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NATO LETTER OF PROMULGATION

13 January 2014

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INTRODUCTION

Aim

1 The overall aim of the Naval Ship Code is to provide a standard for naval surface ship safety based on and benchmarked against IMO conventions and resolutions that embraces the majority of ships operated by Navies.

Scope

2 The Naval Ship Code (the Code) is applicable to all naval surface ships, not nuclear powered, which insofar as the Navies wish it to apply to their own ships and vessels, includes all ships belonging to or operated by the armed forces, coastguard or other protection and security department or agency of a State.

3 The Code is based on and benchmarked against IMO conventions and resolutions (see above), it therefore contains safety related issues that correspond in scope to that which is covered by IMO publications but which reflect the fundamental nature of naval ships. The Code does not include measures specifically designed to address the effects of military attack.

4 The Code provides a framework for the assurance of Naval Ship Safety that to the greatest extent possible:

4.1 Is harmonised among member nations;

4.2 Is harmonised to provide at least an equivalent level of safety to the relevant merchant shipping codes;

4.3 Represents a cost-effective way of specifying and managing naval ship safety.

General

5 This introduction addresses the need for a Naval Ship Code and briefly describes how the Code is structured and used.

6 The Naval Ship Code is supported by the Guide to the Naval Ship Code, which provides guidance on how the Naval Ship Code is developed and maintained and how it should be applied.

Principles of Application

7 Navies who adopt the Naval Ship Code and all parties involved in application must recognise that implementation of the provisions of the Naval Ship Code is a matter for each party;

8 The International Naval Safety Association assumes no responsibility and will not be liable to any person for any loss, damage or expense caused by reliance on the information or advice in this document or howsoever provided.

9 The principles of application are outlined in Chapter I Regulation 1a and supplementary guidance is shown in Annex A.

Structure of the Code

10 The Naval Ship Code adopts a goal based approach. The basic principle of a goal based approach is that the goals should represent the top tiers of the framework, against which ship is verified both at design and construction stages, and during ship operation. This approach has several advantages over more traditional prescriptive standards:

10.1 The Naval Ship Code can become prescriptive if appropriate for the subject, or alternatively, remain at a high level with reference to other standards and their assurance processes.

10.2 The goal based approach permits innovation by allowing alternative arrangements to be justified as complying with the higher level requirements.

10.3 Non-compliances can be managed in a more controlled manner by referring to the higher level intent.

11 For the development of the Naval Ship Code, a hierarchy of tiers has been adopted as shown in Figure 1. The increasing width of the triangle as the Naval Ship Code descends through the tiers implies an increasing level of detail.

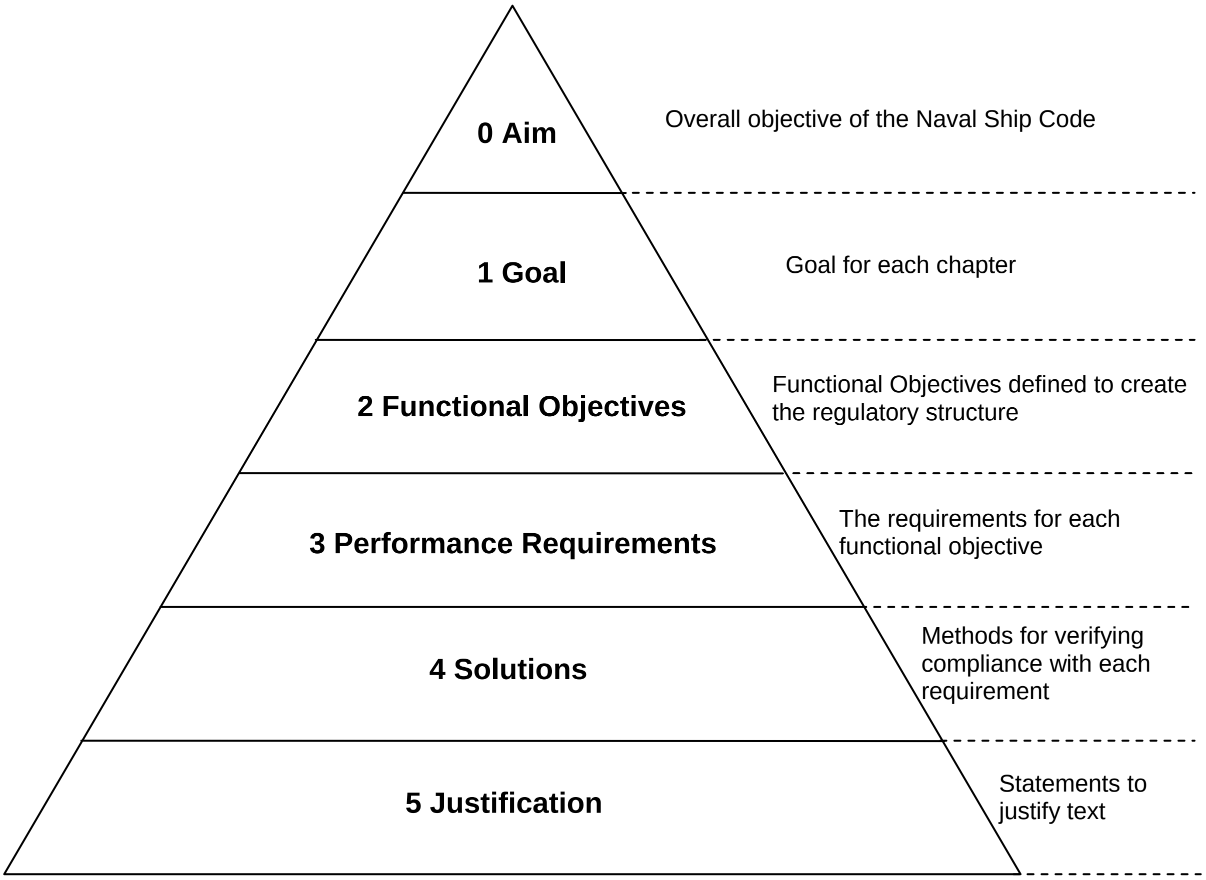

Figure 1: Goal Based Approach to Developing the Naval Ship Code

12 The following example, based on fire safety, illustrates how the methodology is used:

12.1 Tier 0 Aim. The overall Aim, Philosophies and Principles of the Naval Ship Code have been established.

12.2 Tier 1 Goal. For each subject covered by a chapter in the Naval Ship Code, such as Fire Safety, a goal is established. For example, the Goal for Fire Safety may include the statement "The ship and its arrangements……shall be designed, constructed and maintained in such a way that the fire can be extinguished and essential safety functions can be maintained". This is recorded in each Chapter as Regulation 0. The Tier 1 Goals have been established.

12.3 Tier 2 Functional Objectives. Functional Objectives are defined that provide a structure to the chapter so that relevant requirements and acceptance criteria can be captured. Typically, each Functional Objective is covered by a Regulation in the chapter; one Functional Objective might be "Fire Protection Boundaries".

12.4 Tier 3 Performance Requirements. The performance requirements for the Functional Objective are then listed, such as "Divisions formed by bulkheads and decks are to prevent the breakthrough of fire".

12.5 Tier 4 Solutions. The method for confirming that the arrangements on the ship are compliant with the requirement is defined. This may be addressed in one of three ways; a prescriptive requirement, a performance based solution or through reference to the standards of a Recognised Organisation and their confirmation that the standard has been met.

12.6 Tier 5 Justification. Finally, statements justifying how the Performance Requirements and associated Solutions meet the Principles, Aim and Philosophies of the Naval Ship Code and the Goal for the subject. As opposed to other tiers, Tier 5 is developed for future management of the Naval Ship Code and will not be included in the final text.

13 For some Chapters it may considered sufficient to establish requirements for the upper tiers only.

14 Where a Classification Society's rules or other suitable standards are used for tier 4 Solution, a formal validation is to be undertaken at an appropriate level by the Naval Administration. A record of the validation is to be retained.

Note: An acceptable form of validation is defined in the Guide Annex A, Section 2.23.

Philosophy

15 Defined philosophies are required to understand the operation of Naval ships compared to merchant ships, and thus assist the process of justifying departures from the civil system, namely SOLAS. The philosophies help Naval staff, the Owner (nominated government department or industry) and industry as the supplier in understanding and applying the Naval Ship Code.

16 The Philosophies (expanded in more detail as Naval Ship Characteristics in Annex A, Appendix 2) are:

16.1 Naval Philosophy. The role of Naval ships is such that the safety of the Naval ship and embarked personnel may be secondary to the safety of those under the protection of the Naval ship.

16.2 Merchant Philosophy. Merchant ships provide a commercial service where safety of life at sea and protection of the environment are paramount.

17 With reference to embarked personnel; whilst the Naval Philosophy may allow their safety to be a secondary consideration in some situations, the Code is intended to produce an equivalent level of safety, as achieved by application of SOLAS and associated documents in the merchant shipping world.

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CHAPTER I GENERAL PROVISIONS

PART A APPLICATION, DEFINITIONS ETC

Regulation 0 Goal

Note: The goal identified for Chapter I of this Code applies to all subsequent chapters.

1 Through the effective assurance that essential safety functions will be available, the Naval Ship Code provides a framework for the design, construction and maintenance of naval ships with the intention of:

1.1 Safeguarding life in all Foreseeable Operating Conditions throughout the lifetime of the ship;

1.2 Offering a level of safety to which embarked persons are exposed that is no less than the level of safety to which persons embarked on a merchant ship are exposed.

2 For hazards occurring under extreme threat conditions, the code permits an appropriate level of safety as determined by the Naval Administration.

Regulation 1a Principles

1 The purpose of this Code is to provide a regulatory safety framework for naval surface ships that recognises their operational usage and the needs of Navies. The philosophy behind this Code is based on the management of risk which is addressed through:

1.1 the definition of the Concept of Operations that describes the role, ship attributes, required survivability, the environment, and the operating and maintenance philosophies;

1.2 the selection of solutions appropriate to the Concept of Operations and the safety goal outlined at Regulation 0 Goal above;

1.3 the assessment of the ship against the solutions by which achievement of the safety goal can be judged;

1.4 the issue of certificate(s) by the Naval Administration (or its Recognised Organisation) to provide a visible demonstration of safety management and compliance with the safety goal;

1.5 The Code assumes a suitable safety management system is in place; and

Note: The ISM Code - International Management Code and Revised Guidelines on Implementation of the ISM Code Amended by Resolution MSC.179(79), MSC.195(80) and MSC.273(85) would be considered as a suitable safety management system, however the Naval Administration may approve alternative systems.

1.6 periodic survey to ensure that the identified solutions are being met and compliance with the safety goal is maintained.

2 The documentation detailing the Concept of Operations – the Concept of Operations Statement – and the identified standards, procedures and modifications thereto shall be maintained for the design life of the ship.

3 This Code shall be applied as a comprehensive set of requirements. It contains requirements for design and construction and maintenance of naval ships, and sets levels of safety which are equivalent to those of merchant ships.

4 The regulatory function implied in this Code requires as a minimum that the ship offers:

4.1 an equivalent level of safety to that were it regulated under international conventions or regulations applicable to merchant shipping;

4.2 an additional level of safety for normally occurring hazards that reflect the foreseeable operations on which a naval ship is or may be engaged;

4.3 an appropriate level of safety under extreme threat conditions as determined by the Naval Administration.

5 This Code expects the majority of persons normally embarked on naval ships to be able-bodied with a fair knowledge of the layout of the ship and have received some training in safety procedures and the handling of the ship's safety equipment.

6 In addition to the requirements contained elsewhere in this Code, naval ships shall be designed, constructed and maintained in compliance with the structural, mechanical and electrical requirements of a Classification Society which is recognised by the Naval Administration in accordance with the provisions of Regulation 6 Inspection and Survey, or with applicable national standards of the Naval Administration which provide an equivalent level of safety.

Regulation 1b Application

1 Unless expressly provided otherwise, the present regulations apply only to naval surface ships that are not nuclear powered.

2 Nothing in this Code diminishes the responsibility of the Governments of the States to regulate shipping in accordance with IMO conventions and other international and national treaties, conventions and regulations.

3 Compliance with this Code does not diminish the responsibility to comply with applicable IMO conventions and other international and national treaties, conventions and regulations.

4 Where necessary, the ships to which each chapter applies are more precisely defined, and the extent of their application is shown, in each chapter.

Regulation 2 Definitions

Note: Additional definitions which are specific to individual Chapters are located within those Chapters.

Anniversary date	The day and the month of each year which will correspond to the date of expiry of the relevant certificate.
Approved	Approved by the Naval Administration
Breadth	The extreme width from outside of frame to outside of frame at or below the Full Load Draught. For High Speed Craft, it is the breadth of the broadest part of the moulded watertight envelope of the rigid hull, excluding appendages, at or below the design waterline in the displacement mode with no lift or propulsion machinery active.
Bulk Fuel Carriage	See Special Functions
The Code	The regulations and guidance contained in this document

Compartment	A sub-divided volume of a main sub-division compartment so as to facilitate the normal working of the ship. Large compartments may be main sub-division compartments in their own right (e.g. a main machinery space). Compartments may be required to be fitted with fire detection and extinguishing appliances and, depending upon their use and the use of adjoining compartments, provide a degree of structural fire protection between adjacent compartments
Condition of Certification	A notice (from the Naval Administration or its Recognised Organisation) to the ship Owner, advising of a non-compliance with the relevant rules, standards, criteria or convention, which requires permanent rectification but does not need to be addressed immediately. Note: A due date is always to be associated with a Condition of Certification. Failure to complete permanent rectification of a Condition of Certification by the due date will invalidate the certificate.
Commanding Officer	Person in command of the Ship. All persons onboard are under the Commanding Officer's authority and are the Commanding Officer's responsibility. Other terms used outside the Code for the Commanding Officer are Captain and Master.
Crew members	See Persons Onboard.
Damage	Damage is an abnormal state that has resulted in physical harm to a ship or its systems. Noting Regulation 1a paragraph 4, and for Foreseeable Operating Conditions and Extreme Threat Conditions, for the purposes of this Code: a. Foreseeable damage is damage that can be foreseen for the type of ship; Note: Foreseeable damage includes damage that could be caused by one's own cargo or weapons, navigational hazards (collision, grounding), naval exercises (certain types of navigational exercise, replenishment at sea, landings, boat operations, etc), system failures, mal-operation, and some types of terrorist attack. b. Extreme threat damage is damage that may result under extreme threat conditions. Note: Extreme threat damage includes damage that could be caused by freak waves or typhoons, weapon attacks and extreme acts of aggression.
Damage Control Deck	A watertight deck at a location above the submergence limit for the purposes of safe continuous access along the length of the ship, communication and recovery activities. Note: This may be referred to as the bulkhead or communications deck.
Deadweight	For ships subject to the Loadline Convention, means the difference in tonnes between the displacement of a ship in water of a specific gravity (density) of 1.025 at the load waterline corresponding to the assigned summer freeboard and the Lightship Displacement. For ships not subject to the Loadline Convention, deadweight is to be taken as the difference between the Full Load Displacement and the Lightship Displacement.
Design Draught	The Full Load Draught with any additional margins, such as for through life growth.
Due date	See Condition of Certification.
Duty Holder	See Owner
Embarked forces	See Persons Onboard.

Essential safety functions	Those functions that include propulsion, machinery control, manoeuvring (steering gear, etc.), essential auxiliary systems, electrical installations, anchoring (including mooring and embarkation arrangements), fire prevention, detection and extinguishing systems, bilge and ballast systems, escape, evacuation, rescue, radiocommunications, navigation, carriage and preparation of dangerous goods, flood detection, watertight and weathertight closing devices (including doors, hatches, vents, gates, sea chests and their actuating systems), lifting appliances (associated with escape and evacuation), and other services to ensure functions that safeguard life in both Foreseeable Operating Conditions and Extreme Threat Conditions and systems supporting Safe Areas; see Ch VI Reg 10.
Existing ship	A ship which is not a new ship.
Extreme threat conditions	Abnormal operating conditions resulting from the deliberate exposure of a naval ship to extreme natural events or extreme hostile acts deliberately created by other persons.
Extreme threat damage	See Damage.
Flag State Administration	The Administration as defined in the Annex to the IMO SOLAS Convention.
Flashpoint	The temperature in degrees Celsius (closed cup test) at which a product will give off enough flammable vapour to be ignited, as determined by an approved flashpoint apparatus. The term 'low flashpoint' is a flashpoint of less than 60˚C. The flash points of common NATO fuels are given in STANAG 1135 *Interchangeability of Fuels, Lubricants and Associated Products Used by Armed Forces of the North Atlantic Treaty Nations, Edition 5*. The flashpoint of other common products is defined in the IMDG Code.
Foreseeable damage	See Damage.
Foreseeable Operating Conditions	Conditions in which the ship can be foreseen to operate in an intact, degraded, aged and/or damaged state in accordance with Regulation 1a paragraphs 4.1 and 4.2, normally defined in the Concept of Operations Statement. Subject to Naval Administration approval, Foreseeable Operating Conditions will generally also be limited by the conscious imposition of an environmental or other operating restrictions (e.g. a sea state/ speed restriction, a restriction on navigating sea ice, limiting the number of persons that may be embarked, specification of the ship life, reversionary modes and breakdown drills etc).
Full Load Displacement	The displacement of the ship when the ship is in all respects complete, and is fully loaded with full complement, stores, fuel, water and payload.
Full Load Draught	The draught amidships at the Full Load Displacement.
High Speed Craft	A craft capable of a maximum speed, in metres per second (m/s), equal to or exceeding (3.7 x Displacement^0.1667) where the displacement in cubic metres corresponds to the design waterline.
In-service	A ship is in-service at all times after delivery unless: a. it is in for repairs or lay-up (either at anchor or in port); b. it is in for conversion; c. it is declared not in service by the Naval Administration.
Inspection (See also, Survey)	The examination of a ship, equipment or system to ascertain compliance or otherwise against a defined specification, standard or drawing.
International voyage	A voyage from a country to a port outside such country, or conversely. It also includes any voyage into international waters.

Length Between Perpendiculars	That length measured between perpendiculars taken at the extremities of the Full Load Displacement. For High Speed Craft, it is the overall length of the underwater watertight envelope of the rigid hull, excluding appendages, at or below the design waterline in the displacement mode with no lift or propulsion machinery active.
Length Overall	That distance measured parallel to the waterline at the Full Load Displacement from the fore side of the stem to the after side of the stern or transom.
Lightship Displacement, or Lightweight	The displacement of the ship without any complement, stores, fuel, water or payload.
Lightweight	See Lightship Displacement.
Machinery Spaces	Those machinery spaces of Category A and other spaces containing propulsion machinery, boilers, oil fuel units, steam and internal combustion engines, generators and major electrical machinery, oil filling stations, oil transfer and handling equipment, refrigerating, stabilising, ventilation and air conditioning machinery, and similar spaces, and trunks to such spaces. Also included are steering gear spaces and other spaces containing hydraulic power equipment with an aggregate power rating of more than 110 kW and which use flammable hydraulic fluids.
Machinery Spaces of Category A	Those spaces and trunks to such spaces which contain either: a. internal combustion machinery used for main propulsion; b. internal combustion machinery used for purposes other than main propulsion where such machinery has in the aggregate a total power output of not less than 375 kW; c. any oil-fired boiler or oil fuel unit, or any oil-fired equipment other than boilers, such as inert gas generators, incinerators, pyrolysis units, gasification equipment etc; or d. gas turbines
Mal-operation	The faulty or incorrect operation of a device, process or system.
Main sub-division compartment	An enclosed compartment into which the main hull of the ship is divided so as to preserve the maximum amount of buoyancy following damage consistent with the convenient working of the ship. Main subdivision compartments are: a. weathertight; b. watertight to the point beyond which the ship will be lost as defined in the stability standard; c. able to provide structural fire protection; d. smoke tight; e. gas tight if so determined by the Naval Administration.
Memorandum Item	A record within the survey records of the ship, which documents: a. an unusual feature which should be recorded for future reference; or b. that there is a non-compliance with the relevant rules, standards, criteria or convention but the arrangement has been justified as fully equivalent to the intent of the Standard in accordance with Regulation 5.

Naval Administration	The Department of Government of the State responsible for providing safety regulation for naval ships. The Naval Administration may be assisted or supported by other government departments or agencies who, by mutual agreement of the Naval Administration and the department or agency concerned, have agreed to enact this Code for specified ships of that department or agency.
Naval ship	A ship which the Naval Administration has determined shall comply with these regulations. Generally, a naval ship is a ship: a. belonging to or operated by the armed forces, coastguard or other protection and security department or agency of a State, and b. not operated for commercial purposes.
New ship	A ship, the keel of which is laid or which is at a similar stage of construction on or after the date defined by the Naval Administration.
Non-crew	See Persons Onboard.
Owner, or Duty Holder	The organisation charged as the authority with responsibility for ship safety. This is normally the nominated Department of Government of the State or industry supplier. Noting that this responsibility may be delegated to a number of organisations, in which case a nominated lead is to be identified.
Passengers and other embarked persons	See Persons Onboard.
Persons Onboard	Persons shall fall into one of two categories: a. Crew members. Persons carried on board the ship to provide navigation and maintenance of the ship, operation and maintenance of its machinery and systems (including weapon and radio-communication systems), and arrangements essential for propulsion and safe navigation or to provide services for other embarked persons. Crew members are expected to be well-disciplined and able-bodied, and have an excellent knowledge of the layout of the ship and its safety equipment; b. Non-crew. Includes embarked forces, special personnel, wounded personnel, and passengers for whom permanent accommodation is provided on board. i. Embarked forces. Persons who are not members of the crew who are carried on board in connection with the special purpose of the ship. Embarked forces are expected to be very fit, well-disciplined and able-bodied; ii. Special personnel. Persons who are not members of the crew who are carried on board in connection with the special purpose of the ship or the special work being carried out aboard the ship. Special personnel (which may include pilots and air crew of organic aircraft, scientific staff, trials personnel and equipment engineers, surveyors, or persons under training) are expected to be disciplined and able-bodied, and have a fair knowledge of the layout of the ship and its safety equipment; iii. Wounded Personnel. Injured persons carried onboard as part of the planned function of the ship. Note: This Code make no specific provision for unplanned Wounded Personnel and it is the responsibility of the Naval Administration to determine the need for such provision and be satisfied that the arrangements are adequate.

	iv. Passengers and other embarked persons. Persons embarked who are not employed or engaged in any capacity on board the ship and who do not fall into any of the other Categories. Passengers and other embarked persons may include visiting dignitaries, and families. Note: Unless specifically stated otherwise, this Code make no specific provision for passengers and other embarked persons, and it is the responsibility of the Naval Administration to determine the need for such provision and be satisfied that the arrangements are adequate. v. Persons carried in an emergency. For the purposes of rescuing persons in order to avoid a threat to their safety the Naval Administration may permit the carriage of a larger number of persons than is otherwise permitted. Note: Where the ship's primary role includes carriage of people in an emergency then those people should be treated as passengers.
Persons carried in an emergency	See Persons Onboard.
Place of refuge	Any naturally or artificially sheltered area which may be used as a shelter by a ship under conditions likely to endanger its safety.
Planned Maintenance System	A paper and / or software-based system which allows ship owners or operators to carry out maintenance in intervals according to manufacturers and relevant rules and regulations.
Recognised Organisation	An organisation authorised to undertake certain activities on behalf of the Naval Administration.
Ship	A generic term which includes "ship", "vessel", "craft", "cutter" and "boat".
Space	Any other area of a ship that is not a main sub-division compartment or a compartment.
Special personnel	See Persons Onboard.
Standard or Standards	Includes rules, standards, specification, drawings, criteria and convention against which the design, construction, maintenance and procedures are assessed.
Submergence Limit	That limit approved by the Naval Administration in accordance with the agreed stability standard up to which the main subdivision boundaries are to be watertight and which determines where equipment and systems for essential safety functions may be located. Note: This may be referred to as the margin line or the V-line and may lead to the designation of a bulkhead deck (the uppermost deck up to which the transverse watertight bulkheads are carried) or a damage control deck (the deck, or combination of linked decks, on which damage control operations are co-ordinated).
Survey (See also, Inspection)	The examination of the design and/or material state of a ship, equipment or system to ascertain whether it is in compliance or otherwise with: a. the intent of a defined specification, standard or drawing, or b. the intended duties of the ship, system or equipment. Note: A survey is said to be complete when the deficiencies or other departures have been rectified or justified as adequate.
Special Functions	Special Functions are specific parts of a ship's role etc. For each Special Function there are additional regulations within the Code. The Special Functions that exist are: a. Bulk Fuel Carriage – where fuel comprises more than 50% (by weight) of the ship's displacement when fully loaded and where the flash point(s) of the fuel(s) exceeds 60°C Note: The Code is not applicable to ships that carry substantial quantities of fuel with a flash point less than 60°C. Small quantities can be carried in accordance with Chapter VI, Regulation 14.

	Note: Fuel includes all oil fuel – ship's fuel, aviation fuel and cargo fuel.
Wounded Personnel	See Persons Onboard.
Zone	One or more main sub-division compartments grouped for the purposes of damage control in accordance with a definition determined by the Naval Administration.

International Maritime Organization (IMO) Documents

Abbreviation	Title	Resolution No. (if applicable)	Amendments incorporated into or reviewed and applicable to ANEP-77	Amendments under review for ANEP-77
HSC Code (2000 HSC Code)	International Code of Safety for High-Speed Craft, 2000.	MSC.97(73)	Amended by MSC.260(84),	Amended by MSC.222(82), MSC.271(85)
IMDG Code	Adoption of the International Maritime Dangerous Goods (IMDG) Code	MSC.122(75)	No Amendments	
MARPOL (Ref at Annex A)	International Convention for Prevention of Pollution from Ships, Consolidated Edition 2011	-	Amendments not under review Note: ANEP-77 does not cover MARPOL requirements	
SOLAS	International Convention for the Safety of Life at Sea, Consolidated Edition 2004	-	Amendments from 2007 onwards: MSC.256(84) MSC.269(85) MSC.290(87)	Amendments from 2007 onwards: MSC.239(83) MSC.269(83) MSC.257(84) MSC.258(84) MSC.282(86) MSC.283(86) MSC.291(87) MSC.308(88) MSC.309(88) MSC.317(89)

Regulation 3 Exceptions

1 This Code, unless expressly provided otherwise, does not apply to:

1.1 Ships not exempt from SOLAS by the Flag State Administration.

1.2 Ships not operated by or on behalf of the navy, coastguard or other government protection and security department or agency of a State.

1.3 Ships which are operated for both commercial and naval purposes while engaged for commercial purposes.

1.4 Ships where the Naval Administration has accepted an alternative regulatory regime as offering an equivalent level of safety.

Regulation 4 Exemptions

1 A ship which is not normally engaged on international voyages but which, in exceptional circumstances, is required to undertake a single international voyage may be exempted by the Naval Administration from any of the requirements of this Code provided that it complies with safety requirements which are adequate in the opinion of the Naval Administration for the voyage which is to be undertaken by the ship.

2 The Naval Administration may exempt any ship which embodies features of a novel kind from any of the provisions of this Code the application of which might seriously impede research into the development of such features and their incorporation in ships engaged on international voyages. Any such ship shall, however, comply with safety requirements which, in the opinion of that Naval Administration, are adequate for the service for which it is intended and are such as to ensure the overall safety of the ship and which are acceptable to the Governments of the States to be visited by the ship. The Naval Administration which allows such exemption is encouraged to share the particulars and reasons with other Naval Administrations for their information.

3 Where the ship is engaged in a near-coastal voyage or other limited area of operation, the Naval Administration may exempt a ship from complying with the requirements of this Code provided that it complies with safety arrangements which are appropriate for the area of operation.

Regulation 5 Equivalents

1 Where this Code requires that a particular structure, fitting, material, appliance or apparatus, or type thereof, shall be fitted or carried in a ship, or that any particular provision shall be made, the Naval Administration may allow any other structure, fitting, material, appliance or apparatus, or type thereof, to be fitted or carried, or any other provision to be made in that ship, if it is satisfied by trial thereof or otherwise that such structure, fitting, material, appliance or apparatus, or type thereof, or provision, is at least as effective as that required by this Code.

2 A Naval Administration which so allows, in substitution, a structure, fitting, material, appliance or apparatus, or type thereof, or provision, is encouraged to share the particulars and reasons with other navies applying the Code .

3 Each Naval Administration undertakes to supply other navies applying the Code with its national interpretations of this Code.

4 Designs and arrangements may deviate from the solutions set out in Tier 4 of the Code, provided that the design and arrangements meet the goals and performance requirements for the regulations of the chapter.

Note: Some Naval Administrations may not accept the alternative justification without prior agreement that prescriptive solutions are unachievable.

5 When designs or arrangements deviate from the solutions of this code, engineering analysis, evaluation and approval of the alternative design and arrangements shall be carried out in accordance with this regulation.

6 Engineering analysis

6.1 The engineering analysis shall be prepared and submitted to the Naval Administration, based on the guidelines developed by the IMO or other standard agreed by the Naval Administration. The analysis shall include, as a minimum, the following elements:

6.1.1 determination of the ship type, systems, equipments and space(s) concerned;

6.1.2 identification of solution(s) with which the ship will not comply;

6.1.3 identification of the hazards associated with the ship, systems, equipments and space(s) concerned;

6.1.4 determination of the required safety performance criteria for the ship, systems, equipments or the space(s) concerned addressed by the solution(s) in particular:

6.1.4.1 performance criteria shall be based on the safety objectives and on the functional requirements of the appropriate chapter;

6.1.4.2 performance criteria shall provide a degree of safety not less than that achieved by using the solutions;

6.1.4.3 performance criteria shall be quantifiable and measurable;

6.1.5 detailed description of the alternative design and arrangements, including a list of the assumptions used in the design and any proposed operational restrictions or conditions;

6.1.6 technical justification demonstrating that the alternative design and arrangements meet the required safety performance requirements and criteria.

Note: For assessments associated with Chapter VI refer to the Guidelines on alternative design and arrangements for fire safety (IMO MSC/Circ.1002).

7 Evaluation of the alternative design and arrangements

7.1 The engineering analysis required in paragraph 6 shall be evaluated and approved by the Naval Administration taking into account any guidelines developed by the IMO or other standard agreed by the Naval Administration.

7.2 A copy of the documentation, as approved by the Naval Administration, indicating that the alternative design and arrangements comply with this regulation shall be carried on board the ship.

8 Information

8.1 The Naval Administration shall retain records and pertinent information concerning alternative design and arrangements approved by them.

9 Re-evaluation due to change of conditions

9.1 If the assumptions and operational restrictions that were stipulated in the alternative design and arrangements are changed, the engineering analysis shall be carried out under the changed condition and shall be approved by the Naval Administration.

PART B SURVEYS AND CERTIFICATES

Regulation 6 Inspection and Survey

Note: Refer to the definitions for inspection and survey in Regulation 2.

1 The inspection and survey of ships, so far as regards the enforcement of the provisions of this Code and the granting of exemptions therefrom, shall be carried out by officers of the Naval Administration. The Naval Administration may, however, entrust the inspections and surveys either to surveyors nominated for the purpose or to organisations recognised by it.

2 A Naval Administration nominating surveyors or recognising organisations to conduct inspections and surveys as set forth in paragraph 1 shall formally empower any nominated surveyor or recognised organisation to the extent considered appropriate. The Naval Administration is encouraged to share with other Naval Administrations the specific responsibilities and conditions of the authority delegated to nominated surveyors or recognised organisations.

3 Organisations that are recognised by the Naval Administration – Recognised Organisations – shall be authorised using the form of words suggested in Annex C to this Chapter. Organisations shall only be authorised as Recognised Organisations after assessment by the Naval Administration.

4 Organisations conducting inspections and surveys as set forth in paragraph 1 shall be formally engaged as a Recognised Organisation. Generally the responsibility for their engagement rests with the Owner.

5 When a nominated surveyor or Recognised Organisation determines that the condition of the ship or its equipment does not correspond substantially with the particulars of the certificate or is such that the ship is not fit to proceed to sea without danger to the ship, or embarked persons, such surveyor or organisation shall immediately notify the Naval Administration who shall require that immediate corrective action is taken.

6 In every case, the Naval Administration shall fully guarantee the completeness and efficiency of the inspection and survey, and shall undertake to ensure the necessary arrangements to satisfy this obligation.

Regulation 7 Not Used

Regulation 8 Surveys of Naval Ships

Note: Special survey requirements for Ships with Bulk Fuel Carriage are in Chapter II.

1 The purpose of a survey is to provide assurance that the ship complies in all respects with the provisions of this Code and remains compliant throughout its life.

2 Surveys shall be conducted at a periodicity appropriate to the design, construction, material state and usage of the ship at intervals aligned with those required for merchant shipping regulated by international convention unless determined otherwise by the Naval Administration. In the event that the Naval Administration agrees alternative arrangements for the periodicity for a specific ship, the Naval Administration is encouraged to share the particulars and reasons with other Naval Administrations for their information.

3 International convention survey periodicity generally follows the following pattern for merchant ships:

3.1 an initial survey before the ship is put in service;

3.2 a renewal survey at intervals specified by the Administration but not exceeding 5 years;

3.3 a periodical survey at the second or third anniversary date;

3.4 an annual survey.

