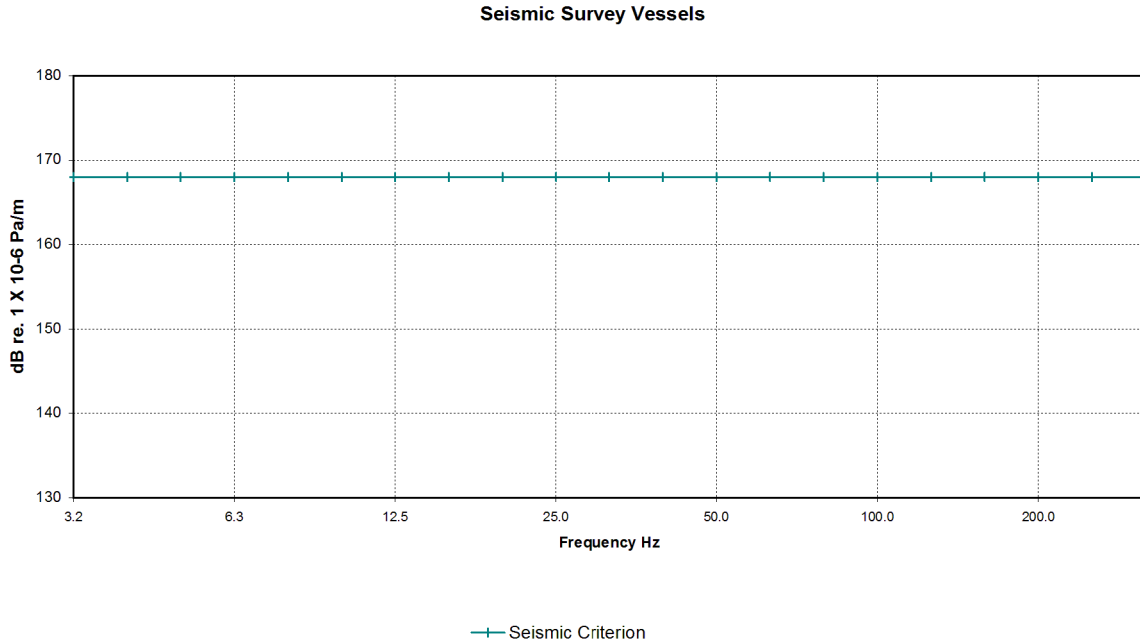


Figure 2 Maximum allowable noise levels for seismic survey vessels, Silent(S).

In addition to the 1/3 octave band level of 168 dB re.1 μ Pa/m, the overall rms noise level in the frequency range 3 – 300 Hz should not exceed 175 dB re.1 μ Pa/m.

Guidance note:

The requirements have been derived based on an assumed distance from the vessel to the first hydrophone groups of 250 m and transmission loss approaching spherical dispersion. For streamers with longer distance to the first hydrophone group the noise will reduce progressively by 20 log (distance in meters/250) dB.

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2.2.4 Fishery (F) requirements

2.2.4.1 Maximum allowable noise levels are specified in Figure 3 for two conditions, one heavy towing condition/trawling, and one light search/fish finding condition:

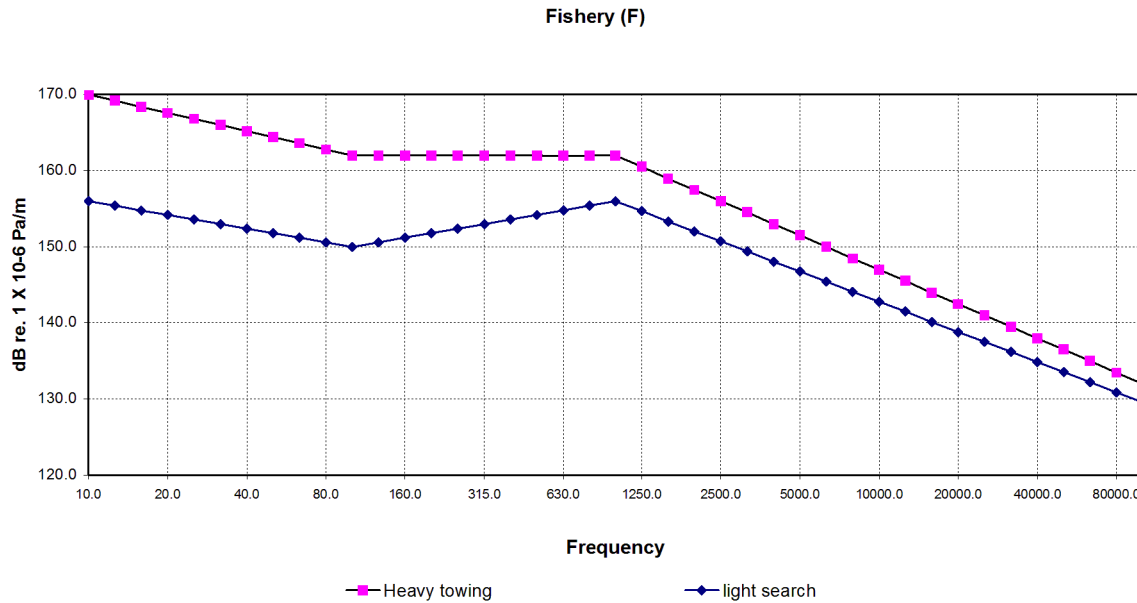


Figure 3 Maximum allowable noise levels in 1/3 octave bands for fishery Silent(F).