4 Renewal survey intervals are often 6 years on naval ships.

5 All surveys shall normally take place within plus or minus three months of the anniversary date.

6 An additional survey either general or partial, according to the circumstances, shall be made after a repair resulting from investigations prescribed in Regulation 11 of this chapter, or whenever any important repairs or renewals are made. The survey shall be such as to ensure that the necessary repairs or renewals have been effectively made, that the material and workmanship of such repairs or renewals are in all respects satisfactory, and that the ship complies in all respects with the provisions of this Code.

7 The surveys referred to in paragraph 3 shall be carried out as follows:

7.1 the initial survey shall include an appraisal:

7.1.1 of the purposes and mode of operation(s) which is to include:

7.1.1.1 use appropriate to the Ship Type;

7.1.1.2 use as amplified in the Concept of Operations Statement;

7.1.2 of the design assumptions made;

7.1.3 of the material state on completion of build;

7.1.4 of the limitations, if any, proposed in relation to the loadings, environment, speed and manoeuvrability necessary to mitigate the risks associated with the ship's purposes and mode of operation(s);

7.1.5 of the proposed survey and maintenance philosophy and schedules.

7.2 the initial survey shall include a complete inspection of the structure, external and internal watertight integrity equipment, fittings and closing devices, scantlings, materials, main and auxiliary machinery (including the ship's outer bottom), boilers and other pressure vessels, lifts, ramps, gates and lifting appliances, steering gear and associated control systems, electrical installations and systems, magazine and other storage and handling arrangements for explosives, fire safety systems and appliances, escape, evacuation and life-saving appliances and arrangements, radio installations (including those used in life-saving appliances), the ship-borne navigational equipment, means of embarkation for pilots, other systems and equipment required under Regulation 1a paragraph 4 of this chapter and other equipment to which this Code refers to provide assurance that they comply with the requirements, are in satisfactory condition and are fit for the service for which the ship is intended;

7.3 the initial survey shall include an appraisal of the operational guidance and limitations relevant to the ship and its equipment referred to in paragraphs 7.1 and 7.2, for compliance with this Code;

7.4 the renewal surveys shall include an inspection of the ship, its equipment and operator guidance and limitations referred to in paragraphs 7.1, 7.2 and 7.3 to provide assurance of compliance with the relevant requirements of the relevant regulations of this Code and that the ship is in a satisfactory condition and is fit for the service for which it is intended;

7.5 the periodical surveys shall include an inspection of the ship and its equipment referred to in paragraph 7.2 to provide assurance that the ship and its equipment comply with the relevant requirements of the relevant regulations, are in a satisfactory condition and are fit for the service for which the ship is intended. Where modifications have been made, the periodical survey shall include a review of the items referred to in 7.1 and 7.3;

7.6 the annual surveys shall include a general inspection of the ship and its equipment referred to in paragraph 7.2 to provide assurance that the ship and its equipment comply with the relevant requirements of the relevant regulations, are in a satisfactory condition and are fit for the service for which the ship is intended. Where modifications have been made, the annual survey shall include a review of the items referred to in 7.1 and 7.3;

7.7 in all cases renewal, periodical and annual surveys shall be in accordance with, but not necessarily be limited to, the survey and maintenance schedules referred to in paragraph 7.1.5.

8 A system of record-keeping is to be implemented that enables all certificates and endorsements to certificates to be available to provide a body of evidence that the ship at all times meets the requirements of this Code.

Regulation 9 Not Used

Regulation 10 Not Used

Regulation 10a Survey of a Naval Ship to International Conventions and Regulations

1 Where adoption of international conventions is required and the ship is a government ship engaged for non-commercial purposes, the Naval Administration is to agree procedures with the Flag State Administration for handling inconsistencies between the requirements of this Code and the requirements of international convention and regulations.

Regulation 11 Maintenance of Ship and Equipment after Survey

1 The condition of the ship and its equipment shall be maintained to ensure that the ship in all respects will remain fit to proceed to sea without danger to the ship or embarked persons.

2 After any survey of the ship has been completed, no change shall be made in the structural arrangements, machinery, equipment and other items covered by the survey, without the approval of the Naval Administration.

3 Whenever an accident occurs to a ship or a defect is discovered, either of which affects the safety of the ship or the efficiency or completeness of its life-saving appliances or other equipment, the Commanding Officer, Owner or operator of the ship shall report at the earliest opportunity to the Naval Administration, the nominated surveyor or recognised organisation responsible for issuing the relevant certificate, who shall initiate investigations to determine whether a survey is necessary.

4 Procedures are to be established to ensure that the ship and its equipment are maintained in conformity with the provisions of the relevant rules and regulations. As part of these procedures it should be ensured that:

4.1 inspections and maintenance are held at appropriate intervals;

4.2 any defect is reported with its possible cause, if known;

4.3 appropriate corrective action is taken; and

4.4 records of these activities are maintained.

5 The inspections at paragraph 4.1 should be integrated in the ship's operational maintenance routine and included in the ship's Planned Maintenance System if applicable.

6 Equipment and technical systems, the sudden operational failure of which may result in hazardous situations, should be identified. Specific measures aimed at promoting the reliability of such equipment or systems should be integrated in the ship's operational maintenance routine and included in the ship's Planned Maintenance System. These measures should include the regular testing of stand-by arrangements and equipment or technical systems that are not in continuous use.

Regulation 12 Issue and Endorsement of Certificates

1 A certificate or certificates shall be issued to a naval ship after an initial or renewal survey which complies with the relevant requirements of this Code. The scope of each certificate shall be in accordance with requirements determined by the Naval Administration but shall at least embrace the scope defined in Regulation 8. Naval Administrations are encouraged to share the particulars and reasons for their certification arrangements with other Naval Administrations for their information.

2 Where relevant, the certificate(s) shall be supplemented by a Record of Equipment.

3 Following surveys required at intervals between renewal surveys by Regulation 8, the certificate is to be endorsed by the Naval Administration. Where endorsement is by a Recognised Organisation, the Recognised Organisation is to be the organisation that issued the initial or renewal certificate.

4 When an exemption is granted to a ship that is normally required to be in possession of a certificate in accordance with the provisions of the present regulations, and where an alternative safety management regime has been accepted as equivalent by the Naval Administration, a certificate called an Exemption Certificate shall be issued.

5 The certificates referred to in this regulation shall be issued or endorsed by the Naval Administration or their Recognised Organisation. In every case, the Naval Administration assumes full responsibility for the certificates.

Regulation 13 Not Used

Regulation 14 Duration and Validity of Certificates

1 Certificates shall be issued for a period specified by the Naval Administration in accordance with Regulation 8 of this chapter. An Exemption Certificate shall not be valid for longer than the period for which the certificate it replaces would have been valid, unless an alternative safety management regime is in place that has been approved by the Naval Administration.

2 The Naval Administration may extend the period of validity of the certificate but this extension shall be granted only for the purpose of allowing the ship to complete its immediate programme, and then only in cases where there appears proper and reasonable to do so. In such cases a “quick-look” survey focussed on issues relevant to the ship is normally to be undertaken.

Regulation 15 Forms of Certificates and Records of Equipment

1 The certificates and records of equipment issued in accordance with these regulations shall be drawn up in the form corresponding to the models given in Annex D to this Chapter. Alternative forms may be determined by the Naval Administration. The Naval Administration is encouraged to share the particulars with other Naval Administrations for their information.

2 If the language used is not a language used by NATO, the text shall include a translation into one of these languages.

Regulation 16 Availability of Certificates

1 The certificates or authenticated copies of the certificates shall be readily available on board for examination at all times.

Regulation 17 Not Used

Regulation 18 Qualification of Certificates

1 If in the course of a particular voyage a ship has on board a number of persons less than the total number stated in the Naval Ship Safety Certificate and is in consequence, in accordance with the provisions of the present regulations, free to carry a smaller number of lifesaving appliances than that stated in the certificate, an annex may be issued by the Naval Administration referred to in Regulation 12 of this chapter.

2 This annex shall state that in the circumstances there is no infringement of the provisions of the present regulations. It shall be annexed to the certificate and shall be substituted for it in so far as the lifesaving appliances are concerned. It shall be valid only for the particular voyage for which it is issued.

Regulation 19 Not Used

Regulation 20 Privileges

1 The privileges of this Code may not be claimed in favour of any ship unless it holds appropriate valid certificates.

PART C CASUALTIES

Regulation 21 Casualties and Other Incidents

1 Each Naval Administration is encouraged to conduct an investigation of any casualty occurring to any of its ships subject to the provisions of this Code when it judges that such an investigation may assist in determining what changes in the present regulations might be desirable.

2 Each Naval Administration is encouraged undertakes to supply other Naval Administrations with pertinent information concerning the findings of such investigations. No reports or recommendations of NATO based upon such information shall disclose the identity or nationality of the ships concerned or in any manner fix or imply responsibility upon any ship or person.

3 Each Naval Administration is encouraged to supply other Naval Administrations with pertinent information concerning the findings of such investigations.

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CHAPTER I ANNEX A

Concept of Operations Statement

CHAPTER I ANNEX A: CONCEPT OF OPERATIONS STATEMENT

<Official seal of the Naval Administration>	**CONCEPT OF OPERATIONS STATEMENT**	<If appropriate, official seal of the Recognised Organisation>

Particulars Of The Ship

Ship Name	*(pennant number and name)*
Class	*(name)*
Date last updated	*(date)*

The Owner

defines the ship details, role and extreme threat survivability and agrees the foreseeable damage survivability, maintenance philosophy and environmental conditions.

Signed		
Name		
Position		
Address		
Date of Signature		Official Seal

The Naval Administration

agrees the ship details, role and extreme threat survivability and defines the foreseeable damage survivability, maintenance philosophy and environmental conditions.

Signed	
Name	
Position	
Address	
Date of Signature	

Official Seal

Primary and secondary roles

Primary Roles	*(high level overview of primary role in sufficient detail for standards to be selected and the design completed)*

Secondary Roles	*(high level overview of secondary role in sufficient detail for standards to be selected and the design completed)*
Special Functions	Bulk Fuel Carriage ☐ *(Tick the relevant boxes)*

Ship Attributes

Ship Design Life	*(years)*
Length Overall	*(m)*
Length between perpendiculars	*(m)*
Breadth Overall	*(m)*
Lightship Displacement	*(te)*
Full load Displacement	*(te)*
Design Draught	*(m)*
Full Load Draught	*(m)*
Scantling Draught	*(m)*
Speed (maximum)	*(knots)*
Cruise speed	*(knots)*
Range at cruise	*(nautical miles)*

Endurance	*(mission length in days)*
Area of Operation	*(restricted by range to refuge {links time, speed, sea state}, restricted to sheltered waters)*
Cargo / Payload	Aircraft: Landing Craft: Vehicles: Weapon Systems Installed: Munitions: Fluids in tanks: Stores: Other: *(weights, volumes and locations)*
Emergency Loading	*(weights, volumes and locations)*

Embarked personnel	Crew: Embarked forces: Special personnel: Wounded personnel allowance: Passenger and other embarked persons: Persons carried in an emergency: *(numbers by type, persons carried in an emergency is an estimated practical limit)*
Accommodation	*(space, access, facilities)*

Survivability

(Scenarios to be defined for foreseeable damage survivability and if applicable extreme threat survivability)

Scenario reference number	Damage Extent DCA Limited DCB Moderate DCC Severe	Damage Location DLI Internal DLSI Specific Internal DLE External DLS Side DLOB Outer Bottom	Vulnerability VB Basic VM Moderate VN Naval	Post-damage Capability PC1 Safe Abandonment PC2 Float and Move PC3 Operational	Recovery Philosophy RPB Basic RPI Intermediate RPA Advanced	Supplementary Notes Relevant additional notes for clarification
1						
2						
3						

4						
..						
N						

Additional notes	*(CBRN requirements, damage control philosophy)*

Environment

A - Meteorology and climatology (above surface)	
Wind	*(maximum Beaufort Force or speed for operation and for survival)*
Precipitation	*(if specifically required, e.g. Tropical Storm)*
Air temperature – high	*(specify e.g. Maximum mean daily max)*
Air temperature – low	*(specify e.g. Minimum mean daily min)*
Air humidity	*(if not 100% relative humidity at all air temps)*
Visibility	*(if specifically required, e.g. night operations)*
Atmospheric pressure	*(if specifically required)*

Solar radiation	*(if specifically required, e.g. equatorial)*
Electro-magnetic discharge	*(if specifically required)*
Air quality	*(if specifically required, e.g. operations in coastal waters near deserts)*
Flora and fauna	*(if specifically required, e.g. in waters of know high activity)*
B - Sea surface (interface)	
Waves	*(Sea State, significant wave height, maximum wave height)*
Waves - other situations	*(if specifically required, e.g. operations in surf, tidal bore)*
Tide	*(range (height) and maximum speed (relevant to berthing))*
Green seas and spray	*(area affected, frequency)*
Ice navigation	*(if specifically required, e.g. icebreaking)*
Sea surface quality (floating objects, pollution)	*(if specifically required, e.g. operations in estuaries)*
Ship motions	Maximum from equilibrium / Period Roll: degrees / seconds Pitch: degrees / seconds Yaw: degrees / seconds Heave: metres / seconds Surge: metres / seconds Sway: metres / seconds *(design values for deviations from the static position)*
Vibration	*(motion induced and wave induced)*
C - Bathymetry and oceanography (below surface)	
Pressure (depth)	*(for specific features in head of sea water)*
Ocean currents	*(if specifically required, e.g. drift)*

Water quality	*(if specifically required, e.g. operations in estuaries)*
Sea temperature	
Flora and fauna	*(if specifically required, e.g. in waters of know high activity)*
D – Geotechnical	
Bottom/Ground conditions	*(if specifically required)*
Banks (inc. canals)	*(dimensions, bottom conditions if specifically required)*
E – Human Caused Environment	
Berthing	*(maximum speed of contact)*
Beaching	*(bottom conditions if specifically required, e.g. landing craft)*
Towing and salvage	*(bottom conditions if specifically required, e.g. landing craft)*
Acoustic fields	*(if specifically required)*
Electro-magnetic fields	*(if specifically required)*
Launching	*(assumptions for build)*
Noise and vibration	*(if additional to statutory limits for accommodation and working spaces)*

Operating philosophy

Naval or civil manning	*(type and level of expertise, e.g. training craft)*
Restrictions and limitations	Cargo restrictions: Loading restrictions: Structural limitations: Other: *(including all restrictions and limitations that are acceptable under the role of the ship)*
Role Specific Operations	*(requirements relating to the specific role of the vessel, e.g. cargo handling, requirement for low flashpoint fuels inc their stowage etc)*
Aircraft Operations	*(embarked, visiting etc)*
Boat Operations	*(launching, recovery, welldock, requirement for low flashpoint fuels inc their stowage etc)*

Replenishment at Sea (RAS)	*(Requirement for liquid / solid replenishment / VERTREP, supply / receive etc)*
Anchoring and Mooring	*(Frequency of use, limitations due to sea conditions,)*
Towing (other than for emergencies)	*(Requirement for routine towing / being towed, operational scenarios etc)*
CBRN (NBCD) Operation	*(Citadel, Machinery requirements, Pre-wet etc)*
Management of hull strength	*(approach to management of structure, e.g. survey regime, loading tool etc)*
Buoyancy and stability	*(approach to management of stability, e.g. stability information book approval, loading tool, damage control philosophy)*

Machinery and Electrical systems	Operating Philosophy: *(modes of operation {inc where equipment operated from},redundancy, emergency means of propulsion & generation, acceptable degradation in emergency conditions {inc essential safety functions}, frequency of use, unattended machinery spaces, watch patterns, operating envelopes, profiles {% time in particular operating conditions})*
	Equipment: Propulsion system: Manoeuvring system: Other machinery systems: Electrical generation system: HV power supply & distribution: LV power supply & distribution: Control systems: *(Description of major equipment and systems, quantity, CBRN operation etc)*

Fire safety	Cargo Payload (Ch VI, Reg. 13) Aircraft Landing Craft (Dock) Boats (Davit) Vehicles Munitions Fluids in tanks Weapon systems Fuel for recreational use Operating Activities (Ch VI, Reg. 3) RAS Anchoring mooring Towing CBRN (Ch VI, Reg 6, Para 14.6) Aircraft refuelling Other Area of Operation Environment Embarked Persons Type A Persons carried in emergency Fire parties Survivability Scenario (Ch VI, Reg 9, Para 15 and 16) Situational Awareness Fire detection equipment (Ch VI, Reg 7) Management Damage control organisation Training (Ch VI, Reg 12, Para 1) Survey and Maintenance Containment

	Prosecution Fire extinguishing equipment Damage control equipment Recovery (Ch VI, Reg 10, Para 1 and 2) Damage extent (fire) Re-configuration and redundancy (Ch VI, Reg. 9, Para. 16) Post damage capability External Assistance Shore Connection Ship-to-Ship Connection Escape and Evacuation Escape routes to be protected (Ch VI, Reg 8, Para 9)
Escape, evacuation, rescue	*(pertinent aspects including issue of personnel equipment, communication, mustering)*
Communications	Sea Area (A1, A2, A3 or A4): Equipment; it's location and operational use: GMDSS (Ch VIII Regs 2-5) - Maritime Safety Information Service (Ch VIII, Reg 2, Para 3.5) - Method to ensure availability (Ch VIII, Reg 3) - Special features, e.g. inhibit transmission (Ch VIII, Reg 14, Para 5) Internal Comms (Ch VIII Reg 6) Main Broadcast system (Ch VIII, Reg 7) Portable Comms (Ch VIII Reg 8) Survival Craft Radio Equipment (Ch VIII Reg 9) Sea-Air Radiocommunications (Ch VIII Reg 10) Other Communications Systems Note: Military communications are not regulated by the Naval Ship Code

	Personnel Certification (maintenance & operation) & Records ((Ch VIII, Reg 3, Para 8.1 & Ch VIII, Reg 12-13) Reserve sources of energy (Ch VIII, Reg 4, Para 9) Periodic Compliance Regime (Ch VIII, Reg 15) GMDSS reliance on military communications: *(Sea Area, GMDSS availability, description of equipment including location and it's purpose)*
Navigation	*(requirements in additional to statutory requirements)*
Carriage of dangerous goods	*(requirements in addition to statutory requirements e.g. carriage as cargo / for ship's use, embarking at sea, stowage, movement on board, breaking out)*

Survey, Maintenance and Disposal philosophy

Survey philosophy	*(overview of survey and inspection philosophy)*
Survey schedule	*(survey cycle and scope of survey if different from that laid down in the present Naval Ship Code, in-water survey etc)*
Maintenance philosophy	*(overview of maintenance philosophy)*
Maintenance schedule	*(maintenance cycles and depth of planned maintenance)*

Disposal philosophy	*(overview of disposal philosophy)*

CHAPTER I ANNEX B

Standards Plan

CHAPTER I ANNEX B: STANDARDS PLAN

<Official seal of the Naval Administration>	**STANDARDS PLAN**	<If appropriate, official seal of the Recognised Organisation>

Particulars Of The Ship

Ship Name	*(pennant number and name)*
Class	*(name)*
Date last updated	*(date)*

The Owner

agrees the Ship Type and principal standards.

Signed	
Name	
Position	
Address	
Date of Signature	

Official Seal

The Naval Administration

defines the Ship Type and principal standards.

Signed	
Name	
Position	
Address	
Date of Signature	

Official Seal

Ship Type, principal standards and authorities

Ship Type	A, B, C Ship not constructed from steel *(delete as applicable referring to Chapter VI Regulation 1)*				
Ship Description	*(e.g. Aircraft carrier, Frigate, Patrol craft)*				
NSC Chapter	Regulation	Principal standards to be applied in support of NSC Performance Requirements and Solutions[1]	Naval Administration	Recognised Organisation	Recognised Organisation delegation *(Full, Partial, Limited)*
Chapter II **Structure**	Regulation 0 Goal				
	Regulation 1 General				
	Regulation 2 Concept of Operations Statement				
	Regulation 3 Structural Design				
	Regulation 4 Construction				
	Regulation 5 Ships in Operation				

	Regulation 6 Disposal				
	Regulation 7 Materials				
	Regulation 8 Coatings				
	Regulation 9 Special Requirements for Ships with a Function of Bulk Fuel Carriage				
Chapter III **Buoyancy and Stability**	Regulation 0 Goal				
	Regulation 1 General				
	Regulation 2 Watertight Integrity				
	Regulation 3 Reserve of Buoyancy				
	Regulation 4 Reserve of Stability				
	Regulation 5 Controllability				
	Regulation 6 Safety of Embarked Persons				
	Regulation 7 Preservation of Life				
	Regulation 8 Provision of Operational Information				
Chapter IV **Engineering Systems**	Regulation 0 Goal				
	Regulation 1 General				
	Regulation 2 Concept of Operations Statement				
	Regulation 3 Provision of operational information				
	Regulation 4 Propulsion				
	Regulation 5 Manoeuvring				
	Regulation 6 Pressure and Piping Systems				
	Regulation 7 Ship Stabilising Systems				
	Regulation 8 Other essential safety functions				

	Regulation 9 Electrical Generation and power supplies				
	Regulation 10 Electrical Distribution and Equipment				
	Regulation 11 Lighting				
	Regulation 12 Electrical Protection Arrangements				
	Regulation 13 Machinery Control				
	Regulation 14 Alerts and safety systems				
	Regulation 15 Programmable Electronic Systems (PES)				
	Regulation 16 Systems Integration				
	Regulation 17 Human Element				
	Regulation 18 Hazardous Areas				
	Regulation 19 Replenishment At Sea (RAS)				
	Regulation 20 Anchoring and Mooring				
	Regulation 21 Towing Equipment				
	Regulation 22 Lifting Appliances				
	Regulation 23 Heating Ventilation and Air Conditioning (HVAC)				
	Regulation 24 Tanks				
	Regulation 25 Novel Arrangements				
Chapter V **NOT USED**					
Chapter VI **Fire Safety**	Regulation 0 Goal				
	Regulation 1 General				
	Regulation 2 Structural integrity				
	Regulation 3 Risk of ignition				

	Regulation 4 Fire growth potential				
	Regulation 5 Smoke generation and toxicity				
	Regulation 6 Control of smoke spread				
	Regulation 7 Detection and alarm				
	Regulation 8 Containment of fire				
	Regulation 9 Fire fighting				
	Regulation 10 Maintain capability				
	Regulation 11 Not used				
	Regulation 12 Provision of Operational Information				
	Regulation 13 Special requirements				
	Regulation 14 Carriage of low flash point fuels in bulk				
Chapter VII **Escape, Evacuation and Rescue**	Regulation 0 Goal				
	Regulation 1 General				
	Regulation 2 Escape, Evacuation and Rescue Measures				
	Regulation 3 Escape and Evacuation Analysis and Demonstration				
	Regulation 4 Inspection and Maintenance				
	Regulation 5 Routine Escape, Evacuation and Rescue Procedures				
	Regulation 6 Escape, Evacuation and Rescue Emergency Procedures				
	Regulation 7 Training and Drills				

Regulation 8 Provision of Operational Information				
Regulation 9 Escape, Evacuation and Rescue Equipment Stowages				
Regulation 10 General Emergency Alarm System				
Regulation 11 Main Broadcast System				
Regulation 12 On board Two-Way Communication				
Regulation 13 External Communication Equipment				
Regulation 14 Power Supply to Escape, Evacuation and Rescue Systems				
Regulation 15 Lighting During Escape, Evacuation and Rescue Emergencies				
Regulation 16 Escape Routes and Escape Exits				
Regulation 17 Fixtures and Fittings on Escape Routes				
Regulation 18 Way Finding System				
Regulation 19 Muster Station				
Regulation 20 Emergency Escape Breathing Devices				
Regulation 21 Stretchers				
Regulation 22 Launching and Embarkation Arrangements				
Regulation 23 Not Used				
Regulation 24 Survival Craft				
Regulation 25 Life-Jackets				

	Regulation 26 Personal Thermal Protection Suits				
	Regulation 27 Rescue Arrangements				
Chapter VIII **Communications**	Regulation 0 Goal				
	Regulation 1 General				
	Regulation 2 GMDSS Equipment				
	Regulation 3 Ensuring Availability of GMDSS Equipment				
	Regulation 4 GMDSS Sources of Energy				
	Regulation 5 Position Updates				
	Regulation 6 Internal Communications				
	Regulation 7 Main Broadcast System				
	Regulation 8 Portable Radiocommunications				
	Regulation 9 Survival Craft Radio Equipment				
	Regulation 10 Sea-Air Radiocommunications				
	Regulation 11 Radio Personnel				
	Regulation 12 Radio Watches				
	Regulation 13 Radio Records				
	Regulation 14 Installation, Maintenance, Testing and Repairs				
	Regulation 15 Operational Audit and Compliance Validation				
Chapter IX **Navigation**	Regulation 0 Goal				
	Regulation 1 General				
	Regulation 2 Working Environment in Navigation Related Spaces				
	Regulation 3 Bridge Design and Arrangement				

	Regulation 4 Navigation Safety - Geospatial, Temporal & Environmental Awareness				
	Regulation 5 Operation & Control Systems				
	Regulation 6 Resilience and Continuous Availability				
	Regulation 7 Integrated Bridge				
	Regulation 8 Data Communication				
	Regulation 9 Collision Avoidance				
	Regulation 10 Training of Personnel				
	Regulation 11 Pilot Transfer Arrangements				
Chapter X **Dangerous Goods**	Regulation 0 Goal				
	Regulation 1 General				
	Regulation 2 Layout and Services				
	Regulation 3 Structural Protection				
	Regulation 4 Fire Protection				
	Regulation 5 Electrical Fittings				
	Regulation 6 Stowage and Handling				
	Regulation 7 Security				
	Regulation 8 Incident Reporting				
	Regulation 9 Training and Personnel Competence				
	Regulation 10 Use of Dangerous Goods				

	Regulation 11 Emergency Procedures				

Note

1. Where alternative design and arrangements have been assessed in accordance with Chapter I Regulation 5 this is to be noted in the principal standards column.

CHAPTER I ANNEX C

Model Words for the Authorisation of Recognised Organisations

CHAPTER I ANNEX C: MODEL WORDS FOR THE AUTHORISATION OF RECOGNISED ORGANISATIONS

1 This Appendix offers a model form of words for the authorisation of a Recognised Organisation by the Naval Administration in accordance with the provisions of Regulation 6.

2 Authorisation and the level of authorisation is only to be given to an organisation following an assessment by the Naval Administration which provides demonstrable evidence that the proposed Recognised Organisation's:

2.1 competence, expertise, procedures and infrastructure,

2.2 availability, selection and competent use of technical standards, and

2.3 business processes and corporate integrity are appropriate for the Ship Types and services for which the authorisation is granted.

3 It is recognised that the legal and administrative systems of the Naval Administration may require adaptation of the wording.

<Official seal of the Naval Administration>	**< NAVAL ADMINISTRATION >** **SCHEDULE OF AUTHORISATION**

Enclosure to Letter reference	
Dated	
Valid until	

The Naval Administration

Signed		
Name		
Qualifications		
Position		
Address		
Date of Signature		Official Seal

The Recognised Organisation

Signed		
Name		
Qualifications		
Position		
Address		
Date of Signature		Official Seal
Basis of the delegation	< Provide reference to the assessment report(s) in which the Recognised Organisation was assessed >	< Date >

Scope of delegation

1 To discharge specified duties of the Naval Administration in accordance with the provisions of the Naval Ship Code as enacted by <Naval Administration Regulations adopting the present Code> and all applicable amendments and any other relevant documentation issued by or on behalf of the Naval Administration for ships and vessels as authorised by the Naval Administration.

2 Limitations and exclusions:

2.1 submarines;

2.2 any ships or vessels which are powered by or engaged in the transport of fissile materials or materials that release ionising radiation of a type or quantity that may be a hazard without special handling precautions;

2.3 any ship or vessel upon which the safety of a ship or vessel specified in paragraph 2.2 above may directly depend for its safety;

2.4 any ship or vessel for which the Owner has not formally engaged the services of the Recognised Organisation;

2.5 any ship or vessel not listed in the Annex or Annexes to this Schedule;

2.6 any specific limitations defined for the ships or vessels listed in the Annex or Annexes to this Schedule;

2.7 any ship or vessel for which delegation has subsequently been withdrawn.

3 Authorisations (specified in the Annex or Annexes to this Schedule)

3.1 Limited Authorisation. The Recognised Organisation is authorised to undertake specified activities for a specified ship or vessel on a case-by-case authorisation basis (e.g. due to time constraints or geographical limitations). These activities will be generally limited to assessing compliance with the standards specified for the ship or vessel.

3.2 Partial Authorisation.

3.2.1 The Recognised Organisation is authorised:

3.2.1.1 to undertake activities to assess compliance with the standards specified for the ships or vessels as authorised by the Naval Administration;

3.2.1.2 where there is a discrepancy, assess and recommend equivalence to the intent of the aforesaid standards.

3.2.2 The Recognised Organisation is not authorised:

3.2.2.1 to determine (i.e. they can recommend but not accept/agree) equivalence for the purposes of Naval Administration certification;

3.2.2.2 to issue certificates on behalf of the Naval Administration.

3.2.3 Reports generated by the Recognised Organisation are to be passed to the Naval Administration who will use the information contained therein to determine whether the ship or vessel will be issued with a Naval Administration certificate.

3.3 Full Authorisation

3.3.1 The Recognised Organisation is authorised:

3.3.1.1 to undertake activities to assess compliance with the standards specified for the ships or vessels as authorised by the Naval Administration;

3.3.1.2 where there is a discrepancy, assess, recommend and determine equivalence to the intent of the aforesaid standards;

3.3.1.3 to issue Certificates on behalf of the Naval Administration.

3.3.2 Equivalence - and the justification of the equivalence - is to be documented and noted as a Memorandum Item to the Certificate. The Recognised Organisation is to report all cases of the determination of equivalence to the Naval Administration.

3.3.3 A non-compliance that cannot be justified as equivalent is to be raised as a Condition of Certification. The Recognised Organisation is to report all cases of non-compliance to the Naval Administration. Conditions of Certification are not normally to be raised when the ship is in a port and there is opportunity for adequate rectification or repair.

3.3.4 Where a non-compliance covered by a Condition of Certification is subsequently justified as equivalent, the Condition of Certification is to be reduced to a Memorandum Item.

3.3.5 Where the non-compliance is of a serious nature or is likely to become serious during the full term of the certificate, certification is to be refused or withdrawn. The Recognised Organisation is to report all cases of certificate refusal or certificate withdrawal to the Naval Administration immediately.

3.3.6 Where Full Authorisation is given, "certification" means undertaking the entire range of duties as authorised by the Naval Administration. The term "certification" or "certificate" includes issue of the Certificate, the Annex to the Certificate and, where required, the Supporting Statement to the Certificate.

Terms and conditions

4 Authorisation and the level of authorisation is based on an assessment of the Recognised Organisation's (a) competence, expertise, procedures and infrastructure,(b) availability, selection and competent use of technical standards, and (c) business processes and corporate integrity to ensure that they are appropriate for the Ship Types and services for which the authorisation is granted.

5 Authorisation is conditional upon written acceptance of the full requirements outlined in this schedule. Where a change and/or exception to the scope and/or terms and conditions is sought, this is to be formally agreed by the Naval Administration and the Recognised Organisation, and the schedule amended accordingly.

6 The Naval Administration shall have the right to inspect and audit the work, records, procedures and practices of the Recognised Organisation at any time.

7 The Naval Administration retains the unilateral right to overrule the Recognised Organisation at any time and revoke or amend any certificate issued by the Recognised Organisation with immediate effect at any time. In such an event, where the Recognised Organisation does not support the decision of the Naval Administration, the Recognised Organisation may record the Naval Administration's requirement as a Memorandum Item as follows: "In their letter <reference, date> the Naval Administration has ruled that <substance of the ruling>. All enquiries on this matter, which should be copied to the Recognised Organisation, are to be referred to the Naval Administration."

8 Modification or termination.

8.1 In exceptional circumstances the Naval Administration may modify or terminate the Recognised Organisation's delegation with immediate effect at any time. In all other circumstances, the delegation may be modified or terminated by either party with due notice being given. Six calendar months shall be deemed to be the minimum period for due notice;

8.2 If the delegation is modified or terminated, the Recognised Organisation shall retain all records, whether in hard or soft form, for use by the Naval Administration or another Recognised Organisation authorised by the Naval Administration to receive them, for a period of ten years beyond the effective date of the modification or termination.

9 Records and correspondence. The Recognised Organisation shall:

9.1 maintain all records and correspondence pertaining to their duties for a period of no less than ten years from the issue of any Certificate;

9.2 provide the Naval Administration or any other authority duly authorised to receive them with direct access to all records, plans, documents and reports of survey, whether held on paper or by electronic means, free of charge. "Free of charge" includes reasonable requests for the free supply of copies whether paper of electronic, but does not include the provision of hardware or telecommunication charges.

10 Records and correspondence. In addition to the provisions in the preceding paragraph, where the Recognised Organisation has Full Authorisation, they shall:

10.1 provide the Naval Administration or any other authority authorised to receive them with a quarterly report of the certification state of all ships and vessels under the Recognised Organisation's authority;

10.2 if instructed by the Naval Administration, the Recognised Organisation shall transfer all records to the Naval Administration or any other authority authorised to receive them at a cost commensurate with the work involved. The transfer shall proceed forthwith on instruction from the Naval Administration even if by then the cost has not been agreed.

11 Information and Liaison. The Recognised Organisation and the Naval Administration recognising the importance of technical liaison, shall provide each other with all their relevant technical reports, instructions, standards and procedures free of charge and in reasonably sufficient quantity to enable the other organisation to carry out its work effectively. Guidance on what is to be made available is indicated in the table below.

12 Insofar as the terms of engagement at paragraph 2.4 permit, the Recognised Organisation shall endeavour to provide continuity of service between periodic surveys and across the interface between surveys for associated Naval Administration certificates.

13 Surveyors. All work within the scope of this agreement (including design appraisal and surveys) is to be undertaken by the Recognised Organisation's exclusive surveyors. An exclusive surveyor is a surveyor who is employed exclusively in the service of the Recognised Organisation.

14 Where the Recognised Organisation wishes to use non-exclusive surveyors, the Naval Administration shall recognise, on a case by case basis, exceptions to the use of exclusive surveyors. Agreement, which will be on the basis of competence and the assurance of a common high standard of training and qualification, is to be reached in writing prior to the use of non-exclusive surveyors.

15 Remuneration for all services supplied to an Owner in support of specific ships, vessels or Ship Types shall not be charged to the Naval Administration. Other charges shall only be accepted by the Naval Administration if agreed in writing before any charges are incurred.

16 The Recognised Organisation shall avoid undertaking activities which may result in a conflict of interest. Any such conflicts of interest or potential conflicts of interest are to be reported to the Naval Administration.

17 Confidentiality. The Naval Administration and the Recognised Organisation shall be bound by the normal national security procedures governing protection of confidential or protectively marked information.

Information (subject to being in existence)	**Available to Naval Administration**	**Available to Recognised Organisation ***
Recognised Organisation's documents		
Standards, regulations and guidelines (F)	1	-
Instructions to surveyors and survey guidelines (F, P)	1	-
Procedures (F, P)	1	-
Naval Administration's documents		
Standards (design, build, survey and maintenance) (F, P, L)	-	1
Regulations (F, P,L)	-	7
Procedures (F, P, L)	-	1
Notices (F, P, L)	-	7
Ship-related information		
Approved drawings (F)	1	1 (if held)
First entry reports/design disclosure documents (F)	1	1
Survey reports (F, P, L)	F = 1. P, L = 7	1
Ship certification status reports and information (F)	7	1
Copies of certificates (F)	7	1
Other information		
Annual reports (F, P)	1	1

Notes:

F = Full authorisation, P = Partial authorisation, L = Limited authorisation.

* May exceptionally be withheld (e.g. on security grounds or if subject to release limitations due to commercial restrictions).

1. On request.

7. Automatically available.

Liability

18 If a liability is finally and definitively imposed on the <Naval Administration or national government department> for loss or damage which is proved to have been caused by a wilful omission or act within the scope of this agreement by the Recognised Organisation, its bodies, officers, employees or others who act on behalf of the Recognised Organisation, the <Naval Administration or national government department> is entitled to full compensation from the Recognised Organisation.

19 If a liability is finally and definitively imposed on the <Naval Administration or national government department> for loss or damage which is proved to have been caused by a negligent act or negligent omission within the scope of this agreement by the Recognised Organisation, its bodies, officers, employees or others who act on behalf of the Recognised Organisation, the <Naval Administration or national government department> is entitled to receive compensation up to but not exceeding the amount of financial liability as defined in the standard terms and conditions of the Recognised Organisation or compensation up to but not exceeding < monetary amount to be inserted > whichever is greater for such loss or damage arising from any one incident.

20 While acting for the Naval Administration under this agreement the Recognised Organisation shall be free to create contracts direct with its clients and such contracts may contain the Recognised Organisation's normal contractual conditions for limiting its legal liability to the Owner.

21 If either party is proceeded against or is expected to be proceeded against to answer for such liability as is mentioned above in this paragraph, the party shall inform the other party without undue delay. Each party shall, for information purposes, send claims, documents and other relevant material to the other.

22 The Recognised Organisation shall in no circumstances be liable for indirect or consequential loss or damage including but not limited to loss of profit, loss of contracts, loss of use, suffered or incurred by the <Naval Administration or national government department> resulting from any failure by the Recognised Organisation in the performance of its obligations under this agreement.

23 The <Naval Administration or national government department> shall not enter into a settlement which involves acceptance of such liability as is mentioned in the first or second sub-paragraph to this paragraph without the consent of the Recognised Organisation which shall not unreasonably be withheld.

24 The Recognised Organisation shall effect adequate policies of insurance against any liabilities aforesaid and keep such policies in force during the continuance of this agreement. The Recognised Organisation shall produce satisfactory evidence of such policies upon <Naval Administration or national government department> request.

25 If it is established that the <Naval Administration or national government department> is not the legal entity responsible for the performance of the duties of the Naval Administration, the term "<Naval Administration or national government department>" as used in the preceding sub-paragraphs shall be replaced by the name or designation of the appropriate Agency, body or organisation as determined by the <Naval Administration or national government department> and agreed by the appropriate Agency, body or organisation.

Scope

26 The details of the authorisation are as follows:

Scope	Ship name, class or type	Type of Authorisation	Standards
Structure	< Type, etc >	< Extent of authorisation >	< Classification Society, Defence etc >
Buoyancy and Stability	< Type, etc >	< Extent of authorisation >	< Classification Society, Defence etc >
Engineering Systems	< Type, etc >	< Extent of authorisation >	< Classification Society, Defence etc >
Fire Safety	< Type, etc >	< Extent of authorisation >	< Classification Society, Defence etc >
Escape, Evacuation and Rescue	< Type, etc >	< Extent of authorisation >	< Classification Society, Defence etc >
Communications	< Type, etc >	< Extent of authorisation >	< Classification Society, Defence etc >
Navigation	< Type, etc >	< Extent of authorisation >	< Classification Society, Defence etc >
Dangerous Goods	< Type, etc >	< Extent of authorisation >	< Classification Society, Defence etc >

CHAPTER I ANNEX D

Form of Certificates

CHAPTER I ANNEX D: FORM OF CERTIFICATES

<Official seal of the Naval Administration>	**NAVAL SHIP SAFETY CERTIFICATE**	<if appropriate, official seal of Recognised Organisation>

PARTICULARS OF THE SHIP

Name of the Ship	
Distinctive number and/or letters	
Naval Flag	[Navy/Coastguard/Etc.]

Type of ship	[High-speed]
Length Overall (m)	
Full Load Displacement (tonnes)	
Full Load Draught (m)	
Shipbuilder and date of Build	

IMO Number	[If applicable]
Certificate Type	[Full/Interim]
Certificate Number	

This Certificate is valid until *	[Date]

* Subject to periodic surveys and inspections in accordance with the requirements of Regulation 8 of Chapter I of the NATO Naval Ship Code

THIS IS TO CERTIFY

That the ship has been surveyed in accordance with the requirements of Regulation 8 of Chapter I of the Naval Ship Code as implemented by the Naval Administration to the extent identified in the Annex to this Certificate.

That the survey showed that the condition of the [subject matter] as defined in the Annex to this Certificate was satisfactory and the ship complied with the Naval Administration requirements.

That the ship is certified to operate in the environmental conditions specified in the Annex to this Certificate. [Delete if not applicable to the scope of this Certificate]

That life-saving appliances are provided for the total number of persons specified in the Annex to this Certificate. [Delete if not applicable to the scope of this Certificate]

CERTIFYING AUTHORITY

Issued under the provisions of the Naval Ship Code under the authority of the Naval Administration of:

Name of the State		
Issued by:		
Name & address of the Naval Administration or Recognised Organisation		
Signature of the official		
Date of issue (day/month/year)		Official Seal

TERMS AND CONDITIONS OF THE CERTIFICATE

1 The ship is certified as compliant with the principal standards relevant to the scope of the Certificate when:

- a. the ship is operated in accordance with the precepts of good seamanship and the relevant operating instructions appropriate to the ship, and the environment and duties upon which it is engaged;
- b. the ship is maintained in accordance with the maintenance requirements for the ship.

2 This Naval Ship Safety Certificate will become invalid if:

- a. The instructions for survey and maintenance are not adhered to;
- b. Any survey is not undertaken within three months of it falling due;
- c. Any unauthorised change of use or modification is made to the ship;
- d. Any significant damage which impairs the safety of the ship is not reported immediately to the Naval Administration;
- e. Any Conditions of Certification and other defects are not addressed and/or repairs not undertaken by the due date;
- f. The ship is not maintained in classification [where applicable].

3 A copy of this Naval Ship Safety Certificate, its Annex and its Supporting Statement (if issued) is to be retained on board at all times.

ENDORSEMENTS

This is to certify that, at a survey required by Regulation 12 of Chapter I of the Naval Ship Code, the ship was found to comply with the relevant requirements.

Type of survey:	[annual/periodical/renewal]	Place:		Seal of the Authority
Signed:		Date:		

Type of survey:	[annual/periodical/renewal]	Place:		Seal of the Authority
Signed:		Date:		

Type of survey:	[annual/periodical/renewal]	Place:		Seal of the Authority
Signed:		Date:		

Type of survey:	[annual/periodical/renewal]	Place:		Seal of the Authority
Signed:		Date:		

Type of survey:	[annual/periodical/renewal]	Place:		Seal of the Authority
Signed:		Date:		

<Official seal of the Naval Administration>	**ANNEX TO THE NAVAL SHIP SAFETY CERTIFICATE**	<if appropriate, official seal of the Recognised Organisation>

Name of the ship:	*< Name of ship >*	Certificate Number:	*< Certificate No. >*
	Issue number of this Annex:	*< Issue number >*	*< Date >*

SCOPE OF THE CERTIFICATE: Naval Ship Code

Relevant regulations	**Date (day/month/year)**
Chapter II Structure	
Chapter III Buoyancy, Stability and Controllability	
Chapter IV Engineering Systems	
Chapter V NOT USED	
Chapter VI Fire Safety	
Chapter VII Escape, Evacuation and Rescue	
Chapter VIII Communications	
Chapter IX Navigation	
Chapter X Dangerous Goods	

SCOPE OF THE CERTIFICATE: Naval Administration requirements

Relevant documentation	**Date (day/month/year)**
[State references to national Naval Administration requirements]	

PRINCIPAL REQUIREMENTS AND STANDARDS

Title of Standard	**Reference**	**Date (day/month/year)**
1. Operational Requirement	[Refer to a document that addresses the issues at NSC Chapter I Regulation 8 paragraph 7.1.1]	
2. Design standards	[Refer to document(s) that addresses the issues at NSC Chapter I Regulation 8 paragraph 7.1.2. Areas of equivalence accepted in accordance with Chapter I Regulation 5 are to be documented.]	

3. Material state	[Refer to document(s) that addresses the issues at NSC Chapter I Regulation 8 paragraph 7.1.3. Areas of equivalence accepted in accordance with Chapter I Regulation 5 are to be documented.]	
4. Operational and environmental limitations	[Refer to document(s) that addresses the issues at NSC Chapter I Regulation 8 paragraph 7.1.4]	
5. Survey/maintenance regime	[Refer to document(s) that addresses the issues at NSC Chapter I Regulation 8 paragraph 7.1.5. Areas of equivalence accepted in accordance with Chapter I Regulation 5 are to be documented.]	
6. Supporting Statement	[In the Supporting Statement the Naval Administration may record any important information in a language and format that can be readily understood that is of direct relevance to the Commanding Officer or his Senior Engineer Officer. It is optional.]	

CLASSIFICATION [if applicable]

Classification Society	**Principle class character symbols and class notations**
	[Provide an explanation of the symbols and notations in the Supporting Statement]

OPERATIONAL AND ENVIRONMENTAL LIMITATIONS [if applicable]

Sea State:	If High Speed Naval Ship, refer to Sea-State/speed diagram		
Sea area/Range to shelter:			
Air temperature:	High:	Low:	
Ice: Ice navigation:			
Other			

LIFE-SAVING APPLIANCES [if applicable]

Life-saving appliances are provided for the embarkation of a total number of | xxx | persons.

Note: this is the total number of persons that may be embarked in compliance with this Code. The number of life-saving appliances carried will in general exceed this figure.

LOADING LIMITATIONS [if applicable]

The ship, its equipment and fittings are to be loaded with safe limits as defined in the following documents:

Relevant documentation	**Date (day/month/year)**
[State references to relevant documentation defining overall loads, local loads, machinery loads (e.g. torque limits), electrical loads (e.g. continuous rating), etc.]	
[Etc.]	

LIFTING APPLIANCES [if applicable]

The lifting appliances and associated structure, equipment and fittings are to be loaded with safe limits as defined in the following documents:

Relevant documentation	**Date (day/month/year)**
Structural items (e.g. lifts, ramps, gates, etc) [State references to relevant lifting appliance documentation.]	
Non-structural items (e.g. cranes, RAS gear, winches, etc.) [State references to relevant lifting appliance documentation (e.g. lifting appliance register).]	

RECORD OF EQUIPMENT [if applicable]

The Record of Equipment referenced below forms a part of the Naval Ship Safety Certificate to which it applies.

Title of document	**Reference**	**Date (day/month/year)**
[Life-saving equipment (e.g. number of lifejackets)]		
[Etc.]		

<Official seal of the Naval Administration>	**SUPPORTING STATEMENT TO THE NAVAL SHIP SAFETY CERTIFICATE**	<if appropriate , official seal of the Recognised Organisation>

Name of the ship:	*< Name of ship >*	Certificate Number:	*< Certificate No. >*
	Issue number of this Annex:	*< Issue number >*	*< Date >*

Here the Naval Administration may provide additional information to support the Safety Certificate and its Annex.

The use of a Supporting Statement is optional.

If used, the Supporting Statement:

- *Is to form part of the Certificate to which it refers;*
- *Is to draw attention only to aspects that are within the control of the Commanding Officer or his Heads of Departments;*
- *Is to be written in a form that has meaning to the Officers on board.*

The Supporting Statement:

- *Should not be seen as a substitute for properly published operating and maintenance handbooks, books of reference, etc.;*

Should draw attention to:

- *Fundamental operational limitations that are critical to the safe operation of the ship;*
- *Issues that have yet to be consolidated into the ship's handbooks, books of reference, etc.;*
- *Naval Administration contact details (addresses, etc.).*

It is recommended that the Supporting Statement follows the format of the Annex to the Safety Certificate. It should include information to a greater depth than is appropriate to the Annex; for example:

- *Scope of the Certificate: a brief description of the technical issues covered and not covered;*
- *Principal standards: as required;*
- *Classification: a description of class character symbols and notations relevant to the Safety Certificate;*
- *Operational and environmental limitations: Could include sea-state-speed diagrams, etc.;*
- *Life-saving appliances: details of the life-saving appliances if not in a separate, referenced record of Equipment;*

Loading limitations:

- *Structural: Aircraft and vehicle deck load limitations, emergency deck loading limits, still water bending moment limits, load line, etc.;*
- *Mechanical: Torque limits, duty cycle information, etc.*
- *Electrical: [As required];*
- *Lifting appliances: as required.*

CHAPTER II STRUCTURE

Regulation 0 Goal

1 For the design life of the ship, the structure shall be designed, constructed and maintained to:

1.1 Provide weathertight and watertight integrity;

1.2 Carry all loads that may be foreseen;

1.3 Permit embarked persons to carry out their duties safely;

1.4 Protect the embarked persons and essential safety functions in the event of all foreseeable emergencies and accidents at least until the persons have reached a place of safety or the threat has receded;

1.5 Minimise the risk of loss of the ship.

Regulation 1 General

Functional Objective

1 The purpose of this Regulation is to outline the principles and framework of Chapter II Structure.

Definitions

Note: Definitions which are applicable to all Chapters are located in Chapter I, Regulation 2.

Accident	An accident is defined as an identifiable event or series of events which can be foreseen but which is unexpected.
Agreed standard	The standard selected by the Owner and agreed by the Naval Administration, compliance with which will be deemed to meet the requirements of this Code.
Appropriate degree of certainty	A quantified or experienced-based degree of certainty adjudged by the Naval Administration's interpretation of society's demands.
Capacity	The capacity of the structure to meet the demand.
Characteristic value	A quantified measure of a demand or a capacity that has a known probability of occurrence.
Classification	Compliance with the requirements of the regulations of the classification society throughout the life of the ship.
Classification Society	An organisation that establishes and applies technical standards in relation to design, construction and through-life survey of ships for the purpose of enhancing safety.
Cyclic demand	A repetitive demand that requires assessment using formulations or methods which take into account the repetitive nature of the demand or response.
Damage tolerant design	Damages that are tolerated if they do not lead to a catastrophic failure before the next scheduled survey period at which all damage may be detected. For example, the corrosion of a hull that is rendered damage tolerant by the inclusion of a corrosion margin.

Demand	A demand made on the structure which is generally a load, but may also be an imposed deflection, thermal effect, the avoidance of an environmental impact, or a human demand (e.g. To avoid sharp edges).
Design life	The nominal period that the ship is assumed to be exposed to operating and/or environmental conditions and/or the corrosive environment which is used for selecting appropriate ship design parameters. The ship's actual service life may be longer or shorter depending on the actual operating conditions and maintenance of the ship throughout its life cycle.
Dynamic demand	A demand that requires assessment using formulations or methods which take into account the dynamic nature of the demand or response. Includes inertial demands.
Inertial demand	See Dynamic demand.
Limit state	A condition at which a structure or structural member fails to perform the function expected of it.
Limit state design	Design to avoid a limit state with an appropriate degree of certainty.
Quasi-static demand	A dynamic or inertial demand that may be treated as static by the inclusion of a load enhancement factor to embrace the inertial or dynamic effects.
Ruggedness	The ability of an apparatus or system, to withstand extreme local and impact loads which may result from a conceivable environment in which it is expected to operate, while retaining its intended functions.
Rules	Standards.
Safe life design	There is a high degree of certainty that no damage will occur during the specified design life. An example might be a fatigue assessment of the hull for the design life.
Safety margin	Ratio of capacity over expected demand. The factor can be expressed as a series of partial factors of safety (or gamma factors) to represent the likelihood of deviation from the characteristic value or the severity of the consequences. An appropriate factor should be assigned for all design parameters whose calculation involves a degree of uncertainty, including loads, structural modelling, fatigue, corrosion, material imperfections, construction workmanship errors, buckling and residual strength.
Static demand	A demand that can be considered as permanent.
Structure	All items of the ships hull that contribute to its ability to withstand global and local loads, maintain watertight and weathertight integrity, support all equipment or other applied loads.
Structural capacity	Structural strength of the ship defined in terms of, but not limited to the following: deflection, corrosion, buckling, yielding and fatigue.
Ultimate limit state (ULS)	That condition beyond which a loss of equilibrium or failure of a part or whole of the structure may be expected to occur (e.g. collapse, fracture).

International Maritime Organization (IMO) Documents

Abbreviation	Title	Resolution No. (if applicable)	Amendments incorporated into or reviewed and applicable to ANEP-77	Amendments under review for ANEP-77
SOLAS	International Convention for the Safety of Life at Sea, Consolidated Edition, 2009	-	MSC.201(81) MSC.204(81) MSC.216(82) Anx 3 MSC.256(84) MSC.257(84) MSC.258(84) MSC.269(85) MSC.282(86) MSC.283(86) MSC.290(87) MSC.291(87) MSC.308(88) MSC.309(88) MSC.317(89)	MSC.325(90)

Purpose

2 Chapter II Structure is written as a “standard for the selection of standards” rather than a standard for direct application in a design office or construction/repair facility. As a consequence, the primary target audience for this Chapter is the Naval Administration and its Recognised Organisations.

Scope

3 This Chapter defines the requirements for the structure of ships. It is not constrained to:

3.1 Hull structure alone. This Chapter applies to all structure required to meet the Goal of this Chapter.

3.2 The structure only when afloat. This Chapter equally applies while the ship is intentionally beached or aground.

3.3 Strength issues alone where “strength” is synonymous with failure to carry load. The structure must not present a hazard in itself, and may be limited by criteria such as deflection (e.g. structural misalignment leading to premature buckling, mast deflection, etc).

Note: Some structural materials may present a hazard during manufacture, repair or when they degrade due to age.

Application

4 In addition to the requirements contained elsewhere in the present regulations, ship structure shall be designed, constructed, and maintained in compliance with the structural requirements of a Classification Society whose rules and procedures are recognised and validated by the Naval Administration as meeting the Goal of this Chapter or with applicable national standards of the Naval Administration which have been demonstrated to provide an equivalent level of safety.

5 The requirements of this Chapter apply to ships the keels of which are laid or which are at a similar stage of construction on or after the date of implementation of this Chapter or any amendments thereto. The Naval Administration may direct retrospective application.

Solutions

6 Verification that the ship complies with this chapter shall be by the Naval Administration. Provision of evidence to support verification shall be by the owner. All decisions that affect compliance with the requirements of this chapter shall be recorded at all stages from concept to disposal and these records be maintained throughout the life of the ship.

Regulation 2 Concept of Operations Statement

Functional Objective

1 The Owner’s vision of how the structure of the ship is to be operated and maintained throughout the design life shall be shared with the Naval Administration and, where appointed, it’s Recognised Organisation.

Performance requirements

2 The scope of the information to be agreed is defined in the Concept of Operations Statement. For the purposes of this Chapter, particular importance is to be attached to defining the following as they relate to structure:

2.1 Hazards created by the natural environment,

2.2 Hazards created by the man-made and built environment (operations, accidents and malicious acts).

2.3 Environmental hazards inside the ship. Includes (a) hazards created by the payload (cargoes, weapons, systems and equipments (including vibration, and corrosive atmospheres and fluids)), (b) hazards introduced from outside the ship (e.g. flood loading), (c) hazards created by the structure itself, (d) fire, and (e) hazards created by human beings (accidents and malicious acts).

2.4 Survey and maintenance philosophy.

3 It is the responsibility of the Owner to define and document the Concept of Operations Statement.

4 The Naval Administration may impose additional requirements where it feels that the Concept of Operations Statement is too restrictive or not consistent with the ships of similar type regulated under SOLAS.

Solutions

5 Approval of the Concept of Operations Statement shall be by the Naval Administration.

Regulation 3 Structural Design

Functional Objective

1 The structural design shall be appropriate to meet the Goal of this Chapter.

Performance requirements

2 Structural demand and capacity models. This Chapter expresses its requirements in terms of a rational philosophy – limit state philosophy – for structural design and assessment. However, limit state methods are not mandated, and compliance with this Chapter relies upon the selection and implementation of an appropriate standard or coherent standards to verify that the goals are met.

3 The structure is to remain effective so that it meets the Goals of this Chapter throughout the design life of the ship.

4 For safe operation:

Structural capacity ≥ Structural demand x Safety Margin
where: Structural capacity = (limit state) x (Safety Margin)

5 For the analysis of damaged ships, it is valuable (but not obligatory) to keep the safety margins separately identified with both the capacity and demand so that appropriate advice can be balanced against non-structural threats.

6 Limit state design methods are not mandatory; authoritative "allowable stress" methods are entirely valid and should be seen as a specific case of limit state design methods in which the partial factors of safety have been combined to a single margin against failure. Irrespective of format, it must be possible to justify that the overall requirements expressed in this code are fulfilled for the ship strength.

7 This Chapter requires due consideration to be given to designing damage tolerant structures. Adequate structural capacity provided either by protecting the structure or providing alternative load paths.

7.1 For all demands other than disregarded demands identified below, Regulation 0 sub-goals 1.4 and 1.5 of this Chapter are always to be fully met.

7.2 Other Regulation 0 sub-goals 1.1, 1.2, and 1.3 are to be met with an appropriate probability of non-exceedance as determined either by the use of limit state assessment or by the use of experience-based rules appropriate for the ship.

Design for manufacture and repair

8 Consideration shall be given to the working practices and processes of the build yards, their suppliers and their sub-contractors.

Design assessment – General

9 In addition to the normal demands that are expected for a ship of the type under consideration, all demands specified in the Concept of Operations Statement must be assessed where relevant to the structural capacity of the ship.

10 In determining the extent and depth to which a demand should be addressed, consideration should be given to the probability of its occurrence and the consequence if it does occur. Additionally, consideration is to be given to loads occurring in combination.

11 When selecting structural requirements consideration should be given to limitations of state of the art.

12 The Performance Requirements under this regulation are now divided into two; Normal Operations and Damage scenarios.

Design assessment – Normal Operations – natural environment

13 As a minimum it is mandatory to assess the structural capacity of all ships when subjected to the following demands:

13.1 Above water: Wind, air temperatures (high and low), ice accretion, solar radiation.

13.2 Sea surface: Waves, green seas, ice navigation, ship motions (including slamming).

14 Structural capacity. The ship shall not suffer any structural damage. Regulation 0 sub-goals 1.1 to 1.5 of this Chapter shall be fully met.

Design assessment – Normal Operations – built and man-made environment

15 As a minimum it is mandatory to assess the structural capacity of all ships when subjected to the following demands:

15.1 Anchoring, mooring and towing, beaching and grounding (where these are normal operations).

15.2 Human intervention:

15.2.1 Permanent loads: permanent weights, solid ballast,

15.2.2 Variable functional loads from cargo, fuel and ballast, stores and equipment.

16 Structural capacity. The ship shall not suffer any structural damage. Regulation 0 sub-goals 1.1 to 1.5 of this Chapter shall be fully met.

Design assessment – Normal Operations – demands limited by capacity

17 If the capacity dictates the demand, the demand may need to be limited. Any limitations applied to the structure must be consistent with the Owner's expectations as detailed in the Concept of Operations Statement. Operator Guidance on the limitations must be provided in a form that is readily understandable by the operator of the ship.

18 As a minimum it is mandatory to provide adequate structural capacity to all ships when subjected to the following demands:

18.1 Emergency towing: from either bow or stern

19 Structural capacity. The ship shall not suffer any structural damage. Regulation 0 sub-goals 1.1 to 1.5 of this Chapter shall be fully met.

Design assessment – Normal Operations – unquantifiable demands

20 Structural demands that are not practically quantifiable shall be addressed by providing adequate structural capacity based upon proven records of satisfactory performance of a similar type of ship in similar operating conditions.

21 As a minimum it is mandatory to provide adequate structural capacity to all ships when subjected to the following demands not addressed elsewhere:

21.1 Ruggedness: cargo and equipment operations, berthing

21.2 Structural continuity

21.3 Environmental degradation: corrosion, erosion

22 Structural capacity. The ship may suffer minor structural damage. Regulation 0 sub-goals 1.1 to 1.5 of this Chapter shall be fully met.

Design assessment – Normal Operations – access, layout and arrangement

23 The structure is to be designed so that it permits safe access by embarked persons to all areas required to undertake their normal duties in all Foreseeable Operating Conditions.

23.1 The need for special arrangements to permit all persons (including shore-based surveyors and maintenance personnel) to undertake their duties safely is to be minimised.

23.2 All fixed arrangements provided for survey of structure are to be assessed.

23.3 All fixed arrangements identified as requiring special consideration in order to satisfy the Goals of other parts of this Code shall be assessed.

24 The structural capacity is to be assessed. Regulation 0 sub-goals 1.1 to 1.5 of this Chapter shall be fully met.

Design assessment – Normal Operations – Disregarded demands and disregarded capacity

25 Disregarded structural capacity. The ship may be subject to demands that are so low in magnitude and/or effect that the structural capacity may be assumed without justification (e.g. machinery vibration in a heavily-built low-speed ship, movement of persons about the ship).

26 Structural capacity. There is no requirement to demonstrate the structural capacity when subjected to disregarded demands.

Design assessment – Damage Scenarios - Foreseeable Damage

27 As a minimum it is mandatory to assess the structural capacity of all ships when subjected to the following demands:

27.1 Foreseeable damage. Events that should be avoided, but the possibility of their occurrence cannot be ignored in the design of the ship:

27.1.1 Navigation errors: Grounding, flooding, collision;

27.1.2 Fire and explosion;

27.1.3 Mal-operation;

27.1.4 Failure of a single structural member.

28 Structural capacity. The ship may suffer structural damage from this event that requires unprogrammed remedial action. Regulation 0 sub-goals 1.1 to 1.3 of this Chapter may be compromised, but sub-goals 1.4 and 1.5 shall be fully met.

Design assessment – Damage Scenarios – Extreme Threat Damage

29 As a minimum it is mandatory to assess the structural capacity of all ships when subjected to the following demands:

29.1 As required by the Owner after consultation with the Naval Administration.

30 Structural capacity. The ship may suffer structural damage from this event that requires unprogrammed remedial action. Regulation 0 sub-goals 1.1 to 1.3 of this Chapter may be compromised, but sub-goals 1.4 and 1.5 shall be fully met.

Design assessment – All Damage Scenarios – access, layout and arrangement

31 The structure is to be designed so that it permits embarked persons to respond appropriately in the event of damage as safely as reasonably practicable.

32 All fixed arrangements identified as requiring special consideration in order to satisfy the Goals of other parts of this Code shall be assessed.

33 The structural capacity is to be assessed. Regulation 0 sub-goals 1.1 to 1.3 of this Chapter may be compromised, but sub-goals 1.4 and 1.5 shall be fully met.

Design assessment – All Damage Scenarios– Disregarded demands and disregarded capacity

34 Disregarded demand. The ship may suffer critical damage, but the probability of such an event is so low that the safety risk for the persons onboard is still acceptable even if the demand is disregarded. In such cases there is no requirement to quantify the demand (though there may be a requirement to demonstrate its probability of occurrence is so low as to be legitimately disregarded).

35 Structural capacity. There is no requirement to demonstrate the structural capacity when subjected to disregarded demands.

Solutions

36 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 4 Construction

Functional Objective

1 The quality of construction shall be consistent with the structural design requirements necessary to meet the Goal of this Chapter. The design basis and essential construction information are to be recorded.

Performance Requirements

Quality of materials and workmanship

2 The design standard will assume or require a certain quality of construction, modification and repair. Ship structure is to be:

2.1 Constructed and repaired in compliance with the selected standard, and

2.2 Verified as having been so constructed and/or repaired.

3 Manufacturing organisations must be able to construct – and demonstrate they can construct – at least to:

3.1 Normal shipbuilding standards as defined in the industry's well accepted quality standards, and

3.2 Where more onerous, a standard consistent with the design solution.

4 The quality of work and work processes is to be undertaken to the satisfaction of the Naval Administration in facilities that are appropriately accredited by persons who are appropriately experienced.

5 A survey plan shall be developed for the construction phase of the ship, taking into account the ship type and design. The survey plan shall contain a set of requirements, including specifying the extent and scope of the construction survey(s) and identifying areas that need special attention during the survey(s), to ensure compliance of construction with mandatory ship construction standards.

Solutions

6 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 5 Ships in Operation

Functional Objective

1 The ship shall be operated in a manner necessary to meet the Goal of this Chapter consistent with the design and material solutions, and the material state of the ship continues to meet the Goal of this Chapter.

Performance Requirements

2 The survey, maintenance and repair philosophy to be adopted is to be considered at all stages, and any constraints imposed on the design by reason of the repair philosophy identified (e.g. if in-theatre repairs are envisaged).

3 Unless explicitly agreed otherwise by the Naval Administration the ship shall be deemed to be in operation when afloat, aground (landing ships, road or air transportable craft) and in dry-dock when all of the following criteria are met:

3.1 Under the command of the Commanding Officer,

3.2 Crew members are embarked,

3.3 Available for sea service at less than 72 hours' notice,

3.4 Not undergoing any structural repairs that would, for example, prevent the ship from putting to sea.

4 Operation: The ship is to be provided with operational information consistent with the design solution that can be readily understood onboard. Where possible, the information is be in a form that allows the operator to understand the increased risk and ultimate failure point if the normal operating limits are exceeded. These normal operating limits are to be defined by the designer and approved by the Naval Administration or Recognised Organisation.

5 Survey: The ship is to be surveyed in accordance with Chapter I and all repairs of modifications undertaken to the satisfaction of the Naval Administration. Surveys are conducted for two primary reasons:

5.1 To ascertain that any structural degradation normal for the type of ship and its material of construction is identified before it gets to a stage at which the structural capacity of the ship is compromised (e.g. corrosion),

5.2 To identify damages that have resulted form specific events (e.g. berthing damage) that may have gone unnoticed or unreported by the embarked personnel.

6 Modification and repair: In general, the Naval Administration is to apply the same standard of assurance to work undertaken in the SiO phase as would be applied for new construction ships. Where defects arise because of inadequacies in design or construction, the owner is to take action to improve the structural capacity.

7 The Naval Administration is to assure itself that the material state philosophy and operator guidance are consistent with the designer's intentions. Where the Concept of Operations Statement has been altered, the ship shall not be authorised for more demanding use until a certification review has been conducted and agreed by the Naval Administration.