2.2.5 Research vessel (R) requirements

2.2.5.1 Maximum allowable noise levels are specified in Figure 4 and are based on the recommendations in ICES Cooperative Research Report no. 209, but are modified for frequencies below 25 Hz.

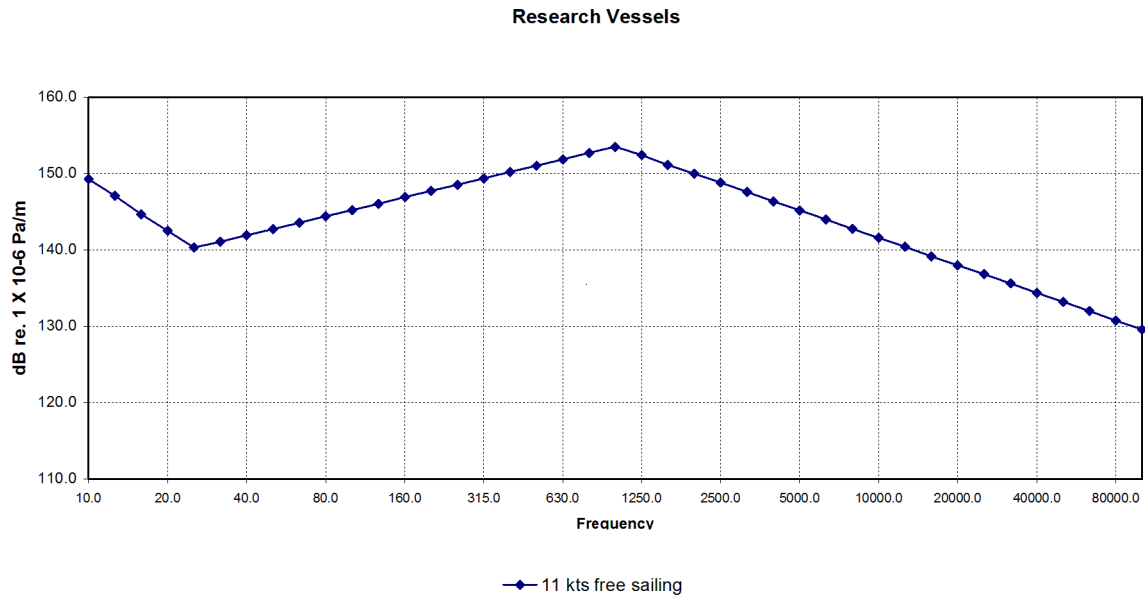


Figure 4 Maximum allowable noise levels in 1/3 octave bands for research vessels Silent(R).

2.2.6 Environmental (E) requirements

2.2.6.1 Maximum allowable noise levels are specified in Figure 5 for two conditions, a normal transit condition and a quiet cruise condition:

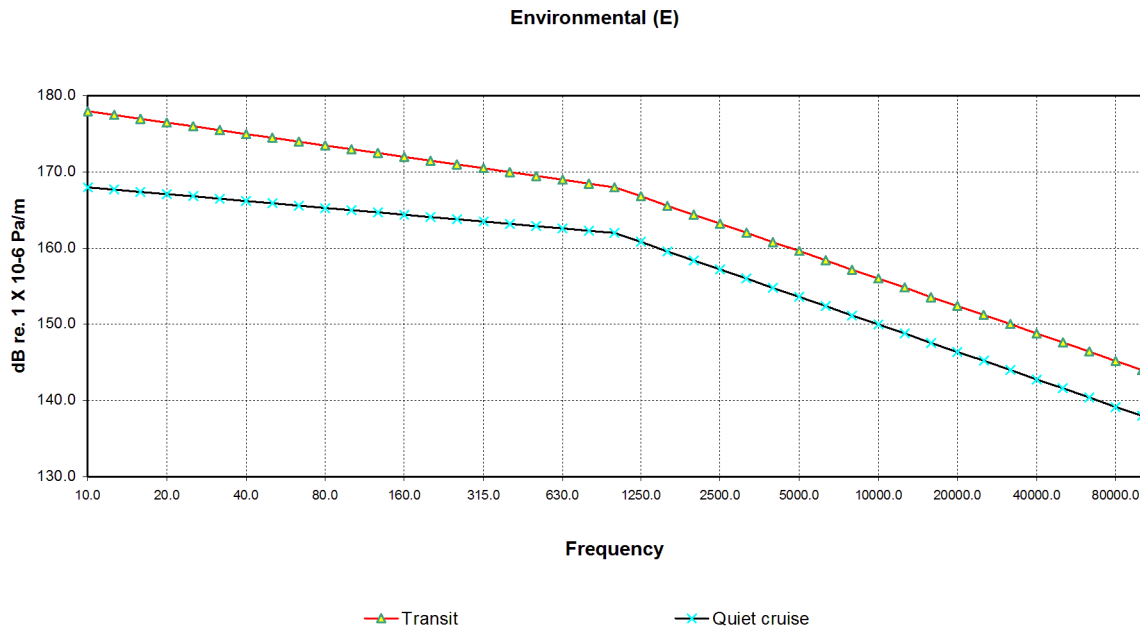


Figure 5 Maximum allowable noise levels in 1/3 octave bands for environmental class notation Silent(E).