8 The Naval Administration is to apply the same or a demonstrably equivalent standard of assurance to work undertaken in the SiO phase as would be applied for new construction ships.

Solutions

9 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 6 Disposal

Functional Objective

1 Ships shall be designed and constructed of materials for environmentally acceptable recycling without compromising the safety and operational efficiency of the ship. Recycling shall be carried out in facilities with sound working practices and environmental standards

Performance Requirements

2 Where possible the IMO Guidelines on Ship Recycling are to be followed, as provided in IMO Resolution A.962(23), 5th December 2003.

Solutions

3 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 7 Materials

Functional Objective

1 The materials have been characterised in sufficient scope and depth in their installed form to enable reliance to be placed on them to perform in a manner that is consistent with the design and material solutions in the environment in which they are used.

Performance Requirements

2 This Code primarily considers ships constructed of steel, aluminium and fibre-reinforced thermo-setting polymers. Where it is intended to construct ships of other materials, these may need to be specially considered.

3 The structure shall not be constructed of materials or combinations of materials that, in the design configuration in which they are used and the Foreseeable Operating Conditions and accident conditions, endanger embarked persons or hinder the safe evacuation of the ship. Examples could include loss of mechanical properties (strength, elasticity, creep), result in excessive deformation (thermal expansion), produce smoke, or give off toxic fumes when heated by solar radiation, high machinery temperatures or a fire.

4 Particular attention must be given when making use of materials that have reduced properties under all Foreseeable Operating Conditions at elevated temperatures (e.g. aluminium in a fire), and materials that are combustible, fibre reinforced plastic with or without structural sandwich core, combustible insulation for structure, ducts and pipes, lining materials, and paint. Protection of structural materials that exhibit such tendencies is, subject to appropriate approvals, acceptable as a solution.

5 The Naval Administration is to assure itself that the manufacturing processes and procedures are consistent with the assumptions made during design appraisal. This assurance must include a significant degree of engineering product audit; audit of management processes alone is not sufficient.

6 For all ships, new installation of materials which contain asbestos shall be prohibited.

Solutions

7 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 8 Coatings

Functional Objective

1 Coatings for the protection of structure shall be properly selected and applied to protect the structure throughout the target useful life of the coating.

Performance Requirements

2 All dedicated seawater ballast tanks and void spaces shall be coated during construction in accordance with the Performance standard for protective coatings (IMO PSPC)).

3 Coatings shall be applied and maintained in accordance with manufactures' specifications concerning surface preparation, coating selection, application and maintenance. Where coating is required to be applied, the design coating life shall be specified. The actual coating life may be longer or shorter than the design coating life, depending on the actual conditions and maintenance of the ship. Coatings shall be selected as a function of the intended use of the compartment, materials and application of other corrosion prevention systems, e.g., cathodic protection or other alternatives.

4 Information on coating life and use of coatings shall be maintained including:

4.1 Locations and/or spaces where coatings are required to be used;

4.2 Types of coating to be used for various spaces;

4.3 Required target useful life of the coating and explanation for selection;

4.4 The coating performance standard to be followed (e.g., IMO PSPC).

Solutions

5 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 9 Special Requirements for Ships with a Function of Bulk Fuel Carriage

Functional Objective

1 The structural survey of ships with bulk fuel carriage shall be at least as good as required by SOLAS.

Performance Requirements

2 Ships with a function of bulk fuel carriage shall be subject to an enhanced programme of survey. The scope of each successive annual, intermediate and renewal survey is to be tailored to reflect the increased risk of significant structural degradation as the ship ages, and hence the increased risk of an escape of fuel from cargo spaces to the environment.

Solutions

3 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

4 Ships with a function of bulk fuel carriage shall be subject to an enhanced programme of survey in accordance with or equivalent to International Association of Classification Societies (IACS) Unified Requirements Z10.1 'Hull Surveys of Oil Tankers' or Z10.4 'Hull Surveys of Double Hull Oil Tankers', as appropriate.

CHAPTER III BUOYANCY, STABILITY AND CONTROLLABILITY

Regulation 0 Goal

1 The buoyancy, freeboard, main sub-division compartment and stability characteristics of the ship shall be designed, constructed and maintained to:

1.1 Provide an adequate reserve of buoyancy in all foreseeable intact and damaged conditions, in the environment for which the ship is to operate;

1.2 Provide adequate stability to avoid capsizing in all foreseeable intact and damaged conditions, in the environment for which the ship is to operate, under the precepts of good seamanship;

1.3 Permit embarked persons to carry out their duties as safely as reasonably practical;

1.4 Protect the embarked persons and essential safety functions in the event of foreseeable accidents and emergencies at least until the persons have reached a place of safety or the threat has receded including preventing the malfunction of the life-saving systems and equipment.

Regulation 1 General

Functional Objective

1 The purpose of this Regulation is to outline the principles and framework of Chapter III Stability.

Definitions

Note: Definitions which are applicable to all Chapters are located in Chapter I, Regulation 2.

Afloat	For the waterline not to exceed the submergence limit.
Approved type	A device that is approved by the Naval Administration.
Capsize	Roll, heel or list to the point of angle of vanishing stability
Catastrophic event	An extreme event where the ship is rapidly lost
Closure	A device for ensuring an opening in a watertight structure can be closed watertight or weathertight.
Collision Bulkhead	A watertight transverse bulkhead in the fore part of a ship, that extends from the keel to the submergence limit, to prevent water flowing aft in the event of a collision.

Conventional Monohull	A Conventional Monohull is a Ship of rigid construction, meeting the following definition: $V \leq 4\sqrt{L_{wl}}$ where: V = Maximum Velocity (knots) Lwl = Length (waterline) (m)
Disturbance	Any event (internal or external to the ship) that has the potential to change the equilibrium state of the ship, including but not limited to, environment (wind, waves, ice build-up, navigational obstructions), cargo, towing, lifting, crowding, turning, conditions of no or reduced load (lightship, minimum operating condition), entrained water, loss of watertight integrity and collision not causing loss of watertight integrity (such as grounding or use of tug boats).
Downflooding point	A large opening above the submergence limit that when submerged will cause unrestricted flooding and may lead to loss of the ship.
Extreme event	An event beyond Foreseeable Operating Conditions
Founder	When the ship sinks below the submergence limit (or where the ship is sitting on the seabed and would sink below the submergence limit if the water depth is increased).
Freeboard	The minimum distance from the edge of the weatherdeck to the maximum depth of submergence of the intact ship.
Green seas	Wash and waves that break over the weatherdeck and exposed ship parts.
Manned Spaces	Spaces on the ship that persons would frequently occupy.
Motion Induced Interruption (MII)	The occasion when a crew member would have to stop working on a task to hold on to prevent loss of balance.
Motion Sickness Incidence (MSI)	The percentage of personnel on board that vomit within two hours of exposure to a defined seaway.
Plunging	The event where the ship's submergence limit repeatedly dips below the waterline for a short period.
Upright	For intact, near vertical; for damaged, the angle of list acceptable to the Naval Administration.
Watertight	Prevent the passage of water in either direction with a head of water commensurate with the submergence limit in all Foreseeable Operating Conditions.
Weathertight	Prevent the passage of water into the ship in all Foreseeable Operating Conditions.
Weatherdeck	All decks exposed to the external environment.
Work Station	Any location that a person onboard is required to stand or sit during the normal operation of the ship.

International Maritime Organization (IMO) Documents

Abbreviation	Title	Resolution No. (if applicable)	Amendments incorporated into or reviewed and applicable to ANEP-77	Amendments under review for ANEP-77
COLREGS (Ref at Annex A)	International Regulations for Preventing Collisions at Sea	-	Amendments from 2007 onwards: A.1004(25)	
SOLAS	International Convention for the Safety of Life at Sea, Consolidated Edition, 2009	-	MSC.201(81) MSC.204(81) MSC.216(82) Anx 3 MSC.256(84) MSC.257(84) MSC.258(84) MSC.269(85) MSC.282(86) MSC.283(86) MSC.290(87) MSC.291(87) MSC.308(88) MSC.309(88) MSC.317(89)	MSC.325(90)

Purpose

2 Adequate reserve of buoyancy and stability shall be provided to safeguard life and property at sea whilst maintaining freedom of manoeuvre.

3 In addition to the hazards facing merchant shipping, the risk of collision from operation in close proximity to other shipping, particularly during replenishment at sea, blockade, interdiction or multi-platform operations shall be considered in determining foreseeable damage.

4 The ability to be deployed to any area of interest to the Navy defined in the Concept of Operations Statement shall be maintained.

Note: This may include constabulary roles, areas of conflict or aid in humanitarian crisis.

Application

5 Any changes to the ship during design, construction or through life that impacts on the compliance with this chapter shall be approved by the Naval Administration.

General Performance Requirements

6 The ship shall:

6.1 Be capable of operating in the environment defined in the Concept of Operations Statement;

6.2 Have a level of inherent seaworthiness including motions tolerable by equipment and persons onboard, controllability and the ability to remain afloat and not capsize;

6.3 Be designed to minimise the risk faced by hazards to naval shipping including but not limited to the impact of the environment causing dynamic capsize, broach or damage to crew & equipment, loss of watertight integrity from collision, grounding or hostile acts, static capsize due to changing loading conditions and errors in ship handling;

6.4 Be provided with operator guidance, as required in Regulation 8 Provision of Operational Information, to facilitate safe handling of the ship.

Note: Assumptions of good seamanship are inherent in practically all stability methods that can be applied to verify the performance requirements of this chapter.

Note: Guidance on hazard identification and bounding the Foreseeable Operating Conditions for buoyancy and stability is provided in Annex A, "Guide to the Naval Ship Code."

Solutions

7 Verification that the ship complies with this chapter shall be by the Naval Administration. Provision of evidence to support verification shall be by the owner. All decisions that affect compliance with the requirements of this chapter shall be recorded at all stages from Concept to Disposal and these records be maintained throughout the life of the ship.

Regulation 2 Watertight Integrity

Functional Objective

1 The ship shall have watertight and weather tight boundaries that prevent the accumulation of water in any undamaged main sub-division compartment, in any Foreseeable Operating Condition.

Performance Requirements

Watertight & Weathertight Boundaries

2 The structure of any main sub-division compartment shall ensure any watertight or weathertight boundary satisfies the functional objectives of this chapter in any Foreseeable Operating Condition.

3 The external ship's structure and fittings shall be weathertight above the submergence limit, defined in Regulation 4, in all Foreseeable Operating Conditions.

Note: The Naval Administration requires that all reasonable and practicable measures shall be taken to limit the entry and spread of water above the submergence limit.

4 Main sub-division compartment boundaries shall be watertight below the submergence limit in all Foreseeable Operating Conditions.

5 Manned spaces and compartments supplying or containing emergency devices within the ship are to be protected from the ingress of water in case of damage to the bottom of the ship.

6 The Damage Control Deck is to be watertight and located above the submergence limit to provide safe continuous access along the length of the ship, communication and recovery activities (such as rapid closure of openings & penetrations in watertight boundaries).

Note: This may be referred to as the bulkhead or communications deck.

7 Machinery space boundaries shall be designed and maintained to be watertight.

Note: Other spaces considered as vital to the safety of the crew should be considered to be provided with watertight boundaries.

8 The fore and aft regions of the ship shall provide protection to the remainder of the ship (extending from keel to weatherdeck) from the consequences of a collision.

9 Access trunks, tunnels or scuttles shall have watertight boundaries.

10 Damage to or loss of any appendage fitted to the ship shall not cause the loss of watertight integrity to any main sub-division compartment.

11 The ship shall be protected from ingress of water in case of damage to stern tube arrangements.

Openings

12 Where down-flooding points (such as air intakes and exhausts) are required they shall limit the ingress of water from weather or waves in any Foreseeable Operating Condition.

13 Openings in all main sub-division compartment boundaries shall be reduced to a minimum compatible with the design and proper working of the ship.

14 Openings in the hull and watertight boundaries shall:

14.1 be fitted with closures of an approved type;

14.2 not be fitted in bulkheads below the first watertight deck above the submergence limit unless approved by the Naval Administration; and

14.3 not be fitted in the collision bulkhead unless approved by the Naval Administration.

15 Openings above the submergence limit, other than approved downflooding points shall be fitted with weathertight closing devices of an approved type that shall;

15.1 for openings in decks, have coamings of adequate height and strength to allow access and protection against ingress of water in all Foreseeable Operating Conditions;

15.2 be of adequately robust construction to withstand minor damage; and

15.3 be capable of being closed in a safe manner.

16 Openings formed by air pipes, ventilators and similar systems shall terminate at a location above the submergence limit.

17 Moving parts penetrating the hull below the submergence limit are to be fitted with watertight sealing arrangements of an approved type.

18 Discharges below the submergence limit shall be, of an approved type and fitted with efficient and accessible means of preventing water from passing inboard.

Closures

19 Closures to openings in watertight boundaries shall;

19.1 permit embarked persons to carry out their duties safely;

19.2 be capable of being operated by embarked persons;

19.3 be able to be closed rapidly in all Foreseeable Operating Conditions;

19.4 provide the same level of watertight integrity as the surrounding structure when closed;

19.5 allow the watertight compartment to be entered following the flooding of any adjacent compartment;

19.6 be minimised in number throughout the ship;

19.7 be located away from areas of foreseeable damage;

19.8 indicate to a manned central control station and other control stations as required by the Naval Administration, if open;

19.9 only be opened whilst afloat at times approved by the Naval Administration and marked accordingly to reflect the operational system for opening at sea;

19.10 When power operated, closures in watertight boundaries are to;

19.10.1 Operate locally from each side of the bulkhead and from a manned central control station and close within a suitable timescale against an angle of inclination. Closures are to be not capable of remote opening when power operated. Where locally opened, closures are to return to the closed position automatically.

19.10.2 Be provided with an individual local hand-operated mechanism on both sides of the closure which is also operable from a position above the submergence limit. The closure is to be able to be closed within a suitable timescale.

19.10.3 Be provided with an audible alarm when the closure is closing;

19.10.4 Be provided with electrical power supplied from the emergency switchboard;

19.10.5 Be provided with two independent power sources with sufficient reserve for three operations in event of power failure, power sources are to have suitable alarms and indication;

19.10.6 Be provided with an approved control system suitable for the operating environment and designed such that there are no single points of failure in the control system or power operating system. Failure of the power operating system should not impair the hand operation of the system.

20 Portable plates shall not be permitted except where acceptable to the Naval Administration.

Penetrations

21 Penetrations (for all piping, cabling, ducting or other purpose) shall:

21.1 provide the same level of watertight and weathertight integrity as the surrounding structure;

21.2 prevent the flow of water through watertight boundaries unless approved by the Naval Administration;

21.3 be able to be closed rapidly in all Foreseeable Operating Conditions, and where required by the Naval Administration by remote operation from above the first watertight deck above the submergence limit;

21.4 not be fitted in the forward most watertight bulkhead unless approved by the Naval Administration;

21.5 not be made of materials that would impair the watertight integrity in the event of a fire or shock under Foreseeable Operating Conditions; and

21.6 be of an approved type.

<u>Drainage</u>

22 A system capable of removing liquid from the bilges of any undamaged main sub-division compartment in any Foreseeable Operating Condition shall:

22.1 be fitted to the ship;

22.2 be of an approved type;

22.3 have at least the capacity to remove water at the rate it can accumulate due to any credible scenario which could lead to simultaneous ingress from penetrations, down flooding points and any intact onboard systems (such as fire fighting systems or localised flooding from domestic services);

22.4 have a liquid leakage detection system for spaces where flooding will cause great danger to the ship.

23 Adequate provision shall be made for the drainage of enclosed spaces, capable of operation in all foreseeable conditions.

24 All exposed decks shall be free draining.

25 Flooding of any main sub-division compartment shall be indicated to a main control station and other control stations as required by the Naval Administration.

Solutions

26 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 3 Reserve of Buoyancy

Functional Objective

1 The ship shall have sufficient freeboard and buoyancy to prevent excessive shipping of green seas, plunging or foundering in any Foreseeable Operating Condition.

Performance Requirements

2 The ship shall, in all Foreseeable Operating Conditions:

2.1 have adequate freeboard;

2.2 have adequate freeboard forward to minimise shipping of green seas;

2.3 remain afloat; and

2.4 have sufficient reserve of buoyancy to meet Regulation 7 Preservation of Life.

Design

3 Buoyancy in a damaged state shall be provided by sub-division or an equivalent method agreed with the Naval Administration.

4 The maximum submergence limit shall be determined from the damaged stability calculations.

5 The ship shall have a minimum freeboard and sub-division or any other mechanism to ensure an adequate reserve of buoyancy.

Ship Condition

6 Draught marks that enable the ships displacement, trim and list to be determined shall be marked on the hull.

7 Means to determine the fluid levels of ships tanks shall be provided;

8 A survey shall be conducted by the Naval Administration during construction to confirm the design arrangements and through life at intervals acceptable to the Naval Administration to ensure the agreed level of performance is maintained.

9 An inclining, witnessed and approved by the Naval Administration, shall be conducted at the completion of construction to validate the design and through life at intervals acceptable to the Naval Administration to ensure the agreed level of performance is maintained. Whenever, in comparison with the approved lightship, a deviation in displacement exceeding 2% or a deviation of the Longitudinal Centre of Gravity exceeding 1% of waterline length or a deviation exceeding 1% of the Vertical Centre of Gravity is found, the Stability & Buoyancy operational information (See Regulation 8) is to be renewed and re-approved by the Naval Administration.

10 A lightweight survey (displacement check) shall be witnessed and approved by the Naval Administration through life at 5 yearly intervals or at internals acceptable to the Naval Administration. The lightweight survey (displacement check) may be conducted as an alternative to an inclining test (experiment) (see Paragraph 9) however the ship is to be inclined whenever, in comparison with the approved lightship, a deviation in displacement exceeding 2% or a deviation of the Longitudinal Centre of Gravity exceeding 1% of waterline length is found or anticipated.

Provision of Operational Information

11 The minimum freeboard acceptable to the Naval Administration shall be provided to the ship (see Regulation 8).

Solutions

12 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 4 Reserve of Stability

Functional Objective

1 The ship shall have adequate resistance to inclination to prevent capsize when disturbed and, adequate restoring energy to return to upright once the disturbance is removed, in any Foreseeable Operating Condition.

Performance Requirements

2 The ship shall, in any Foreseeable Operating Condition:

2.1 adequately resist roll, heel or list caused by a disturbance to an extent that permits embarked persons to carry out their duties as safely as reasonably practical;

2.2 return to upright from a roll, heel or list caused by a disturbance subsequent to the removal of the disturbance.

Note: Compliance with this regulation relies on all operations being conducted to standards of good seamanship.

3 The requirements of this Regulation shall be demonstrated by a stability analysis based on the results of the first inclining and prior to the ship proceeding to sea.

Note: This is separate to any operator guidance to be provided under Regulation 8 Provision of Operational Information

4 Any standards, models (numerical or physical), calculations, tests, trials or procedures used to determine the centre of gravity and restoring energy of the ship and the magnitude of foreseeable disturbances shall be made available for approval by the Naval Administration.

5 Any operator guidance as defined in Regulation 8 Provision of Operational Information shall be made available for approval by the Naval Administration. This may include but not be limited to trim & stability handbook, damage control book (where relevant to reserve of stability), stability or loading computer, weather routing advice, operational restrictions, loading guidance, poster, simulator or electronic display required by the crew to safely operate the ship.

Solutions

6 The ship, systems and equipment are to comply with, and be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

<u>Intact Stability</u>

7 The choices for selection of an appropriate solution to the ConOps for intact stability are:

7.1 A standard as prescribed by the Naval Administration

7.2 For ships with similar foreseeable operating conditions to, and a requirement to have similar survivability to, merchant ships the IMO International Code on Intact Stability is appropriate.

7.3 For ships with a requirement to have similar survivability traditionally expected of naval ships the following solution at Paragraph 8 to 15 is appropriate

7.4 For conventional monohull frigate & destroyer combatant hullforms (subject to applicability) the solution at Paragraph 16 is appropriate

8 Intact stability shall be assessed against stability criteria appropriate to the ships operational requirement for the full range of ship loading conditons.

9 Any unusual threats to stability must be investigated separately, assuming the most unfavourable circumstances, and the Naval Administration consulted on the criteria for acceptance.

10 The intact ship shall be assessed against, and must satisfy criteria limits for:

10.1 beam winds combined with rolling due to wave action;

10.2 beam winds combined with rolling due to wave action including topside icing effects;

10.3 lifting of heavy weights;

10.4 high-speed turning;

10.5 crowding of passengers; and

10.6 payload movement where there is a risk to stability (See Paragraph 11)

11 Stability assessment for ships subjected to beam winds and wave action.

11.1 The effects of beam winds and rolling are to be considered simultaneously. Wind heeling levers are calculated using the procedures set out below. A rollback angle of 25° is to be applied to represent the additional energy imparted on the ship by the rolling motion.

11.2 The following wind velocities are to be used in the calculation of the wind heeling lever.

Table 4-1: Wind velocities

Service		Minimum wind velocity
Ocean Unlimited	Ships which may be expected to weather conditions encountered. This includes all ships which move with the operational fleet.	100 knots
Ocean Limited	Ships which may be expected to avoid extreme conditions.	80 knots
Offshore	Ships which may be expected to weather conditions encountered.	60 knots
Restricted Offshore	Ships which may be expected to avoid gale force conditions.	50 knots

Note: Refer to the Guide to the Naval Ship Code for definition of Service Classification and Environmental Conditions

11.3 Windage calculation.

11.3.1 Wind acting on the ship profile above water exerts a heeling moment which is characterised by a heeling lever:

$$\text{Wind Heeling Lever} = \frac{\text{Wind Heeling Moment}}{\text{Displacement}}$$

11.3.2 The heeling moment is calculated for the upright intact case and is then assumed to reduce with angle of heel as a function of cosine^2. This is because both the profile area, and the lever to the centre of lateral resistance, are each deemed to reduce as a function of the cosine of the heel angle.

11.3.3 Integration of the wind pressure profile over the above water profile area should be conducted to find the total force and associated centre of effort applied by the wind. From this the heeling lever can be deduced.

11.3.4 The following equation should be used to calculate the wind heeling pressure to be assumed acting on structure at a given height above the mean waterline:

$$P = \frac{1}{2g}\rho_a v^2 C_D C_C$$

Where:

P	=	Wind pressure [te/m^2]
g	=	Acceleration due to gravity [m/s^2]
ρ_a	=	Density of air [te/m^3]
v	=	Wind velocity at the required height above waterline [m/s]
C_D	=	Assumed effective drag coefficient
C_C	=	Height dependant correlation coefficient necessary to bring the pressures calculated using the equation into line with empirically derived data

11.3.5 The assumed wind velocity profile is described by:

$$v = V\left[\frac{Z}{10}\right]^{1/7}$$

Where:

v	=	velocity at height Z [m/s]
V	=	"nominal" wind velocity at 10 metres above the mean waterline [m/s]
Z	=	Height above the mean waterline [m]

11.3.6 The correlation coefficient at height Z (m) is given by whichever of the following two equations provides the lower value:

$$C_C = 1.0113 + 0.0046Z$$
$$C_C = 1.0488 - 0.0056Z$$

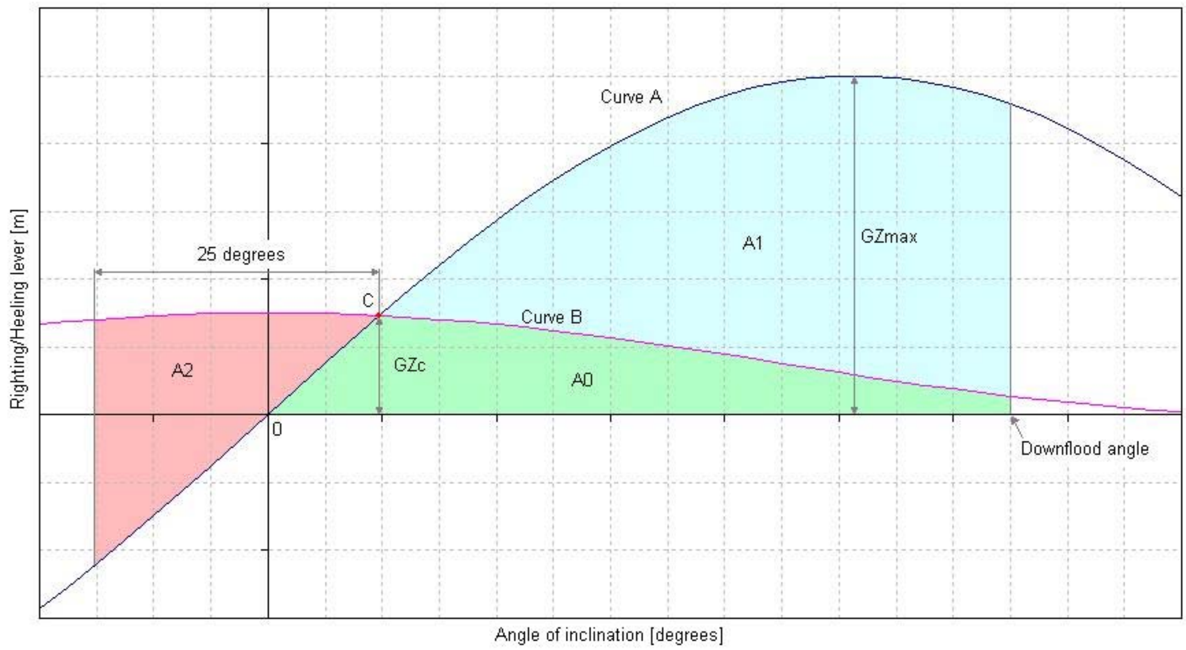
11.3.7 The empirical data on which the above equations are based covers heights above the mean waterline of between zero and 30.5m. Use of this method for extrapolation beyond this range should be undertaken with care.

11.3.8 It is noted that the pressure curve described by these equations reaches a maximum of 0.239te/m^2 at a height of 41.62m above the mean waterline. It is recommended that a horizontal tangent to the pressure curve is assumed when estimating wind-heeling pressure at heights in excess of 41.62m.

11.4 Criteria for adequate stability.

11.4.1 The criteria for adequate stability under adverse wind and sea conditions are based on a comparison of the ship's righting lever and wind heeling lever, shown as Curve A and Curve B respectively in Figure 4-1 below.

Figure 4-1: Righting and heeling levers



Curve A	Intact righting lever.
Curve B	Heeling lever due to wind/lifting/turning/crowding.
Point C	Intact equilibrium point.
GZc	Righting lever at point C.
GZmax	Maximum righting lever.
Downflood angle	Angle of unrestricted downflooding or 70°, whichever is less.
Area A0	Area to the right of zero degrees inclination that is below Curve A, below Curve B and bounded by a vertical line at the downflood angle.
Area A1	Area to the right of point C that is below Curve A, above Curve B and bounded by a vertical line at the downflood angle.
Area A2	Area to the left of point C that is above Curve A, below Curve B and bounded by a vertical line 25 degrees to the left of point C.
Area A3	Area under the intact righting arm curve between zero degrees inclination and a vertical line at the downflood angle.

11.4.2 Apply the heeling lever as Curve B to the intact righting curve as shown in Figure 4-1

11.4.3 Adequate stability is achieved when the following criteria are met:

11.4.3.1 Area $A_1 \geq 140\%\ A_2$

11.4.3.2 Intact righting lever $GZ_C \leq 60\%\ GZ_{max}$

12 Stability assessment for Ships subjected to beam winds and wave action including topside icing effects.

12.1 For ships which may be expected to operate in areas where icing is possible, stability under icing must be proven in all load cases. Alternative criteria are to be used where ships routinely operate with a high probability of ice accretion.

12.2 The following procedure is to be used to ascertain the stability of a ship under icing:

12.2.1 Assume 150mm of ice uniformly distributed over all exposed horizontal decks, platforms and roofs. The density of this ice is to be taken as $950kgm^{-3}$.

Note: Where it is considered appropriate to use an alternative icing allowance it is to be agreed with the Naval Administration.

12.2.2 The weight and centre of gravity of the ice is to be taken into account in the calculation of the righting lever curve.

12.2.3 The operational wind speed is to be taken as 70% of the wind speed used in the assessment of stability when subjected to beam winds and wave action.

12.2.4 Calculate the wind heeling lever curve ignoring the increased profile area due to the ice thickness, but allowing for the increased ship draught resulting from the increase in displacement due to icing.

12.2.5 A rollback angle of 25° is to be applied to represent the additional energy imparted on the ship by the rolling motion.

12.3 Criteria for adequate stability.

12.3.1 Apply the heeling lever as Curve B to the intact righting curve as shown in Figure 4-1.

12.3.2 Adequate stability is is achieved when the following criteria are met:

12.3.2.1 Angle of inclination at C ≤ 30 degrees

12.3.2.2 Intact righting lever GZc ≤ 60% GZmax

12.3.2.3 Area A1 ≥ 140% Area A2

13 Stability assessment for lifting of heavy weights.

13.1 Calculations must be undertaken to demonstrate that a ship fitted with cranes or other lifting gear has an acceptable level of stability while lifting weights. A heeling lever due to lifting of heavy weights must therefore be superimposed onto the intact righting lever curve.

13.2 When assessing the effect of lifting heavy weights the weight must be included in the loading condition and is assumed to be on the centreline initially.

13.3 All possible positions of the jib/boom are to be considered.

13.4 The heeling lever is to be calculated as below:

$$\text{Heeling lever [m]} = \frac{w(a\cos\theta + d\sin\theta)}{\Delta}$$

Where:
- w = Weight being lifted [tonnes]
- a = Offset of point of suspension (top of lifting boom) from ship's centreline [m]
- d = Height of point of suspension above the weight's original position [m]
- θ = Angle of inclination [degrees]
- Δ = Displacement (including weight, w) [tonnes]

13.5 Criteria for adequate stability.

13.5.1 Apply the heeling lever as Curve B to the intact righting curve as shown in Figure 4-1.

13.5.2 Adequate stability is is achieved when the following criteria are met:

13.5.2.1 Angle of inclination at C ≤ 15 degrees

13.5.2.2 Intact righting lever GZc ≤ 60% GZmax

13.5.2.3 Area A1 ≥ 40% Area A3

14 Stability assessment of crowding of passengers.

14.1 Calculations must be undertaken to demonstrate that the ship has an acceptable level of stability in the event of passenger crowding to an extreme of the ship's beam. A heeling lever due to passenger crowding must therefore be superimposed onto the intact GZ curve.

14.2 The weight of the crew should be included in the ships loading condition, whereas the weight of passengers is considered as an additional load.

14.3 Curves of levers are to be calculated assuming all passengers are standing on the upper deck.

14.4 Assume worst case passenger shift to port/starboard of centreline and that each passenger occupies $0.25m^2$. Each passenger is assumed to weigh 80kg.

14.5 The heeling lever is to be calculated as below:

$$\text{Heeling lever [m]} = \frac{wa\cos\theta}{\Delta}$$

Where: w = Weight of passengers [tonnes]
a = Distance of centre of gravity of passengers from centreline [m]
θ = Angle of inclination [degrees]
Δ = Displacement (including passenger weight, w) [tonnes]

14.6 Criteria for adequate stability.

14.6.1 Apply the heeling lever as Curve B to the intact righting curve as shown in Figure 4-1.

14.6.2 Adequate stability is is achieved when the following criteria are met:

14.6.2.1 Angle of inclination at C ≤ 15 degrees

14.6.2.2 Intact righting lever GZc ≤ 60% GZmax

14.6.2.3 Area A1 ≥ 40% Area A3

15 Stability criteria for high-speed turning.

15.1 Calculations must be undertaken to demonstrate that a ship has an acceptable level of stability whilst conducting high-speed turns. A heeling lever representing the effect of centrifugal force must therefore be superimposed onto the intact righting lever curve.

15.2 The steady turn radius can be assumed to be one half of the tactical diameter. If the tactical diameter is not known an estimate can be made. For combatants a value of 2.5 times length between perpendiculars (LBP) is to be taken as the steady turn radius. For auxillaries a value of 3.5 times length between perpendiculars (LBP) is to be taken as the steady turn radius.

15.3 The heeling lever is to be calculated as below:

$$\text{Heeling lever [m]} = \frac{V^2 a \cos\theta}{gR}$$

Where:
V = Ship speed in turn (65% of approach speed) [ms^{-1}]
a = Vertical separation of KG and centre of lateral resistance (½ draught) [m]
Θ = Angle of inclination [degrees]
g = Acceleration due to gravity [ms^{-2}]
R = Radius of turn [m]

15.4 Criteria for adequate stability.

15.4.1 Apply the heeling lever as Curve B to the intact righting curve as shown in Figure 4-1.

15.4.2 Adequate stability is is achieved when the following criteria are met:

15.4.2.1 Angle of inclination at C ≤ 15 degrees

15.4.2.2 Intact righting lever GZc ≤ 60% GZmax

15.4.2.3 Area A1 ≥ 40% Area A3

16 The following intact stability criteria is only applicable to upright conventional monohull frigate & destroyer combatant hullforms with single or twin rudders and the following hullform characteristics:

Table 4-2: Scope of Ship applicability

Parameter	Minimum	Maximum	Definition
D	1730	10220	Displacement (tonnes)
L	78	142	Length on waterline (m)
B	11	19	Breadth on waterline (m)
L/B	6.75	9.23	Length to beam ratio
C_B	0.44	0.55	Block coefficient
C_{WP}	0.64	0.81	Waterline coefficient
C_{VP}	0.59	0.73	Vertical prismatic coefficient
T	3.29	6.91	Mean draft at amidships (m)
f_m	4.13	6.91	Mean freeboard at amidships (m)

16.1 The criteria have been developed on the basis of unlimited operation using North Altantic wave scatter with associated wind speeds.

Note: The background to the derivation of the criteria is contained in the Guide to the Naval Ship Code.

16.2 All users must exercise their professional judgement when applying the criteria to specific ships. In particular, it is essential to take account of any special characteristics of the ship or its intended role and apply whatever additional criteria that may be appropriate.

16.3 Intact stability shall be assessed against stability criteria appropriate to the ships operational requirement for the full range of ship loading conditons.

16.4 Any unusual threats to stability and the influence of novel features must be investigated separately, assuming the most unfavourable circumstances, and the Naval Administration consulted on the criteria for acceptance. The following intact criteria for adequate stability does not address the following hazards, which must be addressed by other criteria acceptable to the Naval Administration (See Paragraph 11).

16.4.1 topside icing effects;

16.4.2 lifting of heavy weights;

16.4.3 high-speed turning;

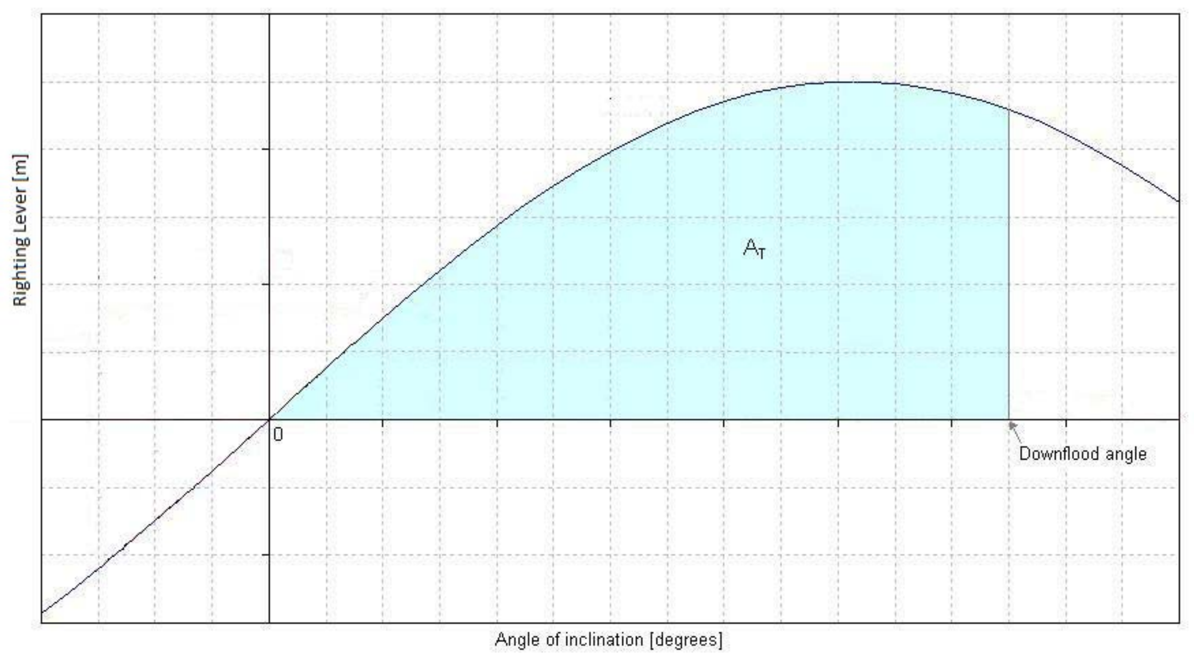
16.4.4 accidental payload movement; and

16.4.5 crowding of passengers.

16.5 Criteria for adequate stability for ships subjected to wind and wave action.

16.5.1 The criteria for adequate stability under adverse wind and sea conditions are based on the area under the ship's righting lever shown in Figure 4-2 below.

Figure 4-2: Righting lever



Downflood angle	Angle of unrestricted downflooding or 70°, whichever is less.
Area A_T	Area under the righting arm between upright and the downflood angle.

Note: Wind heeling levers are not required to be applied as an allowance for windage affects is included in the A_T criterion.

16.5.2 Adequate stability is achieved when the following criteria are met using the watertight hull envelope up to the weather deck (i.e. no allowance for superstructure) :

Table 4-3: Service Stability Criteria

Service	Area A_T	GM_f
Ships which may be expected to weather all conditions encountered.	≥ 0.38mrad	> $0.001B^2$

Regulation 5 Controllability

Functional Objective

1 The ship in all Foreseeable Operating Conditions shall have adequate controllability to maintain speed and heading when underway in order to avoid normal shipping hazards.

Performance Requirement

2 The ship shall have a system that allows its velocity (speed and direction) to be changed to avoid normal shipping hazards.

3 Crash stop, turning circle and initial turning predictions and manoeuvring trials shall be conducted to confirm the ability of the ship to avoid normal shipping hazards.

4 Controllability prediction; Zig-zag and spiral manoeuvre trials shall be conducted to confirm the ability of the ship to control heading and identify any control dead band.

5 Operator Guidance pertaining to the manoeuvring characteristics as defined in Regulation 8 shall be made available for approval by the Naval Administration.

Solutions

6 Following Naval Administration agreement, the ship systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Note: Possible controllability standards dependent upon the CONOPs include IMO Resolution MSC.137(76) Standards for Ship Manoeuvrability and STANAG 4721 Naval Surface Ship Manoeuvring Performance and Requirements.

Regulation 6 Safety of Embarked Persons

Functional Objective

1 The ship shall behave in a manner that allows embarked persons to carry out their duties as safely as reasonably practical, in all Foreseeable Operating Conditions.

Performance Requirements

2 The behaviour of the ship in a seaway shall;

2.1 be optimised considering the stability requirements and the safety of embarked persons in heavy weather;

2.2 be assessed to determine any limitations to safe operation, in all Foreseeable Operating Conditions;

2.3 not prevent the essential safety functions from remaining operational.

Protection of Personnel

3 Where persons onboard can access an exposed deck, that deck shall have means of preventing a person falling from that deck (whether overboard or to another deck).

Note: This includes temporary openings in decks for maintenance or other purposes.

4 Both internal and external access routes to all work spaces and emergency positions shall have means (such as handholds) to assist cautious movement about the ship by persons onboard in adverse weather conditions.

Note: This includes access to all work spaces and emergency positions such as the emergency towing point, muster stations and any access points to inspect main sub-division compartments after a breach of watertight integrity.

5 All work stations shall have means (such as handholds, seatbelts or harnesses) to assist persons onboard to remain in position and conduct normal duties in adverse weather conditions.

6 A survey shall be conducted by the Naval Administration during construction to validate the design and at acceptable intervals through life to ensure the agreed level of performance is maintained.

7 Visual inspection of guardrails, handrails and safety points shall be conducted routinely at intervals acceptable to the Naval Administration.

8 Load testing of guardrails, handrails and safety points shall be conducted during construction to validate the design and through life at intervals acceptable to the Naval Administration.

9 A log of visual inspection and load testing results shall be maintained.

Ship Motions

10 The ship shall have acceptable Motion Induced Interruptions (MII), Motion Sickness Incidence (MSI), deck wetness and other measures to permit embarked personnel to undertake their duties safely. Appropriate methods shall be used to determine the limitations of safe operation and impact of motions on essential safety functions.

Note: Normally requires a combination of at least two methods such as numerical calculation, simulation, model test and full-scale trials.

Solutions

11 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 7 Preservation of Life

Functional Objective

1 The ship shall provide a safe haven following an extreme event, for at least the duration required to evacuate all embarked persons using the ships own escape and evacuation system.

Performance Requirements

2 Subsequent to an extreme event, the ship shall not take up an attitude that prevents:

2.1 movement through the ship by embarked persons to a safe haven;

2.2 the use of sufficient evacuation arrangements and life saving equipment provided under Chapter VII of the Naval Ship Code to evacuate the ship.

3 The ship shall have a margin of reserve of buoyancy and stability beyond the Foreseeable Operating Conditions that will allow embarked persons to evacuate the ship using available evacuation arrangements and life saving equipment as provided under Chapter VII of the Naval Ship Code.

4 This regulation shall not apply following a catastrophic event.

5 Model tests, numerical analysis, calculation, simulation or other methods are to be used to determine the margin of buoyancy, stability, ship attitude and the ability for persons onboard to evacuate following extreme threat damage or extreme flooding.

6 The attitude of the ship and the margin on buoyancy and stability following extreme threat damage or extreme flooding, including transient effects, shall permit embarked personnel to carry out any necessary action following an extreme event.

Solutions

7 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 8 Provision of Operational Information

Functional Objective

1 Information required by the ships crew, pertaining to the stability and buoyancy of the ship, shall be provided & maintained with the ship to facilitate its' safe operation in all Foreseeable Operating Conditions and for escape, evacuation and rescue.

Performance Requirements

<u>Watertight & Weathertight Boundaries</u>

2 The Commanding Officer shall be provided with information to maintain the watertight & weathertight integrity of the ship. The content of this information shall contain as a minimum;

2.1 the extent, location and capabilities of watertight and weathertight boundaries, including access trunks, tunnels & scuttles;

2.2 the locations of watertight and weathertight closing devices, including portable plates, for personnel & cargo/payload access;

2.3 the location of penetration closing devices including remote actuation points;

2.4 the locations of downflooding points;

2.5 the operational system & markings for opening closures at sea;

2.6 the drainage arrangements of enclosed spaces; and,

2.7 the location & capacity arrangements for the removal of liquids.

Stability & Buoyancy

3 The Commanding Officer shall be provided with information, in paper format, to maintain adequate buoyancy and stability of the ship. The content of the buoyancy and stability information shall contain as a minimum:

3.1 Instructions on operation including:

3.1.1 The stability standard or requirements;

3.1.2 General precautions against capsize;

3.1.3 Loading & operating restrictions;

3.1.4 Crossflooding arrangements [if fitted];

3.1.5 Verifying compliance with the stability standard;

3.1.6 Trim and draught limitations;

3.1.7 Free surface effects;

3.1.8 Payload heeling effects;

3.1.9 Loading and unloading precautions;

3.1.10 Securing arrangements;

3.1.11 Control of openings;

3.1.12 Loll;

3.1.13 Hull strength;

3.1.14 Stability or loading computer [if fitted];

3.1.15 Non sailing conditions [if applicable]; and

3.2 Particulars of the ship;

3.3 Details of the lightship & its derivation;

3.4 Details of hydrostatics & cross curves of stability;

3.5 Total capacity, centroid and maximum free surface moment of tanks stores & cargo spaces plus other payload data;

3.6 Sounding or ullage tables for each tank including capacity, centroid and free surface moment;

3.7 Example calculations of stability;

3.8 Example ship conditions compliant with stability requirements;

3.9 Damage stability information demonstrating ship survivability following foreseeable, extreme & catastrophic damage; and

3.10 Methods to recover margins of buoyancy and stability.

Note: The methods documented should assist the operator by providing recommended trigger points for the commencement of evacuation.

4 If a stability or loading computer is fitted to the ship then it is to reflect the contents of paragraph 3. If it is the main source of verifying compliance with stability and buoyancy requirements for conditions outside the scope of the paper format examples provided, then a duplicate backup facility shall be provided on board.

Note : Onboard stability or loading computers can be beneficial to determine the survivability of the ship in the event of forseeable & extreme damage

Note: Refer to the Guidelines for the Approval of Stability Instruments, developed by the IMO. (MSC/Circ.1229).

<u>Collision Avoidance</u>

5 The Commanding Officer shall be provided with information pertaining to the manoeuvring characteristics of the ship to assist in the avoidance of collisions and groundings. The content of this information shall contain as a minimum:

5.1 the turning characteristics including initial turning;

5.2 the stopping & accelerating characteristics;

5.3 the effects of squat & manoeuvring in shallow water;

5.4 the effects of wind on manoeuvring; and,

5.5 the minimum manoeuvring speed.

Note: Examples of Collision Avoidance Operational Information are i) ANEP-79 Controllability and safety in a seaway, and ii) IMO resolution A.601(15) Provision and display of manoeuvring information on board ships

<u>Dynamic Motions</u>

6 The Commanding Officer shall be provided with information pertaining to ship operations (e.g. in heavy weather) or manoeuvres in order to minimise risk/reduce hazards to crew and equipment. The content of this information shall contain as a minimum information on;

6.1 the risk of broaching;

6.2 the shipping of green seas;

6.3 slamming;

6.4 heel in turn characteristics;

6.5 the impact of motions on the safety of the crew and essential safety functions; and

6.6 practices or methods specific to the ship to reduce the impact of motions on the safety of the crew and equipment.

Solutions

7 The operational information is to be approved by the Naval Administration as being compliant with the above Performance Requirements.

CHAPTER IV ENGINEERING SYSTEMS

Regulation 0 Goal

1 The Engineering Systems shall be designed, constructed, operated and maintained to:

1.1 Enable their operation in all Foreseeable Operating Conditions;

1.2 Minimise danger to embarked personnel in all Foreseeable Operating Conditions;

1.3 Operate in a predictable manner with a level of integrity commensurate with operational requirements;

1.4 Ensure the watertight and weathertight integrity of the hull, and meet the requirements of Chapter III (Buoyancy and Stability);

1.5 Enable the restarting of shut-down systems and equipment necessary to provide essential safety functions (“dead ship” starting) without external aid in all Foreseeable Operating Conditions;

1.6 Minimise the risk of fire;

1.7 Provide support to the embarked persons and provide essential safety functions in the event of all foreseeable damage at least until the persons have reached a place of safety or the threat has receded;

1.8 Enable the maintenance and repair in the ship’s maintenance plan.

Regulation 1 General

Functional Objective

1 The purpose of this Regulation is to outline the principles and framework of Chapter IV Engineering Systems and its application.

Definitions

Note: Definitions which are applicable to all Chapters are located in Chapter I, Regulation 2.

Agreed	Documented confirmation between the owner, the designer and the Naval Administration.
Alert system	A means of providing information to the operator that a parameter has deviated from a norm by a defined amount.
Anchoring and mooring equipment	Fixed and non-fixed devices to hold a ship in position such as anchors, windlasses, bollards, fairleads, chains and mooring ropes.
Closed down conditions	Operational conditions where the ship is secured for enhanced levels of integrity as defined by the Naval Administration. This may include watertight integrity or protection in a Chemical, Biological, Radiological or Nuclear environment.

Complex electronic component	The term complex electronic component refers to software and hardware. The complex electronic component is generally part of a larger system, but there may be cases where the entire technological system is composed of complex electronic components. Complex electronic components include, but are not limited to: a. All forms of electronically executed algorithm(s) and associated data (such as configuration data, digital maps, look-up tables). b. Bespoke software including both embedded and computer platform type elements. c. Databases, spreadsheets and other data. d. Firmware including all forms of programmable logic and associated data. e. COTS software and other legacy software elements that would fall into one of the above categories if they were being used in the development of a project. f. Bespoke hardware and hardware that is modifiable after manufacture. g. COTS hardware (including processors and computer platform hardware) and custom manufactured hardware, including Application Specific Integrated Circuits (ASICs).
Conning position	A location where personnel can direct the manoeuvring of the ship.
Control station	A location from where the machinery or equipment can be operated or from which operations can be directed. See also definition of Control Stations in Chapter VI.
Emergency generator	A fully independent generator located above the submergence limit for autonomous operation in supplying the Essential Electrical Services. (The independence extends to the fuel storage and supply system, an associated switchboard, transitional power and electrical distribution).
Emergency operation	A machine or system has suffered a failure and functionality is reduced to the minimum level required to maintain the safety of the system or ship.
Engineering systems	Machinery and its associated control, auxiliaries and support systems including electrical generation, distribution, lighting and other electrical services.
Escape, evacuation and rescue lighting	A combination of secondary and tertiary lighting specifically arranged to enable escape, evacuation and rescue.
Fail safe	Fail to the least hazardous or known state to prevent further damage to the equipment, platform or personnel.
Hazardous area	Any space that represents a risk to personnel or platform. This could be as a result of but is not limited to the following: a. flammable atmospheres including dust laden atmospheres; b. areas that contain electrical and electronic equipment; c. confined spaces or spaces where oxygen content may be depleted; d. gas storage rooms; e. Areas of high noise level; f. Areas with equipment that may move unexpectedly; g. Refrigeration spaces; h. Cleaning or chemical stores; i. Areas with radiation hazards (inc. sonar dome spaces, antennas etc).

Integrity	Capability of a system to satisfactorily perform the required functions under all the stated conditions within a stated period of time.
Isolation	The disconnection, separation and dissipation of every source of energy from the equipment in such a way that this disconnection and separation is secure.
Lifting appliance	Fixed or non fixed equipment used to lift a mass from a horizontal surface. This includes loose gear such as strops, ropes, slings, hooks, D-rings etc.
Machinery control position	An area or areas within the machinery spaces from which the propulsion and manoeuvring machinery may be directly monitored and controlled.
Machinery control room	An area or room, other than the navigation bridge, from where the propulsion and manoeuvring machinery may be remotely monitored and controlled.
Main electrical services	All electrical loads required for maintaining the operational status of the ship and habitable crew conditions.
Manoeuvring equipment	Manoeuvring equipment includes the use of conventional electric and electro hydraulic steering gear as well as, but not limited to, Azimuthing Thrusters, Athwartships thrusters, water jets and propulsion machinery in the case of ships fitted with more than one shaft.
Mechanical Locking	Hydraulic locking or any other condition where the equipment becomes mechanically locked and so can not be operated.
Navigation bridge	An area or room where the ship's navigational controls and other essential equipment related to ship operations are housed and operated. The Naval Administration may identify alternative navigation locations. “Navigation Bridge” in this Chapter refers to any of these locations.
Normal operation	Full functionality of the machinery or system is available.
Novel arrangements	Any piece of equipment or system with an unconventional design, construction, installation or operation as agreed with the Naval Administration.
Operational lighting	Fixed lighting as required for special purposes with different levels of illumination from primary and secondary lighting.
Portable lighting	Non-fixed, portable lighting which may be used to support other lighting systems.
Pressure systems	A system containing pressure other than at atmospheric which may include boilers, piping, heat exchangers, accumulators, pumps, compressors and valves.
Primary lighting	Fixed lighting provided for safe access around the ship and those compartments accessed during normal operations and carrying out operations at control stations.

Propulsion machinery	Propulsion machinery includes all the equipment and systems required to generate thrust including but not limited to: a. prime mover (internal combustion engine, Gas turbine, Electric motors, Steam turbine; b. Combined propulsion and manoeuvring devices (including but not limited to, azimuthing thrusters, athwartship thrusters, water-jets); c. Boilers; d. Gearing; e. Shafting and couplings; f. Propellers (fixed pitch or controllable pitch); g. Auxiliaries (Generators, oil supply, sources of lube oil pressure, sources of water pressure, combustion air supply (if applicable), starting systems, main propulsion control systems (hydraulic, pneumatic, electrical)).
Reversionary operation	A machine or system is reconfigured to maintain the agreed level of functionality.
Secondary lighting	Fixed replacement lighting in the event of primary lighting failure. This may be at a lower illumination level.
Tertiary lighting	Fixed independent lighting system to provide a minimum level of illumination on failure of primary and secondary lighting.
Transitional lighting	Fixed lighting provided upon loss of primary lighting and prior to the operation of the secondary lighting, where a level of continuous illumination must be maintained for operational purposes.

2 The requirements for flashpoint of the fuel used for engineering systems within this Chapter are as defined in Chapter I.

International Maritime Organization (IMO) Documents

Abbreviation	Title	Resolution No. (if applicable)	Amendments incorporated into or reviewed and applicable to ANEP-77	Amendments under review for ANEP-77
SOLAS	International Convention for the Safety of Life at Sea, Consolidated Edition 2009	-	MSC.201(81) MSC.204(81) MSC.216(82) Anx 3 MSC.256(84) MSC.257(84) MSC.258(84) MSC.269(85) MSC.282(86) MSC.283(86) MSC.290(87) MSC.291(87) MSC.308(88) MSC.309(88) MSC.317(89)	MSC.325(90)

Application

3 In addition to the requirements contained elsewhere in the present regulations, ships shall be designed, constructed and maintained in accordance with the structural, mechanical and electrical requirements of a classification society whose rules and procedures are recognised and validated by the Naval Administration, or with applicable standards of the Naval Administration which provide an equivalent level of safety.

4 Chapter IV Engineering Systems is written in a goal based format which specifies high level objectives and relies upon verification against an agreed standard for compliance.

5 For certain ship types, novel craft or for operational reasons the compliance in full with the regulations of this chapter may not be required subject to justification and acceptance by the Naval Administration.

General Performance Requirements

6 Engineering systems shall be designed and constructed to operate in all Foreseeable Operating Conditions.

7 For all engineering systems installed, the choice of materials and components construction as well as the design, location and ship installation shall be made according to the environmental, maintenance and operating conditions in order to ensure the continued function of the equipment during all Foreseeable Operating Conditions and reduce the risk of:

7.1 injury to embarked personnel;

7.2 damage to the equipment, the system it is contained within or adjacent equipment and systems;

7.3 damage to the vessel;

7.4 damage to third parties;

7.5 pollution of the environment.

Note: For all ships, new installation of materials which contain asbestos shall be prohibited

8 Where applicable, engineering systems including system components may be required to operate in one of three modes as agreed by the Naval Administration:

8.1 Normal operation;

8.2 Reversionary operation;

8.3 Emergency operation.

9 Safe access shall be provided to all machinery and systems including access provision in the event of equipment failure.

10 Engineering systems shall be designed in such a way that the essential safety functions can be continuously available following one single operational error and/or system/equipment fault.

11 The availability of engineering systems associated with essential safety functions shall be sustained or restored by means of:

11.1 Reliability, especially of any single points of failure, taking account of e.g. erosion, fatigue, corrosion and mechanical damage due to vibration; and/or

11.2 Redundancy to minimise single points of failure.

12 Means shall be provided to ensure isolation of equipment and systems to allow maintenance to take place safely.

13 Emergency sources of electrical power, fire pumps, bilge pumps except those specifically serving the spaces forward of the collision bulkhead, any fixed fire-extinguishing system required by Chapter VI and other emergency installations which are essential for the safety of the ship, except anchor windlasses, shall not be installed forward of the collision bulkhead.

Solutions

14 Verification that the ship complies with this chapter shall be by the Naval Administration. Provision of evidence to support verification shall be by the owner. All decisions that affect compliance with the requirements of this chapter shall be recorded at all stages from concept to disposal and these records be maintained throughout the life of the ship.

Regulation 2 Concept of Operations Statement

Functional Objective

1 The Concept of Operations Statement is the Owner’s vision of how the engineering systems of the ship are to be operated and maintained throughout the life of the ship and is to be shared by the Naval Administration and, where appointed, it’s Recognised Organisation.

Performance Requirements

2 The scope of the information to be provided is defined in Annex A of Chapter I of the Code. For the purposes of this Chapter, particular importance is to be attached to:

2.1 Mobility - within the operational requirement, a ship's ability to manoeuvre, as and when required by the Command but still remaining within the designed or imposed limitations;

2.2 Operating and maintenance procedures - documentation relating to equipment and systems, operating and maintenance procedures and requirements, including reversionary modes and breakdown drills;

2.3 Personnel - including all individuals whose intervention is relied upon to maintain safety.

Solutions

3 Approval of the Concept of Operations Statement shall be by the Naval Administration.

Regulation 3 Provision of Operational Information

Functional Objective

1 Operators shall be provided with adequate information and instructions for the safe operation and maintenance of all machinery and systems.

Performance Requirements

2 Information and instructions shall be supplied to the operator to ensure the safe operation, fault finding and maintenance of machinery, under all Foreseeable Operating Conditions.

3 Such instructions shall define the safe operating limits and make it clear that operation outside these limits is unsafe and can damage equipment and systems.

4 The operator instructions shall be presented in a language and format that can be understood by the operator in the context in which it is required.

Solutions

5 The operational information is to be approved by the Naval Administration as being compliant with the above Performance Requirements.

Regulation 4 Propulsion

Functional Objective

1 The propulsion machinery shall enable the ship to manoeuvre as and when required by the Command but still remain within the designed or imposed limitations.

Performance Requirements

2 To enable the vessel to manoeuvre, this regulation shall be applied in conjunction with Regulation 5 Manoeuvring.

3 Redundancy of propulsion equipment shall be provided. The Naval Administration shall give consideration of the reliability of single essential propulsion components on application.

4 The propulsion equipment and systems shall be designed, constructed and maintained to minimise danger to personnel onboard in all Foreseeable Operating Conditions.

5 Essential safety functions shall be continuously available or recoverable without compromising the safety of the vessel following a single operational action or system / equipment fault.

6 The design, construction, installation and operation of propulsion equipment shall not cause interference or excessive forces that could lead to its failure or failure of other equipment and systems.

Note: The Naval Administration may impose additional requirements for the reduction of vibration for operational reasons.

7 The requirements for manoeuvrability as required by Chapter III Regulation 5 Controllability apply in addition to these requirements.

8 Effective means of communicating orders from the normal and emergency conning positions to any position from which the speed and direction of thrust of the propellers can be controlled shall be provided.

9 Means shall be provided whereby normal operation of propulsion machinery can be sustained or restored even though one of the essential auxiliaries becomes inoperative.

10 Means shall be provided to ensure that the propulsion machinery can be brought into operation from the dead ship condition without external aid.

11 Fuel supply arrangements from internal storage tanks are to be such that adequate reserve of fuel is available without continuous transfer of fuel and that means are provided to ensure that this reserve is of a suitable quality for use.

Solutions

12 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 5 Manoeuvring

Functional Objective

1 The manoeuvring equipment shall enable the ship to manoeuvre as and when required by the Command whilst remaining within the design or imposed limitations.

Performance Requirements

2 Machinery and systems required for manoeuvring shall meet the relevant requirements of Chapter III Regulation 5 Controllability.

Note: Consideration should be given to the effects of the failure of stabilisers (if fitted) and use of steering gear for roll compensation.

3 The manoeuvring equipment system shall exhibit sufficient redundancy to cope with single failures without the loss of manoeuvring capability.

4 It shall be considered whether a single failure in the manoeuvring equipment could lead to the possibility of mechanical locking.

5 It shall be possible to operate the manoeuvring equipment from a number of locations to be agreed with the Naval Administration.

6 The operational status of the manoeuvring equipment shall be clearly visible at each control station.

7 The manoeuvring equipment control system shall exhibit sufficient redundancy to cope with single failures of components and electrical supply.

8 Effective means of communicating orders from the normal and emergency conning positions to any position from which the speed and direction of thrust of the propellers can be controlled shall be provided.

9 The motive power supply shall exhibit a level of redundancy, diversity and capacity to ensure that the manoeuvring equipment remains operational and shall exhibit a level of continuity to ensure continuous operation.

Note: This is to include provision of supplies and control in the event of damage to the platform.

10 Sufficient electrical protection measures shall be provided to prevent machinery & control system damage in accordance with Regulation 12 Electrical Protection Arrangements.

11 The manoeuvring equipment shall fail safe and exhibit alternative modes of operation to fulfil the manoeuvring requirements during a failure condition.

12 Clear system diagrams and instructions shall be provided detailing the change over procedures and the actions to be completed in the event of machinery breakdown.

Solutions

13 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 6 Pressure and Piping Systems

Functional Objective

1 Pressure vessels and associated piping systems and fittings shall be of a design and construction adequate to safely contain media, taking account of the anticipated pressure and temperature profiles and the service for which they are intended.

Performance Requirements

2 The system shall be designed and constructed to operate safely in static and transient conditions.

3 Surface temperatures of pipes shall not pose a danger to personnel or become a source of ignition in case of flammable fluid leaks.

4 Provision shall be made to reduce to a minimum the entry of contaminants into pressure systems and to provide drainage points for systems as required.

5 Where media quality is required to be maintained, system materials and system operation shall be compatible with the media. Means of testing and treatment shall be provided.

6 Valves associated with maintaining watertight integrity shall be operable from a position as defined in Chapter III Buoyancy, Stability and Controllability.

7 Suitable precautions against the build up of electrostatic charges shall be provided.

8 Pressure relief arrangements shall be fitted to prevent overpressure in excess of the design pressure in any part of a pressure system. The relief setting, quantity, location and flow capacity of the pressure relief devices installed shall be suitable to mitigate the consequences of excessive overpressure.

9 Pressure relief arrangements shall not pose a danger to personnel, the environment or any other ship system. Where the media contained poses a safety hazard to personnel or the environment, arrangements shall be put in place to minimise the risk following release.

10 Failure of a joining arrangement shall not pose a further risk (e.g. due to atomisation of hydrocarbons, leakage of water onto electrical equipment etc).

11 Essential systems may require suitable means of reconfiguring the system to be provided.

Solutions

12 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 7 Ship Stabilising Systems

Functional Objective

1 Where considered necessary, Ship Stabilising Systems shall be fitted to reduce ship motions to limits compatible with personnel endurance and the ships sea-keeping requirements.

Performance Requirements

2 The requirements for manoeuvrability as required by Chapter III Regulation 5 Controllability apply in addition to these requirements.

3 The requirements for watertight integrity and stability required by Chapter III Regulation 2 Watertight Integrity and Regulation 4 Reserve of Stability apply in addition to these requirements.

4 The requirements of Chapter VII, Regulation 22, Paragraph 8.5 apply in addition to these requirements.

5 The ships stability requirements shall not be reliant on ship stabilising systems.

6 The ship stabilising system shall be fully automatic in operation.

7 Control systems shall be in accordance with Regulation 13 Machinery Control.

8 Alerts and indicators shall be in accordance with Regulation 14 Alerts and Safety Systems.

9 It shall be considered whether a single failure in the ship's stabilising equipment could lead to the possibility of mechanical locking.

10 It shall be possible to lock the stabiliser fins in a known position.

11 Failure of any part of the stabiliser unit or its control system shall not result in an unsafe condition which will have detrimental effect on the ship's operating or sea-keeping capability.

Solutions

12 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 8 Other Essential Safety Functions

Functional Objective

1 The ship's machinery outfit shall provide services for essential safety functions not described elsewhere in this Code.

Performance Requirements

2 Arrangements for the continuous supply of energy to essential machinery shall be provided.

3 A fire main system shall be available which is capable of providing essential safety functions required by Chapter VI Fire Safety Regulation 9.

4 Where a ship is expected to receive low-flashpoint fuels, a suitable system is required for its storage, use or safe disposal.

5 Bilge pumping arrangements are to comply with the requirements of:

5.1 Chapter III Buoyancy, Stability and Controllability;

5.2 Chapter VI Fire Safety.

6 Where operation of essential safety functions is reliant on the continuous removal of heat, they shall be provided with an alternative method of cooling or appropriate redundancy.

Solutions

7 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 9 Electrical Generation and Power Supplies

Functional Objective

1 Sufficient electrical power shall be provided to supply the required services and habitability requirements during all operational conditions without recourse to the emergency electrical supply.

2 Sufficient electrical power shall be provided to supply services for essential safety systems during various emergency conditions.

3 Transitional power supplies shall be provided where no interruption of the electrical supply to essential safety systems is required.

Performance Requirements

4 Suitable arrangements shall be provided for the supply of electricity sufficient to supply the consumers agreed by the Naval Administration during:

4.1 All operational conditions;

4.2 Irrespective of the direction of the propulsion shaft rotation;

4.3 Without any requirement to use emergency supplies.

5 Suitable redundancy arrangements shall be provided to supply essential safety functions in the event of loss or unavailability of the largest generator.

6 Suitable protection measures shall be provided in accordance with Regulation 12 Electrical Protection Arrangements.

7 No electrical equipment shall be put into use where its strength and capability may be exceeded in such a way as may give rise to danger or may affect essential safety functions.

8 Where applicable, facilities to safely connect shore side electrical power shall be provided.

9 Facilities shall be provided to regain sufficient power to restore essential safety functions from a dead ship condition.

10 Suitable arrangements for the safe installation and use and maintenance of energy storage devices shall be provided.

11 In the event of failure of the Main Electrical Supply, a means to supply sufficient electricity to supply the Essential Electrical Services shall be provided within a specified time and a duration accepted by the Naval Administration.

12 Where a main generator is used in lieu of the emergency generator, subject to complying with necessary requirements, the requirements of the emergency source of power are to be applied to the main source of power.

13 For essential safety functions for which an interruption to supply is unacceptable, transitional electrical supplies with sufficient capacity and duration accepted by the Naval Administration shall be provided.

14 The power supply to Escape, Evacuation and Rescue systems is to be provided as per the requirements of Chapter VII Regulation 14 Power Supply to Escape, Evacuation and Rescue Systems.