Table 2 Summary of criteria

Operational group	Criteria in dB re. 1μ Pa/m	Frequency range
A. Acoustic	Light survey: $156 - 12 \log f(\text{kHz})$	1 kHz – 100 kHz
A. Acoustic	Thruster condition: $165 - 12 \log f(\text{kHz})$	1 kHz – 100 kHz
S. Seismic	168 in each 1/3 octave band	3.15 Hz – 315 Hz
S. Seismic	175 integrated over the frequency range	3.15 Hz – 315 Hz
F. Fishery	Light search: $162 - 6 \log f(\text{Hz})$	10 Hz – 100 Hz
F. Fishery	Light search: $138 + 6 \log f(\text{Hz})$	100 Hz – 1 000 Hz
F. Fishery	Light search: $156 - 13.2 \log f(\text{kHz})$	1 kHz – 100 kHz
F. Fishery	Heavy towing: $178 - 8 \log f(\text{Hz})$	10 Hz – 100 Hz
F. Fishery	Heavy towing: 162 in each 1/3 octave band	100 Hz – 1 000 Hz
F. Fishery	Heavy towing: $162 - 15 \log f(\text{kHz})$	1 kHz – 100 kHz
R. Research	$171.8 - 22.5 \log f(\text{Hz})$	10 Hz – 25 Hz
R. Research	$128.7 + 8.3 \log f(\text{Hz})$	25 Hz – 1 000 Hz

<i>Operational group</i>	<i>Criteria in dB re. 1μ Pa/m</i>	<i>Frequency range</i>
R. Research	153.6 – 12 log f (kHz)	1 kHz – 100 kHz
E. Environmental	Quiet cruise: 171 – 3 log f (Hz)	10 Hz – 1 000 Hz
E. Environmental	Quiet cruise: 162 – 12 log f (kHz)	1 kHz – 100 kHz
E. Environmental	Transit: 183 – 5 log f (Hz)	10 Hz – 1 000 Hz
E. Environmental	Transit: 168 – 12 log f (kHz)	1 kHz – 100 kHz

3 Measurements and testing

3.1 General

3.1.1 Measurement procedures

3.1.1.1 The underwater noise emission for a vessel aiming to achieve one of the **Silent** notations or a certificate of compliance shall be verified through measurements complying with the requirements specified below.

3.1.1.2 The measurements shall be executed by a company approved by the Society or by the Society. In the former case, the measurements shall be witnessed by a surveyor.

Guidance note:

The company should be able to demonstrate proven capability in underwater noise measurements and should be in possession of necessary high precision instrumentation.

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3.1.1.3 The underwater noise levels shall be measured at a noise range and at a suitable site which shall be approved by the Society before the measurements are initiated.

3.1.1.4 The measurements shall follow the procedures given in [App.A](#).

Guidance note:

Exemption from [\[3.1.1.4\]](#) may be granted by the society based upon approval of procedures adopted by a permanent noise range as well as track records.

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3.1.2 Test conditions

3.1.2.1 A plan for the required operating conditions shall be submitted to the Society for approval prior to the testing. The plan shall at least contain the information specified in [Table 1](#).

3.1.2.2 The operating conditions for the vessel under test shall adhere to the requirements given in one or more of sub-section elements [\[3.1.3\]](#), [\[3.1.4\]](#), [\[3.1.5\]](#), [\[3.1.6\]](#) or [\[3.1.7\]](#) depending on the type of operation for which the vessel shall be tested.

3.1.2.3 The operating conditions shall be monitored during the measurements and the information specified in [Table 1](#) shall as a minimum be recorded as accurately as practicable during the measurements.

3.1.2.4 The vessel shall be fully outfitted and carry a load within the normal load range for the operation in question. For vessels with larger variation than 25% in relevant displacements, measurements at two loading conditions close to the heavy and light displacement conditions may be decided by the Society in each particular case.

3.1.2.5 All equipment and systems normally in use, except hydro-acoustic equipment shall be running at their normal rated capacity or in the normal mode for the operation in question. Hydro-acoustic equipment shall be turned off during the measurements except if these systems are necessary for safe navigation of the vessel. If hydro-acoustic equipment has to be used for safety reasons, the type of equipment and frequency range of the signals shall be stated in the record of measuring conditions.

3.1.3 Acoustic (A) test conditions

3.1.3.1 The vessel shall be tested for a standard set of operating conditions which represent typical or expected operating conditions for the vessel.

3.1.3.2 Vessels which document that use of thrusters is irrelevant during acoustical operations can be allowed to conduct tests at the light survey condition only.

3.1.3.3 Vessels designed to use thrusters to conduct a survey shall be tested at the two sets of operating conditions specified further below.

Guidance note:

Light survey, represents a condition where the vessel is able to perform a survey using the main propulsion propeller(s) only. The thruster condition simulates the noise which will be generated if additional thrusters have to be used to maintain a course during a survey.