Solutions

15 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 10 Electrical Distribution and Equipment

Functional Objective

1 Electrical power shall be distributed safely to consumers.

Performance Requirements

2 Electrical equipment is to meet the requirements of Regulation 9 paragraph 7 in terms of suitability for the quality of electrical power supply.

3 Electrical equipment and distribution systems are to meet the requirements of Regulation 12 Electrical Protection Arrangements.

4 The electrical system voltages and frequencies shall be ensure safe provision of electrical power to systems and to minimise the risk of exposure to personnel.

5 The design of the type and configuration of the distribution system is to consider earthing arrangements to minimise the risk to personnel and equipment under normal and foreseeable abnormal conditions .

6 The number, size, installation and arrangement of electrical switchboards and distribution centres shall be suitable for the functional requirements of the vessel.

7 Emergency sources of power and its distribution system shall be designed and arranged with a high level of integrity and availability.

8 Materials used in electrical distributions systems, particularly cables, are to comply with Regulation 1, paragraph 7.

9 Cables shall be installed such that risk of injury to personnel or damage to the system is minimised when equipment is operating in foreseeable or under fault conditions.

10 Main and emergency supplies, where required for a single consumer, shall be separated as widely as possible.

11 The continuity of supply to Essential safety functions shall be ensured.

12 Suitable arrangements for the isolation and switching of distribution circuits shall be provided.

13 Installation of cables shall not cause mutual interference between systems.

14 Suitable protection arrangements for the use of portable electrical equipment shall be provided

15 Effective means of communications, complying with the requirements of Chapter VIII, Regulation 6, are to be provided between all switchboards.

16 Where a damage control emergency distribution system is installed, it shall not introduce additional risk of harm to personnel, equipment or the platform.

Solutions

17 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 11 Lighting

Functional Objective

1 Illumination shall be provided appropriate for location and operational requirements in both normal and emergency conditions.

Definitions

2 For the purpose of this regulation the following descriptions of lighting systems have been used to provide a common vocabulary (Reproduced from Definitions in Regulation 1 General):

2.1 Primary lighting: Fixed lighting provided for safe access around the ship and those compartments accessed during normal operations. Carrying out operations at control stations.

2.2 Secondary lighting: Fixed replacement lighting in event of primary lighting failure. This may be at a lower illumination level.

2.3 Tertiary lighting: Fixed independent lighting system to provide a minimum level of illumination on failure of primary and secondary lighting.

2.4 Transitional lighting: Fixed lighting provided upon loss of primary lighting and prior to the operation of the secondary lighting, where a level of continuous illumination must be maintained for operational purposes.

2.5 Escape, evacuation and rescue lighting: A combination of secondary and tertiary lighting specifically arranged to enable escape, evacuation and rescue.

2.6 Operational lighting: Fixed lighting as required for special purposes with different levels of illumination from primary and secondary lighting.

2.7 Portable lighting: Non-fixed, portable lighting which may be used to support other lighting systems.

Performance Requirements

3 The light fittings selected for a particular compartment shall be appropriate for the hazardous zone classification of the compartment. Refer to Regulation 18 Hazardous Areas.

4 Siting of light fittings is to consider the transfer of heat to adjacent surfaces.

5 Illumination levels are to meet operational requirements.

6 Lighting systems are to permit the vessel to be operated in accordance with the Concept of Operations Statement.

7 Primary lighting systems are to provide a suitable level of illumination:

7.1 to allow safe access to areas of the vessel that require it for normal operations;

7.2 To allow operation and control of the vessel.

8 The lighting system is to be arranged such that a single failure will not cause total loss of illumination in any compartment.

9 In the event of loss of primary lighting, at locations where a level of illumination must be maintained for operational purposes, transitional lighting shall be provided until the secondary lighting is operational. The transitional lighting is to be available for a period acceptable to the Naval Administration.

10 To meet operational requirements, lighting levels are to be controllable locally.

11 Operational lighting shall be provided in areas where there is an operational requirement for different levels of illumination from that provided by the primary system.

12 Lighting required for escape, evacuation and rescue shall be as defined in Chapter VII Regulation 15 Lighting During Escape, Evacuation and Rescue Emergencies and Regulation 18 Way Finding System.

13 Navigation lights shall be as defined in Chapter IX Regulation 9.

14 Where provided, portable lighting shall be appropriate for the hazardous zone classification of the compartment in which it will be used. Refer to Regulation 18 Hazardous Areas.

Solutions

15 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 12 Electrical Protection Arrangements

Functional Objective

1 All electrical equipment shall be suitably protected against damage to itself under fault conditions and to prevent injury to personnel.

Performance Requirements

2 Exposed metal parts of electrical machines or equipment which are not intended to be live but which are liable under fault conditions to become live shall be earthed.

3 A means to detect and alert of insulation breakdown with respect to earth within equipment and distribution systems shall be provided.

4 Suitable protection arrangements from the ingress of solids, liquids and gases shall be provided for all electrical equipment and distribution systems.

5 Efficient means, suitably located, shall be provided for protecting from excess of current every part of a system as may be necessary to prevent danger.

6 Suitable arrangements for the protection of mechanically connected equipment due to the effects of electrical overloads shall be provided.

7 Suitable arrangements for the protection of electrical equipment due to the effects of mechanical overloads shall be provided.

8 Essential safety functions agreed by the Naval Administration shall be supplied using fire-resistant cable.

9 Electrical Equipment and distribution systems shall be suitably protected from mechanical damage.

10 Suitable Security arrangements to prevent unauthorised access to live electrical connections and electrical control shall be provided.

11 Suitable protection arrangements for lightning strikes shall be provided.

12 Alternative arrangements for cooling of essential machinery and systems in the event of a forced cooling system failure shall be provided.

13 Suitable arrangements shall be provided to minimise the effects of radiation hazards to personnel.

Solutions

14 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 13 Machinery Control

Functional Objective

1 Main and Auxiliary Machinery & Systems essential for propulsion and safety of the ship shall be provided with effective means for its operation and control during all ship operational conditions.

Performance Requirements

2 The design, construction and operation of the control systems shall consider human element requirements in accordance with Regulation 17 Human Element.

3 Provisions shall be made to ensure a continuous electrical supply to the essential machinery/systems control system. An audible and visual alert shall be initiated in the event of the failure of any of the power supplies.

4 The control system must operate essential machinery & systems in a safe, controlled and stable manner throughout the machinery's/systems defined operational limits and shall recover automatically in a safe manner after a loss of power supply.

5 It must be possible to control machinery/systems from only one location at a time, with clear indication showing the location of the control. Transfer between control stations without altering the control set points shall be provided. Transfer of control location will be indicated with visual and audible indication.

6 Appropriate indication and feedback shall be provided at each control station to confirm that the system has responded to operator demands. The status of automatic control systems shall be indicated.

7 It must be possible to disable the automatic or remote control operation of essential machinery & systems to allow inspection and maintenance tasks to be safely performed on the machinery and systems.

8 Indications of impending slow-down / shut-down of essential machinery and systems shall be provided at applicable locations with provision to take alternative actions if approved

9 Automated control systems which utilise stored energy to start essential machinery shall be configured not to exhaust the stored energy completely and to provide an alert when the stored energy is below a critical limit.

10 The monitoring system for system parameters is to have integrity appropriate for its intended purpose.

11 For unattended machinery spaces, a machinery control and alarm position shall be provided.

12 Failure of the external control systems for essential safety functions shall initiate an audible and visual alert at the relevant control stations. It shall be possible to override the control system to regain control of the machinery or system.

13 The control system shall fail safe, and where practicable the essential machinery or system shall maintain the last position or state prior to the failure or to a fail safe condition.

14 Operators shall have an independent, high integrity method to disconnect all energy sources that shall put machinery for essential safety functions into a known safe state.

Solutions

15 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 14 Alerts and Safety Systems

Functional Objective

1 The alert system shall inform operators as soon as reasonably practicable of deviations from normal operation of essential machinery and systems during all ship operations.

2 A safety system shall be installed to ensure that any serious malfunctions of machinery or system which present an immediate danger shall initiate a corrective action where appropriate to remove the risk of danger.

Performance Requirements

3 An alert system shall be arranged with necessary panels at key locations as agreed with the Naval Administration.

4 The design, construction and operation of the alert and safety systems shall consider human element requirements.

5 The operational status of the computer based system should be easily recognisable. Alerts should be visually and audibly presented with priority over other information in every operating mode of the system and should be clearly distinguishable from other information. When using general purpose graphical user interfaces, only functions necessary for the respective process should be available.

6 The alert system and safety system shall be provided with a continuous supply of power.

7 Where parameters of the alert system can be adjusted, the integrity of the system shall be maintained.

8 The status of an alert shall be clearly visible and a means to accept it from all appropriate locations as agreed with the Naval Administration. Visual indication of the alarm shall remain until the fault is cleared.

9 Machinery and Systems shut-down by the safety system must be manually reset before allowing a restart.

10 Where the function of a safety system may lead to a greater hazard than the loss of the equipment, the Naval Administration may agree to an override feature.

11 The status of standby machinery & systems shall be indicated at appropriate control stations as agreed with the Naval Administration.

12 As far as practicable the alert and safety systems shall be designed to fail to a safe state.

Solutions

13 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 15 Programmable Electronic Systems (PES)

Functional Objective

1 Additional hazards shall not be introduced by the application of programmable electronic systems.

Performance Requirements

2 These requirements apply in addition to Regulation 13 Machinery Control and Regulation 14 Alerts and Safety Systems.

3 The requirements specified within Regulation 16 Systems Integration shall be met.

4 Safety requirements for systems shall be derived from a top level risk assessment of all reasonably foreseeable accidents. The safety requirements shall be used to determine safety integrity for each complex electronic component.

5 Evidence for the failure modes and failure rates of the complex electronic element shall be provided to the Naval Administration.

6 The computer based system shall comply with the EMC requirements specified in Regulation 10 Electrical Distribution and Equipment.

7 The PES shall be arranged such that the configuration is protected against unauthorised or unintended change.

8 Where applicable, the synchronisation of date and time stamping between separate equipment shall be considered.

9 There shall be no degradation of the sub-system functionality when integrated into a larger system.

10 Programmable electronic systems shall maintain specified levels of performance in operation, and where necessary, under fault conditions.

11 Systems shall be readily usable under all intended operating conditions and shall support effective and efficient operation. Adequate safeguards against incorrect operation shall be provided.

12 The system repeatability and accuracy shall be adequate for the proposed use and shall be maintained at their specified value during their expected lifetime and normal use.

13 Program and data held in the system shall be protected from corruption by loss of power.

14 A management of change process shall be applied to safeguard against unexpected consequences of modifications.

Solutions

15 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 16 Systems Integration

Functional Objective

1 Essential safety functions shall be designed such that risks of harm to personnel, damage to the platform or the environment are reduced to a level acceptable to the Naval Administration, both in normal operation and under fault conditions. Functions shall be designed to fail safe.

Performance Requirements

2 The integrity of essential machinery or systems, during normal operation and fault conditions shall be demonstrated.

3 Any imposed equipment limitations shall be reflected in system design.

4 Systems shall be designed such that they will not unduly affect any other system (even under failure conditions).

5 Failure of one part of the integrated system shall not affect the functionality of other parts except for those functions directly dependant on the defective part.

Solutions

6 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 17 Human Element

Functional Objective

1 Physical arrangements for machinery and equipment shall not pose a risk to personnel.

2 Information relating to the operation of the equipment shall not result in unintended actions.

Performance Requirements

3 The following areas are to be designed with consideration for the human element:

3.1 the Navigation Bridge;

3.2 the main machinery control position;

3.3 other conning and control positions as agreed with the Naval Administration.

Solutions

4 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 18 Hazardous Areas

Functional Objective

1 Machinery and systems located in hazardous areas shall not create an additional fire or explosion risk.

2 The risks to personnel associated with hazardous areas shall be minimised.

Performance Requirements

3 The categorisation of hazardous areas with potentially flammable atmospheres shall be in accordance with a national or international standard agreed by the Naval Administration.

4 Electrical machinery and systems shall not normally be located in spaces with potentially flammable atmospheres unless required for operational purposes and agreed by the Naval Administration.

5 Where machinery or electrical equipment is required to be fitted in a space with a potentially flammable atmosphere, it is to be of a type suitable for the environment for which it will be operated.

6 Where machinery is operated in a potentially flammable atmosphere, a means is to be provided to detect any abnormal parameters which may lead to ignition of the atmosphere.

7 Any failure that can change the categorisation of a hazardous area shall be indicated by an alert.

8 The integrity of the boundary of the hazardous area shall not compromise the safety of the adjacent space.

9 Suitable indication of the nature of the potential hazards shall be provided at the entrance(s) to the space, and on the equipment where applicable.

10 Arrangements to prevent unauthorised or inadvertent access to hazardous or potentially hazardous areas or equipment shall be provided in accordance with Naval Administration requirements.

11 Measures shall be taken to reduce machinery noise in machinery spaces and transmitted noise to adjacent spaces to acceptable levels, as determined by the Naval Administration.

12 Personnel equipment and platform are to be protected from the risk of static electricity.

13 Any hazardous area which has a risk of personnel becoming inadvertently locked in shall have a means to escape.

Solutions

14 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 19 Replenishment at Sea (RAS)

Functional Objective

1 Ships shall be allowed, where required, to safely transfer solid stores, munitions, fluids or personnel between two ships whilst underway.

Performance Requirements

2 The requirements of a recognised Naval, national or international standard are to be applied in accordance with the functional requirements of the system.

3 Effective means of communications, complying with the requirements of Chapter VIII, Regulation 6, are to be provided between:

3.1 RAS station and conning position;

3.2 Ship to ship RAS stations;

3.3 RAS station to equipment operating positions.

4 The requirements of Chapter II are applicable for local structural loads.

5 The requirements of Chapter IV Regulation 4 Propulsion are applicable for propulsion and machinery redundancy.

6 The requirements of Chapter III are applicable for seakeeping, stability and manoeuvrability.

7 The requirements of Regulation 22 Lifting Appliances are applicable for the lifting appliances associated with RAS operations.

8 Means to rapidly stop operations and disconnect are to be provided.

Solutions

9 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 20 Anchoring and Mooring

Functional Objective

1 A ship shall be capable of being secured in position without the use of propulsion machinery, either alongside or at sea.

Performance Requirements

2 The operational use of the anchoring and mooring equipment shall be defined in the Concept of Operations Statement.

3 Means to allow the controlled deployment of the anchor independent of the motive power shall be provided.

4 Means to lock the anchor in the desired position independent of the motive power shall be provided.

5 Means shall be provided to recover the entire length of anchor and chain.

6 Consideration shall be given to Regulation 21 Towing Equipment if the mooring equipment will be used for towing.

7 It shall be possible to abandon the anchor and chain in the event of motive power failure or fouling of the anchor.

8 For certain ship types, novel craft or for operational reasons, the full anchoring and mooring arrangements may not be required subject to justification and acceptance by the Naval Administration.

Solutions

9 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 21 Towing Equipment

Functional Objective

1 Facilities shall be provided to allow ship to be towed.

2 Facilities shall be provided to allow ship to tow another ship if required by the Concept of Operations Statement.

3 Facilities shall be provided to allow ship to tow equipment if required by the Concept of Operations Statement.

Performance Requirements

4 The strength of equipment is to be based on the Safe Working Load (SWL) of the weakest element in the respective system.

5 The operational use of towing equipment shall be defined in the Concept of Operations Statement.

6 Winches used for towing shall comply with the requirements of Regulation 22 Lifting Appliances.

Solutions

7 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 22 Lifting Appliances

Functional Objective

1 Lifting appliances shall be designed, constructed, maintained and operated to minimise danger to embarked personnel, the lifting equipment and the platform in all Foreseeable Operating Conditions.

Note: For windlasses and capstans see Anchoring and Mooring.

Performance Requirements

2 Lifting appliances shall be equipped with requisite safety devices.

3 The operational use of each item of lifting equipment shall be defined.

4 The lifting appliance shall remain safe during all modes of operation.

5 Operation of lifting appliances shall minimise the risk to embarked personnel, the lifting equipment and the platform during lifting operations.

6 Necessary instructions for assembly, use and maintenance shall be present. Identification of the Safe Working Load (SWL) and the maximum test load shall be displayed on or adjacent to the equipment.

7 As far as reasonably practicable, the location of the lifting appliance shall be such that the load can be viewed directly by the operator. In the event that the load cannot be viewed directly by the appliance operator, an effective means of communication, complying with the requirements of Chapter VIII, shall be provided between the load area and the operating position.

8 The lifting appliance shall not be able to be controlled from more than one operating position at the same time.

9 Additional requirements for lifting appliances used for personnel or munitions must satisfy an applicable naval, national or international standard.

10 Lifting equipment required for life saving functions shall be in accordance with the requirements of Chapter VII, in particular Regulation 22 Launching and Embarkation Arrangements.

11 Upon motive power failure the load shall remain in position.

12 After motive power failure means shall be provided to safely move the load to a pre-determined location.

Solutions

13 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 23 Heating Ventilation and Air Conditioning (HVAC)

Functional Objective

1 Ambient conditions shall be controlled to suit machinery requirements.

2 Ambient conditions shall be controlled for crew habitability.

3 Ventilation shall be provided for hazardous areas.

Performance Requirements

4 Suitable ambient conditions in spaces containing machinery or equipment shall be maintained.

5 Suitable ambient conditions for all accessible spaces shall be maintained.

6 The ventilation requirements of Chapter VI Fire Safety shall be met.

7 Watertight Integrity (see Chapter III) and Fire Zone (see Chapter VI) boundaries are not to be compromised by HVAC systems.

8 Provisions to "Crash Stop" ventilation in case of fire shall be provided.

9 Hazardous areas are to be provided with appropriate ventilation systems.

10 For remote controlled ventilation machinery & systems, appropriate indication, monitoring, alerts and protection shall be provided.

11 Continuity of operation of essential safety functions in the event of a ventilation failure shall be provided. See also Regulation 8 Other Essential Safety Functions.

12 The routing of ventilation systems for spaces with hazardous atmospheres shall not pose a risk to other spaces.

Solutions

13 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 24 Tanks

Functional Objective

1 Bulk fluids, required for machinery systems and crew habitability, shall be safely stored.

Performance Requirements

2 Suitable arrangements to safely determine the level of fluid in a tank are to be provided.

3 Tanks are to be provided with suitable venting arrangements to prevent overpressure and underpressure during all operational evolutions.

4 Location and arrangement of vent pipes for oil fuel service, settling and lube oil tanks shall be such that in the event of a broken vent pipe this shall not directly lead to the risk of ingress of seawater or rainwater.

5 Suitable arrangements to prevent the ignition of vapours in a tank shall be provided.

Solutions

6 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 25 Novel Arrangements

Functional Objective

1 The use of Novel Arrangements shall be allowed whilst maintaining the overall safety of the ship and protection of personnel.

Performance Requirements

2 All novel arrangements shall be considered by the Naval Administration and accepted on the basis of a submission.

3 The submission shall include but not be limited to the following aspects:

3.1 Operational requirements: A description of the agreed functionality of the arrangement including normal, failure and emergency modes.

3.2 Project management: A description of the process that the designer will adopt to address the design, construction, installation, commissioning and acceptance process.

3.3 Quality assurance: The internal quality management system shall be in accordance a recognised national or international standard.

3.4 Engineering safety assessment: Documentation of the hazard identification and mitigation processes required to demonstrate equivalency to conventional arrangements with respect to safety function and protection of personnel.

3.5 Configuration management: Documentation of the process that enables the traceability of changes throughout the life of the system or equipment to be demonstrated.

3.6 Integration: Demonstration that the requirements of Regulation 16 Systems Integration are complied with.

3.7 Maintenance: Identification of any specific through life requirements to maintain the overall safety of the arrangement.

4 The requirements of other applicable regulations are to be complied with.

Solutions

5 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

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CHAPTER VI FIRE SAFETY

Regulation 0 Goal

1 For effective fire safety, the ship and its arrangements shall be designed, constructed, maintained and operated in such a way that as far as is practicable, fire can be prevented, detected, contained and extinguished whilst maintaining essential safety functions during and after the outbreak of a fire.

Regulation 1 General

Functional Objective

1 The purpose of his Regulation is to outline the principles and framework of Chapter VI Fire Safety and its application.

Definitions

Note: Definitions which are applicable to all Chapters are located in Chapter I, Regulation 2.

"A" class divisions	Divisions formed by bulkheads and decks which comply with the following criteria: a. they are constructed of steel or other equivalent material; b. they are suitably stiffened; c. they are insulated with approved non-combustible materials such that the average temperature of the unexposed side will not rise more than 140°C above the original temperature, nor will the temperature, at any one point, including any joint, rise more than 180°C above the original temperature, within the time listed below: i. class "A-60" 60 minutes ii. class "A-30" 30 minutes iii. class "A-15" 15 minutes iv. class "A-0" 0 minutes d. they are constructed as to be capable of preventing the passage of smoke and flame to the end of the one-hour standard fire test; e. they have been prototype tested to the satisfaction of the Naval Administration in accordance with the FTP Code or other standard agreed by the Naval Administration to ensure that it meets the above requirements for integrity and temperature rise. Note: "Light-weight constructions" (honeycomb type, etc.) of steel or equivalent material may be used as non load-bearing internal "A" class division in accommodation and service spaces provided they have successfully passed the relevant standard fire test to the satisfaction of the Naval Administration in accordance with the FTP Code or other standard agreed by the Naval Administration. These "light-weight constructions" should not be used as an integral part of main fire zone bulkheads and stairway enclosures on ships designed to carry more than 60 non-crew.
Aircraft hangars	Enclosed spaces for aircraft storage, maintenance and preparation, into and from which aircraft can be moved and to where crew and non-crew have access. Such spaces may be accommodated on more than one deck provided that the total overall clear height for aircraft does not exceed 10m.

Ammunition spaces	Spaces (integral magazines, independent magazines, small magazines, magazines lockers, magazines boxes and pyrotechnics lockers) used for the storage of munitions, explosives and pyrotechnics for use by the ship and embarked forces. Handling, lifting and preparation spaces of ammunitions are to be considered as ammunition spaces for the purpose of this chapter. This does not include munitions transported in cargo spaces.
"B" class divisions	Divisions formed by bulkheads, decks, deck-heads or linings which comply with the following criteria: a. they are constructed of approved non-combustible materials and all materials used in the construction and erection of "B" class divisions are non-combustible, with the exception of combustible veneers which may be permitted provided they meet other appropriate requirements of this chapter (e.g. Regulations 4 and 5); b. they have an insulation value such that the average temperature of the unexposed side will not rise more than 140°C above the original temperature, nor will the temperature at any one point, including any joint, rise more than 225°C above the original temperature, within the time listed below: i. class "B-15" 15 minutes ii. class "B-0" 0 minutes c. they are constructed as to be capable of preventing the passage of flame to the end of the first half hour of the standard fire test; d. they have been prototype tested to the satisfaction of the Naval Administration in accordance with the FTP Code or other standard agreed by the Naval Administration to ensure that it meets the above requirements for integrity and temperature rise.
Cargo Oil Tanks	Tanks for the carriage of oil fuel in bulk not for the ships own use or use in ship borne equipment.
Cargo spaces	Spaces used for cargos and trunks to such spaces.
Casualty Potential	The number of people that can be injured as the result of a fire or release of the fire extinguishing media.
CBRN	Chemical, Biological, Radiological and Nuclear Also known as NBC
Central control station	The primary station in which the following control and indicator functions are centralised: a. fixed fire detection and fire alarm systems; b. fire pumps and emergency fire pumps; c. fire main isolation and monitoring; d. fixed fire fighting, sprinkler and local application systems; e. fire door indicator panels; f. fire door closure; g. flood detection systems; h. internal and external watertight door indicator panels; i. internal and external watertight door closures; j. all powered ventilation systems; k. general emergency alarm system;

	l. internal communication systems; m. shore telephones when alongside; n. microphones to main broadcast systems; o. emergency evacuation systems; p. CCTV where required by this chapter.
"C" class divisions	Divisions constructed of approved non-combustible materials. They need meet neither requirements relative to the passage of smoke and flame nor limitations relative to the temperature rise. Combustible veneers are permitted provided they meet the requirements of this chapter.
CCTV	Closed Circuit Television
Closed ro-ro spaces	All Spaces which are neither open ro-ro spaces nor open deck spaces.
Closed vehicle and boat spaces	All Spaces used for vehicles or boats which are neither open nor open deck spaces.
Combustible material	Any material other than a non-combustible material.
Continuous "B" class ceilings or linings	Those "B" class ceilings or linings which terminate at an "A" or "B" class division.
Continuously manned control station	Control station which is continuously manned by a responsible member of the crew.
Control stations	Spaces in which the ship's radio or main navigating equipment or the emergency source of power is located or where the fire recording or fire control equipment is centralised (also considered to be a fire control station). Also included are the following spaces: a. Central Control Station. b. Damage Control Stations. c. Wheelhouse and chartroom. d. Spaces containing the ship's radio equipment. e. Fire-extinguishing spaces and spaces with equipment for fire extinguishing. f. Control room for propulsion machinery when located outside the propulsion machinery space. g. Spaces containing centralised fire alarm equipment. h. Spaces containing centralised emergency public address system operating positions and equipment. i. Spaces containing naval systems for detection, command, defence, offence, communication, combat or weapon/control operation. j. Spaces containing centralised ship's operation equipment. Notes: Main navigational equipment includes, in particular, the steering stand and the compass, radar and position-finding equipment. Steering gear rooms containing an emergency steering position are not considered to be control stations.

	Where in the regulations of this chapter and where relevant to fixed fire-extinguishing systems, there are no specific requirements for the centralisation within a control station of major components of a system, such major components may be placed in spaces which are not considered to be a control station. Spaces containing, for instance, the following battery sources should be regarded as control stations regardless of the battery capacity: - emergency batteries in separate battery room for power supply from black-out until the start of the emergency generator; - emergency batteries in separate battery room as reserve source of energy to radio installation; - batteries for start of the emergency generator; - in general, all emergency batteries required for the emergency source of electrical power.
Critical structure	Structure where the loss of a single element of structure such as a pillar, deck or bulkhead could lead to collapse of the hull girder or a main deck.
Damage control station (Secondary)	A control station which is to include as a minimum the following control and indicator functions: a. Fire and flood control and monitoring; b. Communications and main broadcast system. c. And may also contain the following control and indicator functions; d. Essential machinery; e. CBRN protection.
Damage control zone(s)	Areas of the ship, bounded by watertight bulkheads and decks where located below the damage control deck, that have been identified by a qualitative risk analysis and which are considered necessary for controlling the spread of damage following an external event by providing each zone with own damage control measures.
Dangerous goods	Those packaged goods referred to in the IMDG Code as amended or as identified by the Naval Administration.
Enclosed Space	Enclosed spaces are all those spaces which are bounded by the ship's hull, by fixed or portable partitions or bulkheads, by decks or coverings other than permanent or movable awnings. No break in a deck, nor any opening in the ship's hull, in a deck or in a covering of a space, or in the partitions or bulkheads of a space, nor the absence of a partition or bulkhead, shall preclude a space from being included in the enclosed space
Essential safety functions	As defined in Chapter I, Regulation 2 and services to ensure acceptable conditions for safety of persons onboard and protection of the environment.
Fire main	Piping system for supplying pressurised water for fire fighting.
Fire resisting divisions	Those divisions formed by bulkheads and decks which comply with the following: a. They shall be constructed of non-combustible or fire-restricting materials which by insulation or inherent fire-resisting properties satisfy the requirements of this code. b. They shall be suitably stiffened. c. They shall be so constructed as to be capable of preventing the passage of smoke and flame up to the end of the appropriate fire protection time. d. Where required they shall maintain load-carrying capabilities up to the end of the appropriate fire protection time. e. They shall have thermal properties such that the average temperature on the unexposed side will not rise more than 140°C above the original temperature, nor will the temperature, at any one point, including any joint, rise more than 180°C above the original temperature during the appropriate fire protection time.

	f. A test of a prototype bulkhead or deck to the satisfaction of the Naval Administration in accordance with the FTP Code or other standard agreed by the Naval Administration shall be required to ensure that it meets the above requirements.
Fire Safety Systems Code	The International Code for Fire Safety Systems (FSS), as amended, as adopted by the International Maritime Organisation.
Fire Station	A Fire Station (also known as a Fire And Repair Party Post) may be required by the Naval Administration for each fire zone. The station co-ordinates fire fighting activities for the zone and may be sited in a space normally designated for another purpose. The station may require access to whole ship information as well as that relative to its designated area of the ship. The station may encompass an Incident display, Ventilation and Fire main system information display (status, configuration, pressure, etc) plus an ability to call up additional whole ship information including electrical supply and repair data.
Fire Test Procedures Code	The International Code for Application of Fire Test Procedures (FTP), as amended, as adopted by the International Maritime Organisation.
Fire-restricting materials	Materials which have properties complying with the FTP Code or IMO Resolution MSC.40(64) or other standard agreed by the Naval Administration
Flammable Liquids	Flammable liquid or mixtures of liquids containing solids in solution or suspension which give off a flammable vapour used for the role of the ship. It includes IMDG Class 3 Flammable liquids and Combustible liquids in accordance with Section 1.7 of NFPA 30. Flammable liquid includes the following definitions: a. Oil fuel b. Lube oil c. Low flash point fuel d. Other flammable liquids Fuels for military use are specified in STANAG 1135. For the transport of flammable liquids in packaged form, see Regulation 13.
Free cross-sectional area of ventilation duct	The area calculated on the basis of the inner diameter of the duct, even in the case of a pre-insulated duct,
Furniture and furnishings of restricted fire risk	Furniture and furnishings of restricted fire risk are such that: a. case furniture such as desks, wardrobes, dressing tables, bureaux, or dressers, are constructed entirely of approved non-combustible materials, except that a combustible veneer not exceeding 2 mm may be used on the working surface of such articles; b. free-standing furniture such as chairs, sofas, or tables, are constructed with frames of non-combustible materials; and for non steel ships fire restricting materials. c. draperies, curtains and other suspended textile materials have qualities of resistance to the propagation of flame not inferior to those of wool having a mass of 0.8 kg/m^2, this being determined in accordance with the FTP Code or other standards agreed by the Naval Administration to ensure that it meets the requirements; d. upholstered furniture has qualities of resistance to the ignition and propagation of flame, this being determined in accordance with the FTP Code or other standard agreed by the Naval Administration;

	e. bedding components have qualities of resistance to the ignition and propagation of flame, this being determined in accordance with the FTP Code or other standards agreed by the Naval Administration to ensure that it meets the requirements . f. Additional smoke generation and toxicity requirements may be defined by the Naval Administration. e. For ships not constructed of steel, 'Furniture and furnishings of restricted fire risk' above shall be of fire restricting materials or non combustible materials.
Galleys	Enclosed spaces containing cooking facilities with exposed heating surfaces, or which have any cooking or heating appliances each having a power of more than 5 kW.
Landing spot	Unique position marked for aircraft landing and storage which will allow simultaneous landing at other landing spots.
Low flame-spread	Means that the surface will adequately restrict the spread of flame, this being determined in accordance with the FTP Code or other standards agreed by the Naval Administration.
Low flash point fuel	Liquid petroleum product with a flash point of 60°C or less (closed cup) carried on board and used for the role of the ship e.g. aviation, vehicles, propulsion or power generation.
Lube oil	Petroleum fractions, vegetable oils or synthetic liquids with a flash point greater than 60°C used for the lubrication of machinery onboard.
Machinery Enclosure	Machinery may be installed in an enclosure for the reduction of noise, for operation in a CBRN environment and/or to provide a fire boundary. Enclosures containing machinery defined in Chapter I, Regulation 2 are to be treated as unattended machinery spaces, independent from the spaces that contain them.
Machinery spaces	See definition in Chapter I, Regulation 2.
Magazine	Spaces (integral magazines, independent magazines, small magazines, magazines lockers, magazines boxes and pyrotechnics lockers) used for the storage of munitions, explosives and pyrotechnics for use by the ship and embarked forces. This does not include munitions transported in cargo spaces.
Main Fire zones - Vertical	Those sections of the hull, superstructure and deckhouses which are divided by "A" class divisions, the mean length and width of which on any deck does not in general exceed 40 metres. The length and width of main vertical zones may be up to a maximum of 48 metres in order to bring the ends of main vertical zones to coincide with the watertight subdivision bulkheads or in order to accommodate a large space extending for the whole length of the main vertical zone provided that the total area of the main vertical zone is not greater than 1,600 m^2 of any deck. The length or width of a main vertical zone is the maximum distance between the furthermost points of the bulkheads bounding it. Main vertical zones may also include, or be part of, safety zones. To provide crew refuge from the effects of a fire on ships less than 48m, it is recommended that the vessel have 2 fire zones as far as is practicable.
Muster station	See definition in Chapter VII, Regulation 1.
NBC	See CBRN
Non-combustible material	Material which neither burns nor gives off flammable vapours in sufficient quantity for self-ignition when heated to approximately 750°C, this being determined in accordance with the FTP Code or other standard agreed by the Naval Administration.

Oil fuel	Liquid petroleum product with a flash point greater than 60.5°C (closed cup) carried on board and used for the role of the ship e.g. aviation, vehicles, propulsion or power generation.
Oil fuel unit	Includes any equipment for the preparation of oil fuel and delivery of oil fuel, heated or not, to boilers and engines (including gas turbines) at a pressure of more than 0,18 N/mm^2.
Open ro-ro spaces	Those ro-ro spaces that are either open at both ends or have an opening at one end, and are provided with adequate natural ventilation effective over their entire length through permanent openings distributed in the side plating or deckhead or from above, having a total area of at least 10% of the total area of the space's sides.
Open deck spaces	A deck which is completely exposed to the weather from above and from at least two sides.
Open vehicle and boat spaces	Those spaces that are either: a. open at two sides providing with adequate natural ventilation effective over the entire space; b. having an opening at one side and provided with adequate natural ventilation effective over the entire space through permanent distributed openings having a total area of at least 10% of the total area of the space's sides.
Operating compartment	The enclosed area from which the navigation and control of the ship is exercised.
Operating station	A confined area of the operating compartment equipped with necessary means for navigation, manoeuvring and communication, and from where the functions of navigating, manoeuvring, communication, commanding, conning and lookout are carried out.
Organic Aircraft	Aircraft for which there is a permanent facility on board the ship for landing, parking and storage.
Other flammable liquids	Petroleum fractions, vegetable oils or synthetic liquids carried onboard and used for the role of the ship. This includes hydraulic oil, medical spirits, seed oil, paints and cooking oils etc.
Pantries	Spaces containing cooking appliances which may contain: a. Coffee automats, toasters, dish washers, microwave ovens, water boilers, induction heaters and similar appliances each of them with a power or not more than 5kW; b. electrically heated cooking plates and hot plates for keeping food warm each of them with a maximum power of 5kW. c. Accommodation spaces such as dining rooms or crew ready rooms are not considered pantries and can contain electrically heated cooking and beverage appliances provided they each have a maximum power of 2kW and a surface temperature not above 150°C.
Personnel spaces	Spaces such as corridors, heads & bathrooms, cabins, offices, mess decks, hospitals.
Prescriptive requirements	The construction characteristics, limiting dimensions, or fire safety systems, specified in this chapter.
Public spaces	Those portions of the accommodation which are used for halls, mess rooms, wardrooms and similar permanently enclosed spaces.

Ro-ro spaces	Spaces not normally subdivided in any way and normally extending to either a substantial length or the entire length of the ship in which motor vehicles with fuel in their tanks for their own propulsion and/or goods (packaged or in bulk, in vehicles, trailers, containers, pallets, demountable tanks or in or on similar stowage units or other receptacles) can be loaded and unloaded normally in a horizontal direction.
Safe area	Safe area in the context of a casualty is, from the perspective of habitability, any area(s) which is not flooded or which is outside the main vertical zone(s) in which a fire has occurred such that it can safely accommodate all persons onboard to protect them from hazards to life or health and provide them with basic services.
Sauna	A hot room with temperatures normally varying between 80°-120°C where the heat is provided by a hot surface (e.g. by an electrically-heated oven). The hot room may also include the space where the oven is located and adjacent bathrooms.
Steel or other equivalent material	Any non-combustible material which, by itself or due to insulation provided, has structural and integrity properties equivalent to steel at the end of the applicable structural fire protection time when exposed to the tests required by the FTP code or other standard agreed by the Naval Administration.
Service spaces	Those spaces used for galleys, pantries containing cooking appliances, lockers, mail and specie rooms, storerooms, workshops other than those forming part of the machinery spaces, and similar spaces and trunks to such spaces.
Ship Types	See paragraph 3.
Smoke tight or capable of preventing passage of smoke	A division made of non-combustible or fire-restricting materials which is capable of preventing the passage of smoke, demonstrated in accordance with a suitable standard defined by the Naval Administration. Note: Standards could include Smoke tight standards (suitable smoke tight standards include ISO 5925/1 (2007) NFPA 105 (2013) UBC 7-2/2 (1997) DIN 18095-2 (1991) BS 476-31.1 (1983) EN 1634-2 (2008) EN13501-2 (2010)) or Gas tight standards for CBRN. The NA may require smoke tight penetrations to pass smoke and toxicity tests
Special category spaces	Those enclosed spaces above and below the submergence limit, into and from which vehicles can be driven, boats can be docked/housed, aircraft parked and to which crew and non-crew have access. Special category spaces may be accommodated on more than one deck provided that the total overall clear height for vehicles does not exceed 10 metres.
Standard fire test	A test in which specimens of the relevant bulkheads or decks or other construction are exposed in a test furnace by a specified test method in accordance with the FTP Code or other standard satisfying the FTP requirements and agreed by the Naval Administration. Additional tests may be required by the Naval Administration.
Structural Fire Protection Time (SFP)	The time during which the structure maintains sufficient load bearing capabilities when tested to the FTP Code or standard approved by the Naval Administration, see Regulation 2. The Naval Administration may define an enhanced structural fire protection time in the Concept of Operations Statement. For non-steel ships the SFP shall be between 60 and 30 minutes depending on evacuation time of the ship.
Vehicle and boat spaces	Spaces intended for carriage of wheeled or tracked motor vehicles and/or boats with fuel in their tanks for their own propulsion.

International Maritime Organization (IMO) Documents

Abbreviation	Title	Resolution No. (if applicable)	Amendments incorporated into or reviewed and applicable to ANEP-77	Amendments under review for ANEP-77
FSS Code	International Code for Fire Safety Systems	MSC.98(73)	MSC.217(82) MSC.292(87) MSC.311(88)	MSC.327(90)
FTP Code (2010 FTP Code)	International Code for Application of Fire Test Procedures, 2010	MSC.307(88)	No Amendments	
HSC Code (2000 HSC Code)	International Code of Safety for High-Speed Craft, 2000	MSC.97(73)	MSC.222(82) MSC.260(84) MSC.271(85)	MSC.326(90)
IMDG Code	Adoption of the International Maritime Dangerous Goods (IMDG) Code	MSC.122(75)	MSC.157(78) MSC.205(81) MSC.262(84) MSC.294(87 MSC.328(90)	
IMSBC Code	Adoption of the International Maritime Solid Bulk Cargoes (IMSBC) Code	MSC.268(85)	MSC.318(89)	
SOLAS	International Convention for the Safety of Life at Sea, Consolidated Edition, 2009	-	MSC.201(81) MSC.204(81) MSC.216(82) Anx 3 MSC.256(84) MSC.257(84) MSC.258(84) MSC.269(85) MSC.282(86) MSC.283(86) MSC.290(87) MSC.291(87) MSC.308(88) MSC.309(88) MSC.317(89)	MSC.325(90)
STCW (Ref at Annex A)	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers	-	Amendments from 2007 onwards: No Amendments	

Application

2 Alternatives to the requirements will be accepted provided that they have been demonstrated to be equivalent to meet the fire safety goal and functional requirements of this Chapter to the satisfaction of the Naval Administration with an engineering analysis and evaluation based on Chapter I Regulation 5.

3 For the purpose of this chapter, the following definitions of Ship Types apply:

3.1 Ship Type A: Any naval ship with a total number of Persons Onboard of 240 or greater, or which will foreseeably carry greater than 36 passengers;

3.2 Ship Type B: Any naval ship with between 60 and 239 total number of Persons Onboard, of which there are no more than 36 passengers:

3.3 Ship Type C: Any naval ship with less than 60 Persons Onboard in total, of which there are no more than 12 passengers.

Note: Passengers are defined in Chapter I, Regulation 2.

4 The basis of each of the requirements outlined in the chapter for each Ship Type is detailed in Annex A.

5 The function of the ship as defined in the Concept of Operations Statement will determine the applicability of the Tier 4 Solutions of this Chapter.

6 For complex naval ships, the Naval Administration will advise on the applicability of the Tier 4 solution and may require an enhancement of some of the Solutions in this chapter.

Note: Revised assumptions can be defined in the Concept of Operations Statement and at a more detailed level in the Default Concept of Operations Statement, see Annex A.

7 For ships not constructed from steel or having significant parts not constructed from steel, e.g. ships using aluminium or composite construction, the application of the code is limited to Type C ships with no more than 60 persons on board. For ships with greater number of persons onboard, a fire safety analysis is to be undertaken in accordance with Chapter I Regulation 5.

Note: Significant structure is defined as that which contains whole compartments, decks and bulkheads.

8 This code is not applicable to tankers. SOLAS Chapter II-2 should be consulted instead.

General Performance Requirements

9 A fire safety policy is to be defined for the ship and is to include the functional objectives of this Chapter.

Solutions

10 Verification that the ship complies with this chapter shall be by the Naval Administration. Provision of evidence to support verification shall be by the owner. All decisions that affect compliance with the requirements of this chapter shall be recorded at all stages from concept to disposal and these records be maintained throughout the life of the ship.

Regulation 2 Structural Integrity

Functional Objective

1 Structural integrity of the ship shall be maintained preventing partial or whole collapse of the ship structures due to strength deterioration by heat consistent with the Concept of Operations for the ship.

Performance Requirements

2 The hull, superstructure, structurally effective bulkheads, decks, deckhouses and pillars shall be constructed of approved non combustible materials or fire restricting materials having adequate structural properties or having suitable protection from fire.

3 The primary structure of the ship when subjected to fire for a defined period of time and after a fire shall not:

3.1 Deform such that it prevents access for escape, maintenance of essential services and fire fighting activities;

3.2 Threaten the structural integrity of the vessel through loss of structural member e.g. bulkhead strut or pillar, in or adjacent to a compartment which has a fire;

3.3 Threaten or degrade structure supporting “A” and “B” class fire divisions, and fire resistant divisions for all ships not constructed of steel;

3.4 Threaten or degrade structure supporting components of columns, stanchions and other structural members required to support lifeboat and life raft stowage, and launching and embarkation areas such that they unable to operate;

3.5 Threaten or degrade structure supporting naval systems or specific compartments as defined by the Naval Administration.

4 Fittings that preserve external water tight integrity shall remain efficient during and after a fire.

5 Minor structure that is essential for escape, maintenance of essential services or fire fighting activities shall remain effective during or after a fire.

Note: Examples of minor structure are raised floor plating in category A machinery spaces, staircases, and access ladders.

6 The Naval Administration may require a significant structural loading from an extreme load event or damage event to be considered co-incident with a fire.

Solutions

7 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society’s rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

Materials of construction

8 The hull, superstructure, structurally effective bulkheads, decks, deckhouses and pillars shall be constructed of steel or approved non-combustible materials having adequate structural properties. The use of other fire-restricting materials may be permitted provided the following requirements are complied with and the materials are in compliance with the FTP Code.

9 If load bearing structures are made of steel components, critical elements of structure that require insulation shall be protected such that the temperature of the structural core does not rise more than 400°C above the ambient temperature when exposed for the structural fire protection time to the tests required by the FTP code or other standard agreed by the Naval Administration.

10 If load bearing structures are made of composite material, their insulation shall be such that their temperatures will not rise to a level where deterioration of the construction will occur to such an extent that the load-carrying capability will be impaired, when exposed for the structural fire protection time to the tests required by the FTP code or alternative standard agreed by the Naval Administration.

11 If load bearing structures are made of aluminium alloy components they shall be protected such that the temperature of the structural core does not rise more than 200°C above the ambient temperature when exposed for the structural fire protection time to the tests required by the FTP code or other standard agreed by the Naval Administration.

12 Fire insulation need not be applied to those parts of the structure in contact with water at the lightweight condition, if it can be demonstrated that there is adequate through thickness cooling for areas of the hull in contact with water and that there is no heat transfer from any uninsulated structure in contact with water to insulated structure above the water.

Protection of Hull Structure

13 Sufficient structural integrity is to be maintained during and after a fire by protecting critical structure.

14 Critical structure constructed from aluminium or composite, shall be fire-resisting and shall provide by themselves or due to insulation provided, adequate structural integrity properties at the end of the structural fire protection time when exposed to the tests required by the FTP code or alternative standard agreed by the Naval Administration. The structural fire protection time for critical structure is not to be taken as less than 60 minutes for all areas of the ship.

Note: For aluminium and composite ships critical structures shall be provided with fire insulation appropriate for the structural fire protection time. Where it is proposed to build Type A or B ships out of aluminium or composite a residual strength assessment should be carried out at multiple locations to determine structural redundancy.

Note: The consequences of a fire outside of the outer boundaries of the hull and superstructures on mooring decks, walkways and weather decks should be evaluated carefully for ships not constructed of steel. Active means of controlling an external fire should be considered.

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15 Where the hull, superstructures, load bearing bulkheads, decks, deckhouses and pillars are constructed of steel, insulation is not generally required. Critical structure constructed of steel that could lead to a collapse of the hull girder or primary hull structure, are to be insulated to provide adequate structural integrity properties at the end of the structural fire protection time when exposed to the tests required by the FTP code or alternative standard agreed by the Naval Administration. The structural fire protection time for critical structure is not to be taken less than 60 minutes for all areas of the ship.

Note: Where a ship is of conventional mono hull multi deck design, with multiple partition bulkheads, structural protection above that required by Regulation 8 will not be required.

Note: The consequences of a fire outside of the outer boundaries of the hull and superstructures on mooring decks, walkways and weather decks should be evaluated carefully for the ships not constructed of steel. Active means of controlling an external fire should be considered.

Protection of escape arrangements

16 Sufficient structural integrity is to be maintained for the structural fire protection time in way of escape arrangements during and after a fire by protecting the following structure in areas of major and minor fire hazard:

16.1 load bearing structure supporting, evacuation, launch or muster stations and equipment stowage;

16.2 load bearing structure that could obstruct access for escape and fire fighting activities;

16.3 load bearing structure supporting control stations.

17 Load bearing structure constructed from aluminium or composite, shall be fire-resisting and shall provide by themselves or due to insulation provided, adequate structural integrity properties at the end of the structural fire protection time when exposed to the tests required by the FTP code or alternative standard agreed by the Naval Administration. The structural fire protection time is to be specified by the Naval Administration in the Concept of Operations Statement based on the time required for escape.

Note: For aluminium and composite ships load bearing structures supporting these elements will normally be provided with fire insulation. Protection should be provided in spaces vertically underneath the space protected down to the double bottom unless it can be demonstrated there is sufficient structural redundancy.

18 For load bearing structure constructed of steel, components that could lead to collapse of structure supporting escape arrangements are to be insulated to provide adequate structural integrity properties at the end of the structural fire protection time when exposed to the tests required by the FTP code or alternative standard agreed by the Naval Administration. The structural fire protection time is not to be less than 60 minutes.

Note: If load bearing structure supporting these elements are constructed of steel using conventional framing and pillar bulkheads (not pillars), structural protection above that required by Regulation 8 will not be required.

Protection of fire divisions

19 Sufficient structural integrity is to be maintained in way of fire divisions during and after a fire by protecting structure supporting “A” and “B” class divisions in areas of major and minor fire hazard.

20 For structure constructed from aluminium or composite, fire-resisting bulkheads and decks shall provide by themselves or due to insulation provided, adequate structural and integrity properties at the end of the fire protection time defined in Regulation 8 for the boundary concerned, when exposed to the tests required by the FTP code or alternative standard agreed by the Naval Administration.

Note: For aluminium and composite ships load bearing structures supporting these elements will normally be provided with fire insulation. Protection should be provided in spaces vertically underneath the space protected down to the double bottom unless it can be demonstrated there is sufficient structural redundancy.

21 For structure constructed of steel, components that could lead to collapse of structure supporting a fire division are to be insulated to provide adequate structural integrity properties at the end of the fire protection time defined in Regulation 8 for the boundary concerned when exposed to the tests required by the FTP code or alternative standard agreed by the Naval Administration.

Note: If load bearing structure supporting these elements are constructed of steel using conventional framing and pillar bulkheads (not pillars), structural protection above that required by Regulation 8 will not be required.

Protection from flooding

22 Materials readily rendered ineffective by heat shall not be used for overboard scuppers, sanitary discharges, and other outlets which are below the submergence limit and where the failure of the material in the event of fire would give rise to danger of flooding. The Naval Administration may also restrict the use of such materials for all components preserving internal watertight integrity, including penetrations.

Protection of minor structure

23 The raised floor plating and supporting structure of normal passageways in category A machinery spaces, control stations, all staircases, and access ladders on primary and secondary escape routes, shall be made of steel. The Naval Administration may allow alternative materials where it can be demonstrated that the structure remains efficient during and after a fire. The Naval Administration may require that all raised floor plating, catwalks and ladders be made of steel to assist in fire fighting and damage control.

Additional naval requirements

24 Load bearing components of columns, stanchions and other structural members supporting specific naval systems or compartments are to be provided with adequate fire protection as defined by the Naval Administration based on the risks identified.

25 If there is a requirements from the Naval Administration to consider a fire co-incident with a significant structural loading from an extreme load event or damage event, adequate fire protection is to be arranged in way of critical structure identified from extreme or damage strength assessments.

Plan appraisal survey and testing

26 Plans showing critical structure, load bearing structure and proposed insulation arrangements are to be submitted for appraisal.

Regulation 3 Risk of Ignition

Functional Objective

1 The ignition of combustible materials or flammable liquids, gasses and vapours shall be prevented.

Performance Requirements

2 The following functional requirements are to be satisfied:

2.1 means are to be provided to control leaks of flammable liquids;

2.2 means are to be provided to limit the accumulation of flammable vapours;

2.3 the ignitability of combustible materials is to be restricted;

2.4 ignition sources are to be restricted;

2.5 ignition sources are to be separated from combustible materials and flammable liquids;

2.6 flammable liquids and gasses are to be stored in dedicated spaces.

3 Additional requirements for machinery and electrical installations that present a risk of ignition are identified in Chapter IV.

4 Except as otherwise agreed, the flash point of fuel used should not be less than 60°C.

5 A margin between the maximum ambient temperature of a space, consistent with the Concept of Operations Statement and the minimum flash point of oil fuel contained in piping in a space, is to be maintained.

Solutions

6 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

Arrangements for oil fuel, lube oil and other flammable liquids

7 The following limitations are applicable to the use of oil as fuel:

7.1 except as otherwise permitted by this paragraph, no oil fuel with a flash point of less than 60°C is to be used;

7.2 in emergency generators low flash point fuel of not less than 43°C may be used;

7.3 the use of low flash point fuel with a flash point of not less than 43°C may be used (e.g., for feeding the emergency fire pump's engines and the auxiliary machines which are not located in the machinery spaces of category A subject to the following:

7.3.1 Oil fuel tanks except those arranged in double bottom compartments are to be located outside of machinery spaces of category A;

7.3.2 provisions for the measurement of oil temperature are provided on the suction pipe of the oil fuel pump;

7.3.3 stop valves and/or cocks are provided on the inlet side and outlet side of the oil fuel strainers;

7.3.4 pipe joints of welded construction or of circular cone type or spherical type union joint are applied as much as possible.

7.4 For All ships not constructed of steel, tanks containing fuel and other flammable liquids shall be separated from accommodation spaces by vapour-proof enclosures or cofferdams which are suitably ventilated and drained.

7.5 For ships with a function of bulk fuel carriage, pump rooms for the treatment, transfer and discharge of bulk fuel are to be fitted with a fixed hydrocarbon detection system that complies with the FSS Code and which alarms at the continuously manned control station.

Note: For carriage of fuels with a flashpoint less than 60°C see Regulation 14.

Arrangements for oil fuel

8 In a ship in which oil fuel is used, the arrangements for the storage, distribution and utilisation of the oil fuel is to be such as to ensure the safety of the ship and persons onboard and is at least to comply with the following provisions.

Location of oil fuel systems

9 As far as practicable, parts of the oil fuel system containing oil under pressure exceeding 0.18 N/mm^2 are not to be placed in a concealed position such that defects and leakage cannot readily be observed. The machinery spaces in way of such parts of the oil fuel system are to be adequately illuminated.

Ventilation of machinery spaces

10 The ventilation of all machinery spaces is to be sufficient under normal conditions to prevent accumulation of oil vapour.

Oil fuel tanks

11 Oil fuel, lube oil and other flammable liquids are not to be carried in forepeak tanks.

12 No oil fuel tank shall be situated where spillage or leakage there from can constitute a fire or explosion hazard by falling on heated surfaces.

13 Oil fuel pipes which, if damaged, would allow oil to escape from a storage, settling or daily service tank having a capacity of 500 litre and above situated above the double bottom, are to be fitted with a cock or valve directly on the tank capable of being closed from a safe position outside the space concerned in the event of a fire occurring in the space in which such tanks are situated. In the special case of deep tanks situated in any shaft or pipe tunnel or similar space, valves on the tank are to be fitted, but control in the event of fire may be affected by means of an additional valve on the pipe or pipes outside the tunnel or similar space. If such an additional valve is fitted in the machinery space it is to be operated from a position outside this space. The controls for remote operation of the valve for the emergency generator fuel tank are to be in a separate location from the controls for remote operation of other valves for tanks located in machinery spaces.

14 Safe and efficient means of ascertaining the amount of oil fuel contained in any oil fuel tank are to be provided.

15 Where sounding pipes are used, they are not to terminate in any space where the risk of ignition of spillage from the sounding pipe might arise. In particular, they are not to terminate in crew or non-crew spaces. As a general rule, they are not to terminate in machinery spaces. However, where the Naval Administration considers that these latter requirements are impracticable, it may permit termination of sounding pipes in machinery spaces on condition that all of the following requirements are met:

15.1 an oil-level gauge is provided meeting the requirements of paragraph 16;

15.2 the sounding pipes terminate in locations remote from ignition hazards unless precautions are taken, such as the fitting of effective screens, to prevent the oil fuel in the case of spillage through the terminations of the sounding pipes from coming into contact with a source of ignition;

15.3 the termination of sounding pipes are fitted with self-closing blanking devices and with a small-diameter self-closing control cock located below the blanking device for the purpose of ascertaining before the blanking device is opened that oil fuel is not present. Provisions are to be made so as to ensure that any spillage of oil fuel through the control cock involves no ignition hazard.

16 Other oil-level gauges may be used in place of sounding pipes subject to the following conditions:

16.1 Gauge glasses of any type are not to be used on oil fuel tanks or tanks integral to the ships structure.

16.2 Other oil-level gauges used on oil fuel tanks or tanks integral to the ships structure are not to require penetrations below the top of the tank and their failure or overfilling of the tanks is not to permit release of fuel.

16.3 Flat glass gauge glasses may be used on lube oil and hydraulic oil tanks and are to be fitted with a self closing valve at the top and bottom of the gauge. The arrangement may incorporate a single point of operation for the valves.

17 As far as practicable, oil fuel tanks are to be part of the ship’s structure and are to be located outside machinery spaces of category A and areas of major fire hazard. Where oil fuel tanks, other than double bottom tanks, are necessarily located adjacent to or within machinery spaces of category A and areas of major fire hazard, at least one of their vertical sides is to be contiguous to the machinery space boundaries, and preferably have a common boundary with the double bottom tanks, and the area of the tank boundary common with the machinery spaces is to be kept to a minimum. Where such tanks are situated within the boundaries of machinery spaces of category A and areas of major fire hazard they are not to contain oil fuel having a flashpoint of less than 60°C. In general, the use of free-standing oil fuel tanks is to be avoided. When such tanks are employed their use is prohibited in category A and areas of major fire hazard machinery spaces Where permitted, they are to be placed in an oil-tight spill tray of ample size having a suitable drain pipe leading to a suitably sized spill oil tank.

18 For Type A and B ships

18.1 When free-standing oil fuel tanks are employed their use is prohibited in category A and areas of major fire hazard machinery spaces.

Prevention of overpressure

19 Provisions are to be made to prevent overpressure in any oil tank or in any part of the oil fuel system, including the filling pipes served by pumps on board. Air and overflow pipes and relief valves are to discharge to a position where there is no risk of fire or explosion from the emergence of oils and vapour and are not to be lead into crew or non-crew spaces nor into special category spaces, closed ro-ro cargo spaces, machinery spaces or similar spaces.

Note: This also applies to systems used during RAS operations.

Oil fuel piping

20 Oil fuel pipes and their valves and fittings are to be of steel or other approved material, except that restricted use of flexible pipes will be permissible in positions where the Naval Administration is satisfied that they are necessary. Refer to ISO 15540:1999, Fire resistance of hose assemblies – test methods and ISO 15541:1999, Fire resistance of hose assemblies – requirements for the test bench. Such flexible pipes and end attachments shall be of approved fire-resisting materials of adequate strength and shall be constructed to the satisfaction of the Naval Administration. For valves fitted to oil fuel tanks and under static pressure, steel or spheroidal-graphite cast iron may be accepted. However, ordinary cast iron valves may be used in piping systems where the design pressure is lower than 7 bar and the design temperature is below 60°C.

Note: Naval Administration may define additional restrictions or requirements based on ship capability for shock and explosion, and smoke and toxicity.

21 External high-pressure fuel delivery lines between the high-pressure fuel pumps and fuel injectors / fuel metering valves shall be protected with a jacketed piping system capable of containing fuel from a high-pressure line failure. A jacketed pipe incorporates an outer pipe into which the high-pressure fuel pipe is placed, forming a permanent assembly. The jacketed piping system is to include a means for collection of leakages and arrangements are to be provided with an alarm in case of a fuel line failure.

22 The provision to drain all excess fuel and oil to a safe position so as to avoid a fire hazard shall apply to gas turbines in respect of fuel which might reach the interior of the jet pipe or exhaust system after a false start or after stopping.

23 Oil fuel lines are not to be located immediately above or near units of high temperature including boilers, steam pipelines, exhaust manifolds, silencers or other equipment required to be insulated by paragraph 27. As far as practicable, oil fuel lines are to be arranged far apart from hot surfaces, electrical installations or other sources of ignition and are to be screened or otherwise suitably protected to avoid oil spray or oil leakage onto the sources of ignition. The number of joints in such piping systems is to be kept to a minimum.

24 Components of a diesel engine fuel system are to be designed considering the maximum peak pressure which will be experienced in service, including any high pressure pulses which are generated and transmitted back into the fuel supply and spill lines by the action of fuel injection pumps. Connections within the fuel supply and spill lines are to be constructed having regard to their ability to prevent pressurized oil fuel leaks while in service and after maintenance.

25 In multi-engine installations which are supplied from the same fuel source, means of isolating the fuel supply and spill piping to individual engines, shall be provided. The means of isolation shall not affect the operation of the other engines and shall be operable from a position not rendered inaccessible by a fire on any of the engines.

26 Where the Naval Administration may permit the conveying of oil and combustible liquids through accommodation and service spaces, the pipes and connections conveying oil or combustible liquids are to be of a material and type approved by the Naval Administration having regard to the fire risk.

Protection of high-temperature surfaces

27 Surfaces with temperatures above 220°C which may be impinged as a result of a fuel system failure are to be properly insulated.

28 Precautions are to be taken to prevent any oil that may escape under pressure from any pump, filter or heater from coming into contact with heated surfaces.

Arrangements for lube oil

29 The arrangements for the storage, distribution and utilisation of oil used in pressure lubrication systems are to be such as to ensure the safety of the ship and persons on board. The arrangements made in machinery spaces of category A and areas of major fire hazard, and whenever practicable in other machinery spaces, shall at least comply with the provisions of paragraphs 9, 12, 13, 14, 16, 19, 20, 23 and 27, except that:

29.1 this does not preclude the use of sight-flow glasses in lubricating systems provided that they are shown by testing to have a suitable degree of fire resistance;

29.2 sounding pipes may be authorized in machinery spaces; however, the requirements of paragraphs 15.1 and 15.3 need not be applied on condition that the sounding pipes are fitted with appropriate means of closure.

30 The provisions of paragraph 13 also apply to lube oil tanks except those having a capacity less than 500 litres, storage tanks on which valves are closed during the normal operation mode of the ship, or where it is determined that an unintended operation of a quick closing valve on the oil lubricating tank would endanger the safe operation of the main propulsion and essential auxiliary machinery.

Arrangements for other flammable liquids

31 The arrangements for the storage, distribution and utilisation of other flammable liquids employed under pressure in power transmission systems, control and activating systems and heating systems are to be such as to ensure the safety of the ship and persons on board. Suitable oil collecting arrangements for leaks are to be fitted below hydraulic valves and cylinders. In locations where means of ignition are present, such arrangements are at least to comply with the provisions of paragraphs 12, 14, 23, and 27 and with the provisions of paragraphs 19 and 20 in respect of strength and construction.

Arrangements for oil in periodically unattended machinery spaces

32 In addition to the requirements of paragraphs 7 to 31, the oil fuel and lube oil systems in a periodically unattended machinery space shall comply with the following:

32.1 where daily service oil fuel tanks are filled automatically, or by remote control, means shall be provided to prevent overflow spillages. Other equipment which treats flammable liquids automatically (e.g. oil fuel purifiers) which, whenever practicable, shall be installed in a special space reserved for purifiers and their heaters, shall have arrangements to prevent overflow spillages;

32.2 where daily service oil fuel tanks or settling tanks are fitted with heating arrangements, a high temperature alarm shall be provided if the flashpoint of the oil fuel can be exceeded.

Arrangements for gaseous fuel for domestic purposes

33 Gaseous fuel systems used for domestic purposes shall be approved by the Naval Administration. Storage of gas bottles shall be located on the open deck or in a well ventilated space which opens only to the open deck.

Miscellaneous items of ignition sources and ignitability

34 Electric radiators

34.1 Electric radiators, if used, shall be fixed in position and so constructed as to reduce fire risks to a minimum. No such radiators shall be fitted with an element so exposed that clothing, curtains, or other similar materials can be scorched or set on fire by heat from the element.

35 Waste receptacles

35.1 Waste receptacles shall be constructed of non-combustible materials with no openings in the sides or bottom.

36 Insulation surfaces protected against oil penetration

36.1 In spaces where penetration of oil products is possible, the surface of insulation shall be impervious to oil or oil vapours.

37 Primary deck coverings

37.1 Primary deck coverings, if applied within accommodation and service spaces and control stations, shall be of approved material which will not readily ignite, this being determined in accordance with the FTP Code or other standard agreed by the Naval Administration.

Plan appraisal survey and testing

38 Plans showing the general ship arrangement, location and arrangement of flammable liquids and gaseous fuels are to be submitted for appraisal.

39 After installation onboard, Independent verification of the functioning of the hydro carbon detection systems are to be carried out in accordance with the agreed test programme.

Regulation 4 Fire Growth Potential

Functional Objective

1 The fire growth potential shall be limited in every space of the ship.

Performance Requirements

2 The following functional requirements shall be met:

2.1 means of control for the air supply to a space or group of spaces shall be readily accessible from outside the spaces concerned;

2.2 means of control for flammable liquids in a space or group of spaces shall be provided readily accessible from outside the spaces concerned;

2.3 the use of combustible materials shall be restricted. Exposed surfaces in normally occupied locations and access routes are to have low flame spread characteristics in accordance with FTP code or where a reduced level of toxicity is required by the Naval Administration, STAGNAG 4602 *Fire Assessment of Materials, Edition 1*.

2.4 Storage of flammable liquids within high risk spaces shall be restricted to the minimum.

2.5 Storage of flammable gasses shall be appropriately located and restricted to the minimum.

Solutions

3 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

Closing appliances and stopping devices of ventilation

4 The main inlets and outlets of all ventilation systems shall be capable of being closed from outside the spaces being ventilated. The means of closing shall be easily accessible as well as prominently and permanently marked and shall indicate whether the shut-off is open or closed.

5 Power ventilation of accommodation spaces, service spaces, cargo spaces, control stations and machinery spaces shall be capable of being stopped from an easily accessible position outside the space being served. This position shall not be readily cut off in the event of a fire in the spaces served.

6 For Type A ships and Type B ships

6.1 Power ventilation, except machinery space and cargo space ventilation and any alternative system which may be required under Regulation 6, paragraph 7. shall be fitted with controls so grouped that all fans may be stopped from either of two separate positions which shall be situated as far apart as practicable. Fans serving power ventilation systems to cargo spaces shall be capable of being stopped from a safe position outside such spaces.

Means of control in machinery spaces

7 Means of control shall be provided for opening and closure of skylights, closure of openings in funnels which normally allow exhaust ventilation and closure of ventilator dampers.

8 Means of control shall be provided for stopping ventilating fans. Controls provided for the power ventilation serving machinery spaces shall be grouped so as to be operable from two positions, one of which shall be outside such spaces. The means provided for stopping the power ventilation of the machinery spaces shall be entirely separate from the means provided for stopping ventilation of other spaces.

9 Means of control shall be provided for stopping forced and induced draught fans, oil fuel transfer pumps, oil fuel unit pumps, lube oil service pumps, thermal oil circulating pumps and oil separators (purifiers). However, paragraphs 10 and 11 need not apply to oily water separators.

10 The controls required in paragraphs 7 to 9 and in Regulation 3, paragraph 13 shall be located outside the space concerned so they will not be cut off in the event of fire in the space they serve.