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3.1.3.4 An operational speed profile for typical hydro-acoustic operations for the vessel shall be submitted to the Society prior to the tests. The speed profile shall contain the maximum speed allowed when using the main hydro-acoustic equipment as well as expected operational speed(s) for the majority of the operations. The profile shall also indicate if side thrusters are expected to be used. Based on the received information, the Society will determine speed(s) at which the vessel shall be tested.

3.1.3.5 When relevant speed(s) for testing has been established, measurements shall be performed with the propulsion system in a normal configuration for the relevant speed(s).

3.1.3.6 When a thruster noise test is required, see [3.1.3.3], measurements shall be carried out with the thruster(s) operating at 40% of the rated load for the thruster(s).

3.1.4 Seismic (S) test conditions

3.1.4.1 Measurements shall be carried out towing the ordinary seismic equipment or simulated equivalent towing load. The equivalent towing load procedure shall be forwarded to the Society for approval prior to testing.

Guidance note:

Equivalent load may be established by calculations or from measured experience data from other vessels with similar seismic gear. The towing load should be established for the normal seismic towing speed for the vessel, or at 5 knots, or through a bollard pull method. The measured noise levels during bollard pull will be corrected using the Society's "Tip vortex method". No cavitation vortices should occur between the propeller and the hull during bollard pull.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3.1.5 Fishery (F) test conditions

3.1.5.1 Vessels which can document that they will perform heavy towing/trawling only will be allowed to test at that condition only.

3.1.5.2 An operational speed profile typical for the vessel when operating hydro-acoustic search equipment shall be submitted to the Society prior to the tests. The speed profile shall contain the maximum speed allowed when using the main hydro-acoustic equipment as well as expected operational speed(s) for the majority of the operations. Based on the received information, the Society will determine speed(s) at which the vessel shall be tested.

3.1.5.3 For the trawling condition, the vessel shall tow its usual trawl or an alternative object yielding equivalent towing force at a distance of at least 150 m from the vessel at 4 knots or at the highest allowable speed for the trawl if this is less than 4 knots. The trawl or alternative object shall not touch the bottom.

3.1.5.4 If an alternative object will be towed, calculated or measured towing force for the standard trawl that the vessel will be equipped with as well as calculated or measured towing force for the alternative object shall be submitted to the Society for approval.

3.1.6 Research (R) test conditions

3.1.6.1 Research vessels > 50 m in overall length shall sail at 11 knots without towing any object and without the use of side thrusters.

3.1.6.2 Research vessels ≤ 50 m overall length or less shall sail at 8 knots without towing any object and without the use of side thrusters.

3.1.6.3 Only equipment and machinery necessary to achieve the stated free running speed and to maintain normal electric load shall be used during the testing.

3.1.7 Environmental (E) test conditions

3.1.7.1 Each vessel shall be tested at two different conditions: transit and quiet cruise.

3.1.7.2 The transit condition shall correspond to the contractual normal seagoing condition, or 85% of maximum continuous power available at the propeller shaft(s).

3.1.7.3 The quiet cruise condition shall be performed at a speed of 11 knots if the overall vessel length > 50 m. For vessels ≤ 50 m, the test shall be performed for a speed of 8 knots.

3.1.7.4 All other machinery shall be run at normal operating conditions during the tests.

3.2 Reporting

3.2.1 General

3.2.1.1 The measured apparent source levels shall be reported in 1/3 octave bands. The reporting shall comply with the requirements in [App.A](#).

3.2.1.2 The Society will assess the reported results, documented operating conditions and any other relevant information. If the results are found to be acceptable the relevant **Silent** class notation will be issued.

3.2.1.3 The Society may, based on an evaluation of all factors associated with the measurements, accept deviations from the requirements.

APPENDIX A MEASUREMENT PROCEDURE

1 Scope

1.1 General

1.1.1 This appendix defines procedures for measurement of underwater noise generated by vessels to be tested for the assignment of the class notation **Silent**.

2 Test procedures

2.1 General

2.1.1 The procedure requires use of an external bottom mounted hydrophone. The vessel under test shall sail past the hydrophone as indicated in [Figure 1](#) and [Figure 2](#) for free sailing vessels, and as indicated in [Figure 3](#) for thruster tests. The noise from the vessel is then recorded during a defined portion of the sailing path. The vessel shall sail in a straight line with minimal use of rudders and steerable thrusters for free sailing runs. The vessel shall rotate as close to the hydrophone as practical within the defined measuring range for thruster spins.

2.1.2 Geometry of test site

2.1.2.1 A sloping seabed as indicated in [Figure 1](#) is preferred, but measurements from a flat bottom area are also allowed. The recording equipment can be located in a moored auxiliary vessel if measurements are taken offshore or when land access is limited.

2.1.2.2 The measurements shall be carried out within a source to hydrophone distance range of 100 m to 200 m at the closest point of approach (cpa) to restrict the influence of variation in distance correction errors.

2.1.2.3 The depth below the keel of a vessel shall not be less than 30 meters. For vessels operating at high speeds, the minimum depth of water at the test site shall at least satisfy the following relationship for minimum depth under the keel: $d \geq 0.64v^2$ where v represents the maximum ship speed in m/s required for the test and d is the depth in m.

2.1.2.4 The distance between the down sloping seabed and a rising seabed to the same level as the hydrophone (typical opposite side of a fjord or a bay) shall be at least 500 m.

2.1.2.5 The hydrophone shall be mounted in a cage or fixture able to keep the hydrophone in a stable position at a maximum height of 0.2 m above the sea bottom. The bottom shall be firm and able to be support the cage without significant subsidence, e.g. sand, firm clay or stone. An example of a cage construction is shown in [Figure 5](#). The cage structure shall be open, stiff and well damped. The structural members of the cage shall be slim with a maximum diameter of 20 mm in order to limit shadowing effects on the hydrophone. The base of the cage shall be between 0.4 m² and 0.7 m². The method relies on the seabed giving a diffuse reflection not a perfect mirror reflection, i.e. the surface shall not be perfectly flat.

2.2 Recording of data

2.2.1 Preparations

Before start of the measurements the following preparations shall be carried out:

- a) Selection of measuring site and agreement with vessel about timing of survey

- b) Preparation of test protocol covering operating conditions to be tested and number of test runs to be carried out
- c) Preparation and check of calibration for instrumentation to be used
- d) Instructions for ship crew to monitor operating conditions and briefing on procedures for execution of the tests
- e) Instructions to ship crew for construction of measuring cage or for suitable threaded holes for through the hull transducers.
- f) Establish a method of undisturbed communication between vessel operating crew and measuring crew.
- g) Ensure that any auxiliary equipment needed for the test is available, e.g. battery power sources, auxiliary vessel, etc.

2.2.2 Measurements

2.2.2.1 For free sailing verification tests, data for averaging shall be recorded from when the vessel midship position is abeam the hydrophone position and until the vessel has passed abeam the hydrophone position by half a ship length for speeds ≤ 5 kts. For speeds > 5 kts, recording of data shall be performed from abeam the front of the vessel and until the vessel has passed the hydrophone with one ship length, see [Figure 4](#). Distance correction shall assume the distance of cpa for the complete data segment.

2.2.2.2 For all free sailing tests, two sets of measurements shall be taken with the vessel sailing in opposite directions at the same operating condition. The results of the two runs shall be averaged on a power basis in order to establish the resulting noise level for that operating condition.

2.2.2.3 The noise during bollard pull shall be measured as if the vessel had been passing the hydrophone from a location abeam the propeller plane. The averaging time shall be set to 1 minute for each set of data acquired.

2.2.2.4 For thruster tests, the spin shall start with the bow facing the hydrophone position. Data shall be averaged over a time of 30 seconds. Distance correction shall be carried out for segments of approximate 10 seconds of data using the average distance within each segment for each distance correction.

2.2.2.5 For thruster tests, two sets of measurements shall be taken for each operating condition with the thrusters running in opposite directions during the two runs. The results of the two runs shall be averaged on a power basis in order to establish the resulting noise level for that operating condition.

2.2.2.6 For multi thruster configurations, the thrusters can be operated in the same direction letting the vessel rotate or alternatively the thrusters can be run in opposite directions thereby limiting the motion of the vessel.

2.2.2.7 Before the start of the tests, the position and depth of the hydrophone shall be determined within an accuracy of ± 5 m. The position of the ship shall be recorded by differential GPS or equivalently accurate navigation equipment. The source to hydrophone distance can then be calculated using Pythagoras theorem. As an alternative the distance between hydrophone and ship can be measured using an acoustic beacon. The response at the frequency of the latter shall then be accounted for during the analysis of data.

2.2.2.8 The background noise at the test site shall be monitored at least at the start and end of the measurement survey. If the background noise is more than 10 dB below the noise from the object under test - no correction is necessary.

2.2.2.9 For background noise 5 dB – 10 dB below the noise from the tested object – the background noise to be subtracted from source noise level on a power basis.

2.2.2.10 If the background noise is in the range 3 dB – 5 dB below the noise from the object under test, the source of background noise to be investigated and if possible removed. If impractical to remove the source of background noise, background noise can be subtracted from source noise level.

2.2.2.11 For background noise levels less than 3 dB below the noise from the object under test, the source of background noise to be investigated and if possible removed. If it is impossible to remove the source of the background noise, the results will not be valid. If the excessive background noise occurs over a limited part of the frequency range, data can be presented for the remaining part of the spectrum with a statement of the reason for the lack of data in the frequency range blocked by background noise. Later assessment will then determine if the measured results can be accepted or not.

2.2.2.12 The instrumentation used to record and analyse the data shall have a dynamic range of 90 dB or higher. It is important that the instrument operator attempts to utilise the full dynamic range in order to limit data sinking below the instrument threshold noise at high frequencies.

2.2.2.13 The instrumentation shall be of high precision and shall be maintained and calibrated in accordance with the instructions of the instrument manufacturer. At the beginning and end of each measurement survey the entire measurement system shall be checked by an appropriate check calibrator.

2.2.3 Analysis of data

2.2.3.1 The data shall be analysed using real time 1/3 octave filters or FFT analysers. In the latter case the data shall be converted to apparent 1/3 octave bandwidth by integration of each narrow frequency point within the bandwidth of the relevant filter to a filter with characteristics in compliance with minimum IEC 61260 class 2. Narrow band data may be presented on a voluntary basis for information.

2.2.3.2 The frequency range of the measurements shall cover the relevant 1/3 octaves, however, the frequency range 50 kHz to 100 kHz can be omitted if it can be proved that the data will fall below the required 90 dB dynamic range.

2.2.3.3 Distance correction shall be carried out using the actual measured transmission loss at the test site or the relationship: $+ 18 \log r$, where r is the distance in meters for which correction shall be made.

2.2.3.4 A pressure reflection correction of -5 dB shall be applied to measurements made with bottom mounted hydrophones located on the bottom in a fixture with hydrophone height not exceeding 0.2 m above the bottom.

2.2.3.5 The results of the tests shall be presented as apparent source level values for each of the 1/3 octave filters used during the analysis of the data. An example of data presentation format is shown in [Figure 6](#).

Table 1 Summary of measuring parameters

Measurement reporting unit	dB re 1 Pa at 1 m
Reference distance	1 meter
Distance adjustment factor	Measured transmission loss or $18 \log_{10} (r/r_{1m})$
Hydrophone installation	In fixture max. 0.2 meter above bottom. Bottom not perfectly flat
Correction for surface reflection	- 5 dB
Acoustical source centre, vessel	At 0.7 propeller radius when the blade is pointing upwards
cpa distance, vessels	100 m – 200 m
Minimum depth under vessel	30 m and $d \geq 0.64v^2$
Required accuracy of depth and distance measurements	+/- 5 meters
Frequency range	All relevant 1/3 octave bands

Frequency analysis	1 / 3 octave
Frequency analysis, optional	Narrowband
Averaging time for data, vessels free sailing: Vessels thruster spin: Bollard pull:	≤ 5 kts, ship length/speed > 5 kts, 2 x ship length/speed 30 seconds 1 minute
Signal / Background noise	> 10 dB no action < 10 dB, follow specified procedure
Minimum dynamic range of instrumentation	90 dB
Weather conditions	Max. Beaufort 4 / Sea State 3

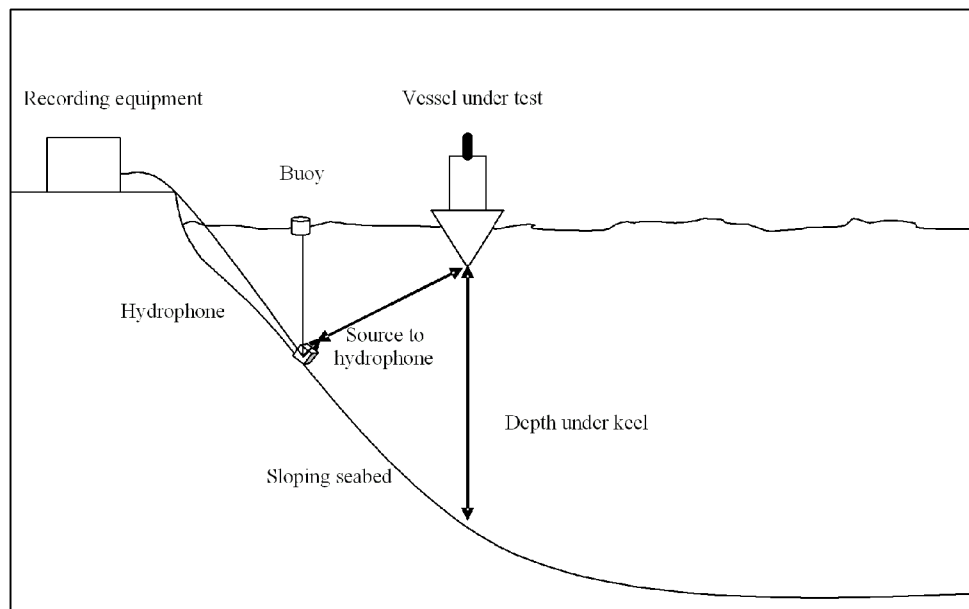


Figure 1 Schematic drawing of measuring situation for surface vessel

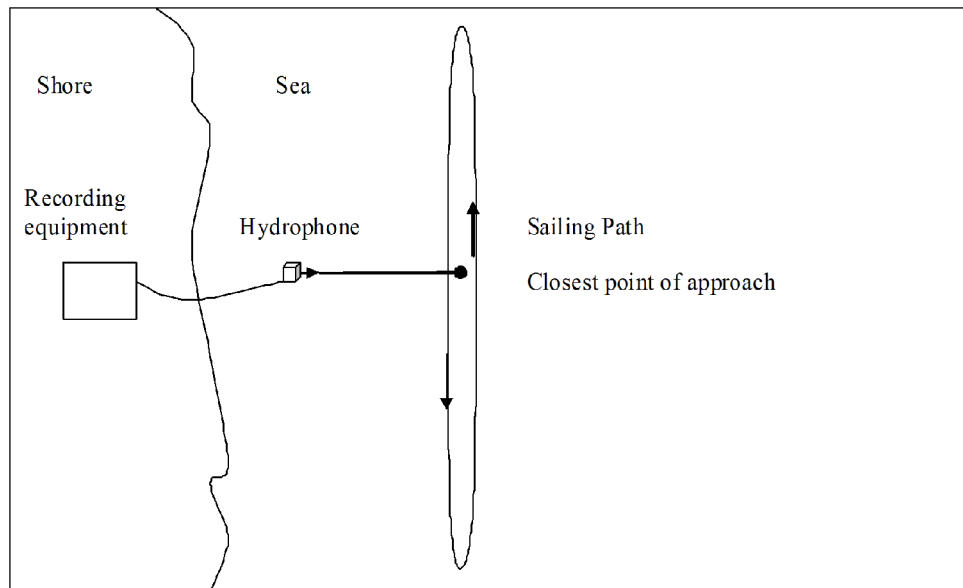


Figure 2 Measuring situation seen from above, free sailing tests

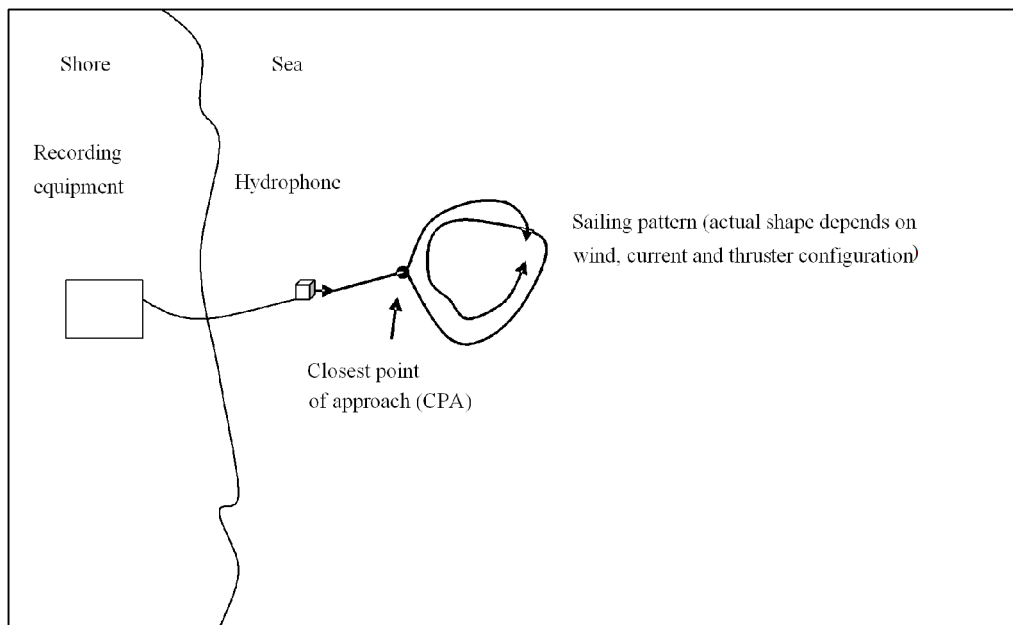


Figure 3 Measuring situation seen from above, thruster tests

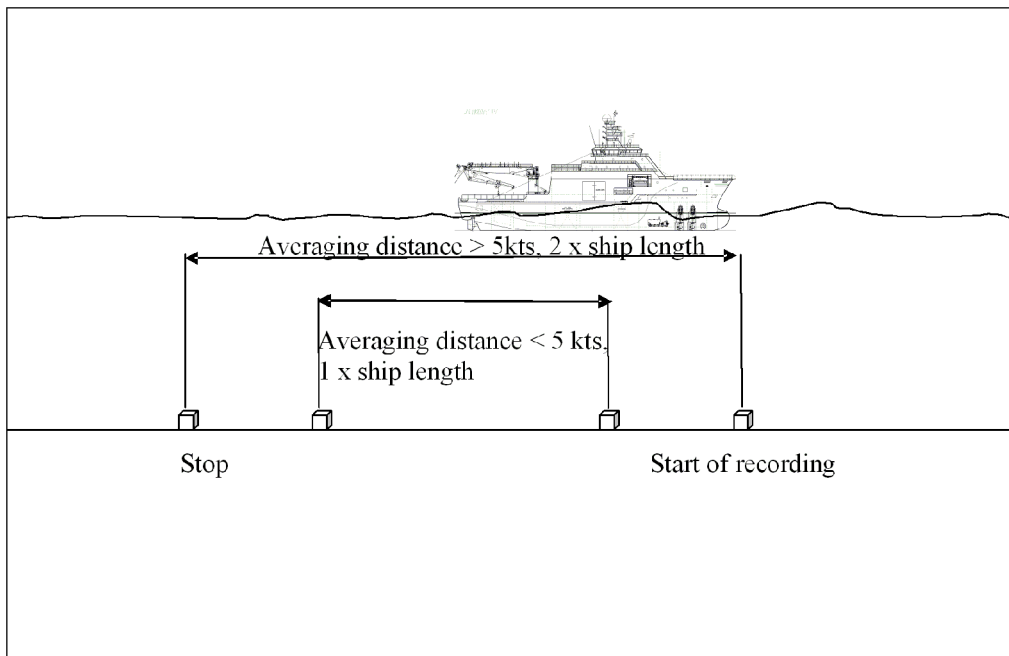


Figure 4 Sketch of averaging distance for different free sailing speeds



Figure 5 Hydrophone attached to an example of a seabed cage

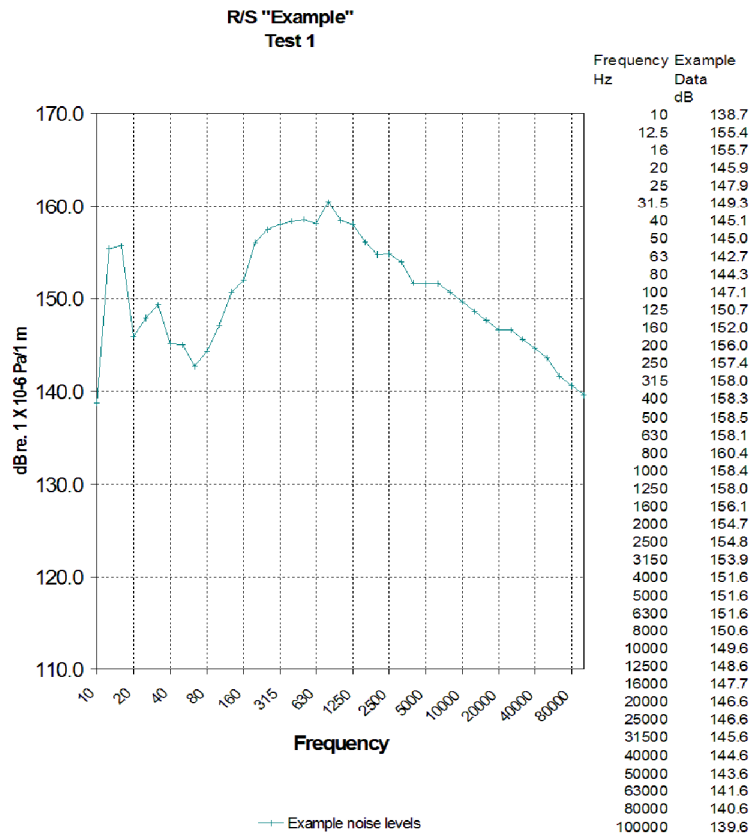


Figure 6 Example on data format

CHANGES – HISTORIC

January 2017 edition

Main changes January 2017, entering into force as from date of publication

- Sec.1 Ballast water management - BWM
 - Sec.1 [2.6.1] and Sec.1 [2.4.2]: Ballast water management plans including sequential exchange of ballast water will not be required to include detailed calculations if an approved loading computer is onboard. In case a detailed calculation is to be submitted, only the most critical condition need to be included.
- Sec.2 Environmental class - Clean
 - Sec.2 [1.1] and Sec.2 [1.2]: Qualifiers for the class notation **Clean** are added: **Clean(Tier III)** and **Clean(Design,Tier III)**.
- Sec.3 Fuel and lubrication oil systems and arrangement for meeting regulations in emission control areas - ECA
 - Sec.3 [1.3]: Sentence included to ensure that ECA SOx notation formally can be given to e.g. ships with gas fuel or scrubbers.

July 2016 edition

This document supersedes the January 2016 edition.

Main changes July 2016, entering into force 1 January 2017

- Sec.1 Ballast water management - BWM
 - Sec.1 Table 2: In accordance with 5.1.9 of IMO G8, the commissioning procedure (Z254) is changed from FI to AP and shall be approved in accordance with Sec.1 [3.3], Sec.1 [3.4] and Sec.1 [3.5].
 - Sec.1 [3.3] and Sec.1 [3.4]: The sub-sections are updated to cover IACS UR M74.
 - Sec.1 [3.3.1][1]: The paragraph is updated for further clarification and a guidance note has been included.
 - Sec.1 [3.3.1][2]: The paragraph is updated to further clarify compliance requirements with Pt.4 Ch.6 Sec.2.
 - Sec.1 [3.4.3][5]: The paragraph is updated to follow DNV GL rules for ozone detection found in Pt.4 Ch.6 Sec.7.
 - Sec.1 [3.4.5][1]: The paragraph is updated for further clarification with regards to the ventilation.
 - Sec.1 [3.5.1][8]: A new paragraph is included to cover 5.1.9 and 8.2.6 of IMO G8.
- Sec.2 Environmental class - Clean
 - Sec.2 Table 4: References updated from DNV programmes to DNV GL programmes.
 - Sec.2 [2.3.8][2]: Change in reference has been made.

January 2016 edition

This document supersedes the October 2015 edition.

Main changes January 2016, entering into force 1 July 2016

- Sec.4 Recycling - Recyclable

- General: References are neutralized in the document and document numbers are only mentioned under "References".
- [1.1, 1.4, 2.3.3, 3]: EU SRR is mentioned and explained.
- Tables 4, 6 and 7: Revised for DocReq.
- [2]: General update on Class Notation Recyclable.
- [3]: New item inserted for EU SRR details.

October 2015 edition

This is a new document.

The rules enter into force 1 January 2016.

About DNV GL

Driven by our purpose of safeguarding life, property and the environment, DNV GL enables organizations to advance the safety and sustainability of their business. We provide classification, technical assurance, software and independent expert advisory services to the maritime, oil & gas and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our experts are dedicated to helping our customers make the world safer, smarter and greener.