11 For Type A ships and Type B ships

11.1 The controls required in paragraphs 7 to 10 and in Regulation 8, paragraph 34.3 and the controls for any required fire-extinguishing system shall be situated at one control position or grouped in as few positions as possible to the satisfaction of the Naval Administration. Such positions shall have a safe access from the open deck.

Additional requirements for means of control in periodically unattended machinery spaces

12 For periodically unattended machinery spaces, the Naval Administration shall give special consideration to maintaining the fire integrity of the machinery spaces, the location and centralisation of the fire-extinguishing system controls, the required shutdown arrangements (e.g. ventilation, fuel pumps, etc.) in a permanently attended space and that additional fire-extinguishing appliances and other fire-fighting equipment and breathing apparatus may be required. The requirements shall be at least equivalent to those of machinery spaces normally attended.

Fire protection materials - Use of non-combustible materials

13 Insulating materials

13.1 Insulating materials shall be non-combustible, except in cargo spaces, mail rooms, baggage rooms and refrigerated compartments of service spaces. Vapour barriers and adhesives used in conjunction with insulation, as well as the insulation of pipe fittings for cold service systems, need not be of non-combustible materials, but they shall be kept to the minimum quantity practicable and their exposed surfaces shall have low flame-spread characteristics. For All ships not constructed of steel all insulating materials shall be non-combustible or fire restricting.

Note: The fire main is not considered a cold service system.

13.2 The Naval Administration may require non-combustible materials in all spaces.

14 Ceilings and linings

14.1 For Type A ships and Type B ships

14.1.1 Except in cargo spaces, all linings, grounds, draught stops and ceilings shall be of non-combustible material except in mail rooms, baggage rooms, saunas or refrigerated compartments of service spaces. Partial bulkheads or decks used to subdivide a space shall also be of non-combustible materials.

Note: The Naval Administration may allow combustible materials for ceilings and linings in other spaces based on the selected policy for fire growth potential; such as compartments employing detection and active suppression systems.

14.2 For Type C ships

14.2.1 All linings, ceilings, draught stops and their associated grounds shall be of non-combustible materials (or fire restricting materials for All ships not constructed of steel), in accommodation and service spaces and control stations.

Fire protection materials - Use of combustible materials

15 General

15.1 All furniture and furnishings shall be of restricted fire risk. The Naval Administration may allow the use of other types of furniture and furnishings in which case additional precautions, e.g. increased fire insulation or adoption of active systems, are to be applied.

15.2 For Type A and Type B ships

15.2.1 "A", "B" or "C" class divisions in accommodation and service spaces which are faced with combustible materials, facings, mouldings, decorations and veneers shall comply with the provisions of paragraphs 16 to 18 and Regulation 5. However, traditional wooden benches and wooden linings on bulkheads and ceilings are permitted in saunas and such materials need not be subject to the calculations prescribed in paragraphs 16 and 17.

15.3 For Type C ships

15.3.1 For ships constructed of steel, non-combustible bulkheads, ceilings and linings fitted in accommodation and service spaces may be faced with combustible materials, facings, mouldings, decorations and veneers provided such spaces are bounded by non-combustible bulkheads, ceilings and linings in accordance with the provisions of paragraphs 16 to 18 and Regulation 5.

16 Maximum calorific value of combustible materials

16.1 Combustible materials used on the surfaces and linings specified in paragraph 15 shall have a calorific value not exceeding 45 MJ/m^2 of the area for the thickness used. The requirements of this paragraph are not applicable to the surfaces of furniture fixed to linings or bulkheads or for All ships not constructed of steel.

Note: Refer to the recommendations published by the International Organisation for Standardisation, in particular publication ISO 1716:2002, Determination of calorific potential.

17 Total volume of combustible materials

17.1 Where combustible materials are used in accordance with paragraph 15, they shall comply with the following requirements:

17.1.1 The total volume of combustible facings, mouldings, decorations and veneers in mess areas, typical accommodation and service spaces shall not exceed a volume equivalent to 2.5 mm veneer on the combined area of the walls and ceiling linings. Furniture fixed to linings, bulkheads or decks need not be included in the calculation of the total volume of combustible materials. Calculations for the Total Amount of Combustible Materials per Unit Area in Accommodation and Service Spaces are to be performed in accordance with IMO MSC/Circ.1003 or other standard defined by the Naval Administration.

17.1.2 In the case of ships fitted with an automatic water extinguishing system complying with the requirements of Regulation 9, the above volume may include some combustible material used for erection of "C" class divisions.

18 Low flame-spread characteristics of exposed surfaces

18.1 The following surfaces shall have low flame-spread characteristics in accordance with the FTP Code:

18.1.1 Surfaces and grounds in concealed or inaccessible spaces in accommodation and service spaces and control stations and internal assembly and evacuation stations.

18.1.2 For Type A and Type B Ships,

18.1.2.1 exposed surfaces in corridors and stairway enclosures and of bulkhead and ceiling linings in accommodation and service spaces (except saunas) and control stations and internal assembly and evacuation stations;

18.1.3 For Type C ships

18.1.3.1 exposed surfaces in corridors and stairway enclosures and of ceilings in accommodation and service spaces (except saunas), control stations and internal assembly and evacuation stations;

18.1.4 For Type C, All ships not constructed of steel,

18.1.4.1 exposed surfaces in corridors and stairway enclosures, in accommodation and service spaces (except saunas) and control stations and internal assembly and evacuation stations.

Note: Low flame spread is not applicable to elements of ships not constructed of steel, as the composite/aluminium assembly have to qualify as Fire Restricting Material in full scale and in end use condition (Ref IMO Resolution MSC.40(64). The Low Flame Spread test (IMO Resolution A.653) is a small scale test designed for combustible surfaces on non-combustible structures, and is not appropriate for composite structures.

Note: The Naval Administration may require compliance with either the FTP Code or STANAG 4602 *Fire Assessment of Materials, Edition 1* in this regulation based on the fire fighting policy adopted by the navy as defined in the Concept of Operations Statement.

18.1.5 surfaces and grounds in concealed or inaccessible spaces in accommodation and service spaces and control stations.

Furniture in stairway enclosures

19 For Type A and Type B ships

19.1 Furniture in stairway enclosures shall be limited to seating. It shall be fixed, limited to six seats on each deck in each stairway enclosure, be of restricted fire risk determined in accordance with the Fire Test Procedure Code, and shall not restrict the escape route. Furniture shall not be permitted in corridors forming escape routes in cabin areas. In addition to the above, lockers of non-combustible material, providing storage for non-hazardous safety equipment required by these Regulations, may be permitted. Drinking water dispensers and ice cube machines may be permitted in corridors provided they are fixed and do not restrict the width of the escape routes.

Storage of flammable liquids and gasses

20 The maximum quantity of flammable liquid stores in high risk spaces such as machinery, ammunition spaces and special category spaces is to be agreed with the Naval Administration.

21 The maximum quantity and location of flammable gas stores on the ship is to be agreed with the Naval Administration.

Plan appraisal survey and testing

22 Details of ventilation arrangements and control arrangement for safety systems are to be submitted for appraisal.

23 Details of tests and certification for materials are to be submitted for appraisal, together with calculations for use of combustible materials.

24 After installation onboard, independent verification of the functioning of safety systems are to be carried out in accordance with the agreed test programme.

Regulation 5 Smoke Generation and Toxicity

Functional Objective

1 The hazard to life shall be reduced in spaces where persons work, live and may have regular access, from smoke and toxic products generated during a fire from spaces that contain the fire or adjacent to the fire.

Performance Requirements

2 Smoke and toxic products released from materials exposed to the effects of fire are to be limited and demonstrated to be in accordance with either the FTP Code or, where a reduced level of toxicity is required by the Naval Administration, STAGNAG 4602 *Fire Assessment of Materials, Edition 1*.

2.1 Paints, Varnishes and other surface finishes, excluding surfaces of voids, tanks and exterior surfaces exposed to weather.

2.2 Primary deck coverings and floor finishes.

2.3 Combustible Insulation Materials.

2.4 Electric and fibre optic cabling.

2.5 Other materials identified by the Naval Administration which may include:

2.5.1 Non combustible Insulation Materials.

2.5.2 Soft Furnishings, textiles and mattresses.

2.5.3 Non metallic piping.

2.5.4 Armour in especially selected spaces.

Solutions

3 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

4 Control stations, evacuation stations, escape routes and muster stations, shall be kept free of materials which generate smoke and toxic products if exposed to heat or fire, unless agreed with the Naval Administration.

5 For all ships, new installation of materials which contain asbestos shall be prohibited.

6 All electric cables are to be in accordance with the requirements of Chapter IV.

<u>Paints, Varnishes and other Finishes</u>

7 Paints, varnishes and other finishes shall be limited and when used, such products shall be approved in accordance with the FTP Code.

<u>Primary deck coverings</u>

8 Primary deck coverings, if applied within accommodation and service spaces and control stations, shall be of approved material which will not give rise to smoke or toxic or explosive hazards at elevated temperatures, this being determined in accordance with the FTP Code or other standard agreed by the Naval Administration.

Combustible Insulation Materials

9 For Type A and Type B ships

9.1 Where combustible insulation materials are used, the requirements of Regulation 4 paragraph 13 also need to consider smoke and toxicity properties.

Note: The use of combustible insulation materials is restricted in Regulation 4, paragraph 15.

Optional requirements

10 Where required by the Naval Administration, whatever the non-combustibility, fire resistance or low-flame spread characteristics of the materials used in accommodation, service spaces and control stations, such material shall be tested for smoke generation and toxicity.

11 Bunk mattresses should be designed to minimise the amount of potential combustible material(s), and such materials should have acceptable fire properties to the Naval Administration in terms of flammability, smoke generation, and toxic fume production.

12 Bunk mattresses consisting essentially of a block(s) of polymer foam (e.g. polyurethane, latex, etc) are not to be used unless permitted by the Naval Administration in which case a smoke detection system shall be provided in the cabin.

Plan appraisal survey and testing

13 Details of tests and certification for materials are to be submitted for appraisal.

Regulation 6 Control of Smoke Spread

Functional Objective

1 The spread of smoke shall be controlled in order to minimize the hazards from smoke.

Purpose

2 The purpose of this regulation is to control the spread of smoke in order to minimize the hazards from smoke. For this purpose, means for controlling smoke in control stations, machinery spaces and concealed spaces shall be provided.

Performance Requirements

3 A means for controlling the spread of smoke is to be provided within;

3.1 Main vertical zones, Fire control zones, ventilation zones and smoke tight boundaries;

3.2 Control stations;

3.3 Machinery spaces;

3.4 Special category spaces of high fire risk;

3.5 Concealed spaces behind ceilings, panelling or linings;

3.6 Muster stations and Evacuations stations.

4 Smoke clearance is to be provided for machinery spaces and other spaces nominated by the Naval Administration following a fire.

5 Control stations are to have arrangements that ensure ventilation, visibility and freedom from smoke so that, in the event of fire, the equipment contained therein may be operated effectively.

Solutions

6 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

Common requirements to all Ship Types

Protection of control stations outside machinery spaces

7 Practicable measures shall be taken for control stations outside machinery spaces in order to ensure that ventilation, visibility and freedom from smoke are maintained so that, in the event of fire, the machinery and equipment contained therein may be supervised and continue to function effectively. Alternative and separate means of air supply shall be provided and air inlets of the two sources of supply shall be so disposed that the risk of both inlets drawing in smoke simultaneously is minimized. At the discretion of the Naval Administration, such requirements need not apply to control stations situated on, and opening on to, an open deck or where local closing arrangements would be equally effective.

Release of smoke from machinery spaces

8 The provisions of this paragraph shall apply to machinery spaces of category A and machinery spaces of ships not constructed of steel, and where the Naval Administration considers desirable, to other machinery spaces.

9 Suitable arrangements shall be made to permit the release of smoke, in the event of fire, from the space to be protected, subject to the provisions of Regulation 8, paragraph 32.3. The normal ventilation systems may be acceptable for this purpose if constructed of steel or equivalent material.

10 Means of control shall be provided for permitting the release of smoke and such controls shall be located outside the space concerned so that, in the event of fire, they will not be cut off from the space they serve.

11 For Type A and Type B ships, the controls required by paragraph 10 shall be situated at one control position or grouped in as few positions as possible to the satisfaction of the Naval Administration. Such positions shall have a safe access from the open deck.

Draught stops

12 Air spaces enclosed behind ceilings, panelling or linings shall be divided by close-fitting draught stops spaced not more than 14 metres apart. In the vertical direction, such enclosed air spaces, including those behind linings of stairways, trunks, etc., shall be closed at each deck.

Smoke Extraction

13 Means are to be provided to control and configure ventilation, to;

13.1 Increase the pressure in any one or more smoke containment zones to protect the zone from smoke ingress.

13.2 Draw air from and exhaust smoke and other gases to different sides of the vessel, or areas of the ship with sufficient vertical or longitudinal separation to prevent smoke being drawn back into the vessel.

Requirements for Type B and C ships not constructed of steel

14 Ventilation zones and active smoke control

14.1 The ventilation systems in public spaces, cabins and corridor areas shall be divided into zones. Each zone shall not exceed 150 m^2 and shall be enclosed by either fire resisting divisions or smoke tight boundaries.

14.2 The ventilation zones shall be independent of each other both with respect to ventilation duct layout and control of fans and dampers. Ducts can be routed through other ventilation zones provided that smoke divisions and fire resisting divisions are not impaired.

14.3 When in line with the approved smoke control philosophy, balancing duct can be installed in divisions between cabins and corridors without the provision of smoke dampers. Elevation of balancing ducts, air intakes and extracts shall be designed with care to evacuate smoke effectively without impairing escape ways. All balancing ducts shall be provided with closing dampers operable from corridor side.

14.4 Each zone shall be designed to operate in the early stage of a fire. All essential components (ventilation fans, any dampers and control system for these) shall be designed to resist the smoke, moisture and heat expected in the first 10 minutes of a fire.

Note: Materials capable of operating at 200°C can be used for supply ducts, steel or equivalent should be provided for exhaust ducts. Fans and electrical motors with a rating of IP56 or above and cables design according to the latest version of IEC 60332 are considered to meet this requirement, even when located inside the zone or exhaust ducts serving such zones.

14.5 The smoke control philosophy is to be defined by the Concept of Operations Statement and agreed by the Naval Administration.

14.6 Emergency operation procedures for ventilation systems shall be available onboard. The procedures shall define which areas where ventilation is to be shut down in case of fire (stores) and areas where ventilation shall operate in case of fire (cabin, corridors and similar spaces) as per the Concept of Operations Statement. Drawings and descriptions of smoke zones, fan and damper location and control are to be enclosed. Procedures in case of fire when the vessel is in CBRN mode shall be defined.

Regulation 7 Detection and Alarm

Functional Objective

1 A fire in the space of origin shall be detected and an alarm shall be provided for safe escape and fire-fighting activity.

Performance Requirements

2 An effective means of detecting and locating fires and alerting the navigation bridge, continuously manned control station and fire teams is to be provided.

3 Fixed fire detection and fire alarm system installations shall be suitable for the nature of the space, fire growth potential and potential generation of smoke and gases.

4 Manually operated call points shall be placed effectively to ensure a readily accessible means of notification.

5 The fire alarm is to sound the ships general alarm if not responded to within a defined timescale.

6 Fixed fire detection and fire alarm system installations are to be demonstrated in accordance with a recognised standard and shall be tested periodically in accordance with a recognised procedure.

Solutions

7 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

General requirements

8 A fixed fire detection and fire alarm system shall be provided in accordance with the provisions of this regulation.

9 A fixed fire detection and fire alarm system and a sample extraction smoke detection system required in this regulation and other regulations in this chapter shall be of an approved type and comply with the FSS Code or other standard agreed by the Naval Administration, taking into account the requirements of paragraph 35.

10 Where a fixed fire detection and fire alarm system is required for the protection of spaces other than those specified in paragraph 18, at least one detector complying with the FSS Code or other standard agreed by the Naval Administration shall be installed in each such space.

11 A fixed fire detection and fire alarm system for all ships, with a length greater than 50 metres, shall be capable of remotely and individually identifying each detector and manually operated call point.

12 The Naval Administration may require detection and alarm arrangements in spaces adjacent to high fire risk spaces based on the fire risk analysis (for example machinery spaces of category A and special category spaces) for fire control and monitoring.

Protection of machinery spaces

13 A fixed fire detection and fire alarm system shall be installed in:

13.1 periodically unattended machinery spaces;

13.2 machinery spaces where flammable liquids are in circuits;

13.3 incinerator, gasification and pyrolysis equipment spaces.

14 Main propulsion machinery spaces that are periodically unattended or other high fire risk spaces as nominated by the Naval Administration, such as pump rooms, shall be supervised by TV cameras monitored from the continuously manned control station.

Note: Machinery Enclosures containing machinery defined in Chapter I, Regulation 2 are to be treated as unattended machinery spaces.

15 The fixed fire detection and fire alarm system shall be so designed and the detectors so positioned as to detect rapidly the onset of fire in any part of those spaces and under any normal conditions of operation of the machinery and variations of ventilation as required by the possible range of ambient temperatures. Except in spaces of restricted height and where their use is especially appropriate, detection systems using only thermal detectors shall not be permitted. The detection system shall initiate audible and visual alarms distinct in both respects from the alarms of any other system not indicating fire, in sufficient places to ensure that the alarms are heard and observed on the navigation bridge and at the continuously manned control station. When the navigation bridge is unmanned, the alarm shall sound in a place where a responsible member of the crew is on duty.

16 For machinery enclosures, a minimum of two different detector types or sensors; smoke, heat or flame are to be provided. Automatic release of the local application fire extinguishing system for the enclosure is to be activated upon detection by two detectors of different types. A fault in one detector is to initiate an alarm at an attended control station and is not to inhibit activation of the system under the control of the other detector or manually.

17 For machinery enclosures, the detection system shall initiate an audible alarm within the enclosure and in the space in which the enclosure is located.

Note: Where required by the Naval Administration machinery spaces may be fitted with flame detectors in addition to smoke detectors.

Note: The fixed fire detection and fire alarm system shall be able to detect a fire with a response time not exceeding 3 minutes and is to be agreed by the Naval Administration based on an agreed test method as detailed in paragraphs 37 - **Error! Reference source not found.**.

Protection of accommodation and service spaces

18 Fire detectors shall be installed in all stairways, corridors and escape routes within accommodation spaces. Consideration shall be given to the installation of special purpose smoke detectors within ventilation ducting.

19 For Type A and Type B ships

19.1 A fixed fire detection and fire alarm system shall be so installed and arranged as to provide fire detection in service spaces, control stations and accommodation spaces, including corridors, stairways and escape routes within accommodation spaces. Smoke detectors need not be fitted in private bathrooms. Spaces having little or no fire risk such as voids, public toilets, carbon dioxide rooms and similar spaces need not be fitted with a fixed fire detection and alarm system.

19.2 Smoke detectors with variable set tuned for commissioning are acceptable in galleys in which heat detectors are fitted.

20 For Type C ships

20.1 A fixed fire detection and fire alarm system shall be installed and arranged to provide smoke detection in all corridors, stairways and escape routes within accommodation spaces.

21 For All ships not constructed of steel

21.1 a fixed fire detection system shall be installed in accordance with paragraph 19.

Protection of hold spaces

22 A fixed fire detection and fire alarm system or a sample extraction smoke detection system shall be provided in any cargo space which, in the opinion of the Naval Administration, is not accessible, except where it is shown to the satisfaction of the Naval Administration that the ship is engaged on voyages of such short duration that it would be unreasonable to apply this requirement.

Manually operated call points

23 Manually operated call points complying with the FSS Code or other standard agreed by the Naval Administration shall be installed throughout the accommodation spaces, service spaces and control stations. One manually operated call point shall be located at each exit. Manually operated call points shall be readily accessible in the corridors of each deck such that no part of the corridor is more than 20 metres from a manually operated call point.

24 Manually operated call points shall be available on each exit of the machinery spaces of category A, each exit of the galleys, as well as those of the special category spaces and all other areas of major and significant fire hazard.

Fire patrols or equivalent

25 Where required by the Naval Administration an efficient patrol system or rounds system shall be maintained so that an outbreak of fire may be promptly detected. Each member of the fire patrol shall be trained to be familiar with the arrangements of the ship as well as the location and operation of any equipment he may be called upon to use.

26 The construction of ceilings and bulkheads shall be such that it will be possible, without impairing the efficiency of the fire protection, for the fire patrols to detect any smoke originating in concealed and inaccessible places, except where in the opinion of the Naval Administration there is no risk of fire originating in such places.

27 Each member of the fire patrol, if any, shall be provided with a two-way portable communication apparatus, complying with the requirements of Chapter VIII, Regulation 8.

Fire alarm signalling systems in ships

28 Ships shall at all times when at sea, or in port (except when out of service as defined in Chapter I, Regulation 2), be so manned or equipped as to ensure that any initial fire alarm is immediately received by a responsible member of the crew, or an equivalent arrangement made to respond to the alarm. Where the alarm is not responded to, the ships general alarm is to be sounded after 2 minutes.

29 The Naval Administration may require an alarm to sound immediately in the space where a detector has been activated as well as the continuously manned control station. The alarm signal can be an integrated part of the detector or be provided from the fire detection control unit.

30 Where escape arrangements require early warning of a fire in accordance with Ch VII Regulation 16 Paragraph 6, detectors when activated, shall be capable of emitting, or cause to be emitted, an audible alarm within space where they are located. The alarm signal can be an integrated part of the detector or be provided from the fire detection control unit.

31 For All ships not constructed of steel

31.1 As a minimum, an alarm shall immediately sound in the space where a detector has been activated and in the continuously manned control station. This alarm can be an integrated part of the detector or be provided from the fire detection control unit.

32 The control panel of fixed fire detection and fire alarm systems shall be designed on the fail-safe principle (e.g., an open detector circuit shall cause an alarm condition).

33 Ships shall have the fire detection alarms for the systems required centralised in a central control station.

34 For Type A Ships

34.1 Controls for remote closing of the fire doors if any and shutting down the ventilation fans shall be centralised in the same location. The ventilation fans shall be capable of reactivation by the crew at the continuously manned control station. The control panels in the central control station shall be capable of indicating open or closed positions of fire doors if fitted and closed or off status of the detectors, alarms and fans. The control panel shall be continuously powered and shall have an automatic change-over to standby power supply in case of loss of normal power supply. The control panel shall be powered from the main source of electrical power and the emergency source of electrical power defined by Chapter IV of the code.

Requirements for fixed fire detection and fire alarm systems

35 Chapter 9 of the FSS Code for fixed fire detection and fire alarm systems is to be applied with the changes incorporated below.

36 Sources of power supply

36.1 There shall be not less than two sources of power supply for the electrical equipment used in the operation of the fixed fire detection and fire alarm system, one of which shall be an emergency source, which may be a second main switchboard where both feeding switchboards can not be put out of service at the same time in any event.

36.2 The supply shall be provided by separate feeders reserved solely for that purpose. Such feeders shall run to an automatic change-over switch situated in or adjacent to the control panel for the fire detection system.

36.3 The main (respective emergency) feeder shall run from the main (respective emergency) switchboard to the changeover switch without passing through any other distributing switchboard.

37 Detectors

37.1 The operation temperature of heat detectors in drying rooms and similar spaces of a normal high ambient temperature may be up to 30°C above the maximum deckhead temperature.

37.2 A section of fire detectors which covers a control station, a service space or an accommodation space shall not include a machinery space of category A. For fixed fire detection and fire alarm systems with remotely and individually identifiable fire detectors, a loop covering sections of fire detectors in accommodation, service spaces and control station shall not include sections of fire detectors in machinery spaces of category A or ammunition spaces. Where a fire detection loop passes through several spaces of which at least one is an area of major fire hazard the loop must be protected against failure from a single fault. The parts of the loop outside the space of origin (of the fire) shall not be disabled by single or multiple faults on the loop within the space of origin.

37.3 If the ship is divided into damage control zones, there shall be one control panel per damage control zone. Associated loops of detectors shall not extend outside the damage control zone in which its control panel is fitted. In any case a loop shall not extend beyond one main vertical zone.

37.4 For ships with a length less or equal to 50 metres, remotely and individually identifiable fire detectors are not mandatory. Where used, no section covering more than one deck within accommodation spaces, service spaces and control stations shall normally be permitted except a section which covers an enclosed stairway. In order to avoid delay in identifying the source of fire, the number of enclosed spaces included in each section shall be limited as determined by the Naval Administration. In no case shall more than 50 enclosed spaces be permitted in any section.

37.5 For ships with a length greater than 50 metres, remotely and individually identifiable fire detectors are mandatory. The sections may cover several decks and serve any number of enclosed spaces.

37.6 The maximum spacing of detectors shall be in accordance with the table below (Table 7-1):

Table 7-1: Maximum spacing of detectors

Type of detector	**Maximum floor area per detector (square metres)**	**Maximum distance apart between centres (metres)**	**Maximum distance away from bulkheads (metres)**
Heat	37 m^2	9 m	4.5 m
Smoke	74 m^2 [60 m^2]*	11 m [10 m]*	5.5 m [5.0 m]*
* The reduced area and distances are to be applied to high fire risk areas and may be extended to other areas where required by the Naval Administration.			

37.7 The Naval Administration may require or permit different spacing to that specified in the above table (Table 7-1) if based upon test data which demonstrates the characteristics of the detectors.

37.8 Indicating units shall, as a minimum, denote the section in which a detector has been activated or manually operated call point has been operated. At least one unit shall be so located that it is easily accessible to responsible members of the crew at all times. One indicating unit shall be located on the navigating bridge. if the control panel is located in the main fire control station.

37.9 Detection and alarm arrangements may also be required in adjacent spaces for fire control and monitoring.

37.10 It is necessary to identify all spaces and any associated fire zones.

38 Testing

38.1 Independent verification of the functioning of fire detection systems and arrangements is to be carried out in accordance with an agreed test programme.

38.2 After installation onboard, the functioning of the fire detection systems required in the relevant sections of this chapter shall be tested under different conditions of ventilation and machinery operation. Each detector shall be tested individually to confirm activation of the fire detection system.

38.3 Each detector is to be individually tested.

38.4 The function of the detection system shall be periodically tested to the satisfaction of the Naval Administration at a frequency not less than one year, by means of equipment producing hot air at the appropriate temperature, or smoke or aerosol particles having the appropriate range of density or particle size, or other phenomena associated with incipient fires to which the detector is designed to respond.

39 Detector Type

39.1 Areas of major and moderate fire hazard and other enclosed spaces not regularly occupied within public spaces and accommodation, such as stairway enclosures, corridors and escape routes shall be provided with an approved automatic smoke detection system and manually operated call points complying with the requirements of the FSS Code or other standard agreed by the Naval Administration to indicate at the control station the location of outbreak of a fire in all normal operating conditions of the installations. Detectors operated by heat instead of smoke may be installed in galleys.

39.2 Machinery spaces of major fire hazard shall be provided with a suitable combination of smoke and heat detectors. In addition, flame detectors shall cover all engines, heated oil fuel separators, oil-fired boilers and similar equipment. One flame detector may as a maximum cover a pair of engines. Where prime movers are fitted within acoustic enclosures, these enclosures are to be treated as a separate main machinery space and detectors fitted accordingly.

39.3 In addition to the above requirements, gas turbines are to be monitored by flame detectors.

39.4 Auxiliary machinery spaces of minor fire hazard, cargo spaces, fuel tank compartments and similar spaces shall also be fitted with smoke detectors.

39.5 Areas of no fire risk and areas with minor fire risk and limited areas such as bathrooms within cabins, void spaces and tank compartments need not to be provided with fire detectors.

39.6 All switchboard cabinets above 0.5 m^3 shall be provided with an early fire detection system and a fixed fire extinguishing system suitable for such spaces, in accordance with Regulation 9.

39.7 The detector locations and types shall be agreed by the Naval Administration and detectors are to conform to a recognised standard.

39.8 Detectors located in cabins and other public spaces shall immediately sound an alarm in the space where a detector has been activated and in the continuously manned control station. This alarm can be an integrated part of the detector or be provided from the fire detection control unit.

Optional requirements

40 It should be possible to isolate a section/loop of detectors in a safety zone for a duration of less than 30 minutes with the aim of smoke evacuation for recovering a damaged space. The isolation shall automatically revert to the operational mode after 30 minutes.

41 It should be possible to isolate individual detectors to avoid nuisance alarms during hot work.

Plan appraisal survey and testing

42 Plans of proposed installation arrangements and details of equipment are to be submitted for appraisal.

43 The proposed test plan for installation and in-service testing is to be submitted for appraisal.

44 Details of tests and certification for detector are to be submitted for appraisal.

45 Independent verification of the functioning of fire detection systems and arrangements is to be carried out in accordance with an agreed test programme.

46 After installation onboard, the functioning of the fire detection systems required in the relevant sections of this Chapter are to be tested under different conditions of ventilation and machinery operation. The system and arrangement of fire detectors is required to be tested.

47 Each detector is to be individually tested in accordance with a test programme approved by the Naval Administration.

48 For risk spaces such as machinery, galleys, special category spaces, the response time for a detector alarm is not to exceed 3 minutes after the start of the test and is to be agreed by the Naval Administration.

49 The function of the fixed fire detection and fire alarm system shall be periodically tested to the satisfaction of the Naval Administration at a frequency not less than one year.

Regulation 8 Containment of Fire

Functional Objective

1 A fire in the space of origin shall be contained.

Performance Requirements

2 The ship shall be subdivided by thermal and structural boundaries or equivalent.

2.1 Fire containment at boundaries shall have due regard to the fire risk of the space, function of the space, and function of adjacent spaces.

2.2 The fire integrity of the boundary shall be maintained at openings and penetrations.

2.3 Active and/or passive containment arrangements may be provided

3 Fire boundaries, openings and penetrations shall be demonstrated in accordance with a recognised standard.

Solutions

4 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

Thermal and structural boundaries for Type A Ships

5 Main vertical zones and horizontal zones

5.1 In all Type A ships, the hull, superstructure and deckhouses shall be subdivided into main vertical zones by "A-60" class divisions. Steps and recesses shall be kept to a minimum, but where they are necessary they shall also be "A-60" class divisions. Where tanks are on both sides of the division the standard may be reduced to "A-0".

5.2 As far as practicable, the bulkheads forming the boundaries of the main vertical zones above the submergence limit shall be in line with watertight subdivision bulkheads situated immediately below the submergence limit.

5.3 Such bulkheads shall extend from deck to deck and to the shell or other boundaries.

5.4 On ships designed for special purposes, in spaces such as vehicle spaces, ro-ro vehicle spaces or hangars, where the provision of main vertical zone bulkheads would defeat the purpose for which the ship is intended, equivalent means for controlling and limiting a fire shall be substituted and specifically approved by the Naval Administration. Service spaces and ship stores shall not be located on ro-ro decks unless protected in accordance with the applicable regulations.

5.5 The boundary bulkheads and decks of vehicle spaces, ro-ro vehicle spaces or hangars shall be insulated to "A-60" class standard. Where tanks are below vehicle spaces, ro-ro vehicle spaces or hangars, the integrity of the deck between such spaces, may be reduced to "A-0" standard.

6 Bulkheads within a main vertical zone

6.1 Bulkheads which are not required to be "A" class divisions shall be at least "B" class or "C" class divisions as prescribed in the tables 8-2 and 8-3.

6.2 Bulkheads required to be "B" class divisions shall extend from deck to deck and to the shell or other boundaries. However, where a continuous "B" class ceiling or lining is fitted on both sides of a bulkhead which is at least of the same fire resistance as the adjoining bulkhead, the bulkhead may terminate at the continuous ceiling or lining.

7 Fire integrity of bulkheads and decks

7.1 The minimum fire integrity of all bulkheads and decks shall be as prescribed in tables 8-2 and 8-3.

7.2 Where, due to any particular structural arrangements in the ship, difficulty is experienced in determining from the tables the minimum fire integrity value of any divisions, such values shall be determined to the satisfaction of the Naval Administration.

7.3 The following requirements shall govern application of the tables:

7.3.1 Table 8-1 shall apply to bulkheads not bounding either main vertical zones or horizontal zones. Table 8-2 shall apply to decks not forming steps in main vertical zones nor bounding horizontal zones;

7.3.2 For determining the appropriate fire integrity standards to be applied to boundaries between adjacent spaces, such spaces are classified according to their fire risk as shown in categories (1) to (15) below. Where the contents and use of a space are such that there is a doubt as to its classification for the purpose of this regulation, or where it is possible to assign two or more classifications to a space, it shall be treated as a space within the relevant category having the most stringent boundary requirements. Smaller, enclosed rooms within a space that have less than 30% communicating openings to that space are considered separate spaces. The fire integrity of the boundary bulkheads and decks of such smaller rooms shall be as prescribed in tables 8-2 and 8-3. The title of each category is intended to be typical rather than restrictive. The number in parentheses preceding each category refers to the applicable column or row in the tables.

Table 8-1: Categorisation of spaces for Type A ships

(1) Control stations

- Damage control stations: continuously manned control station in which the control and indicator of functions and operations for fire, flooding alarms, essential machineries, NBC protection, public address etc. are centralised as may be deemed necessary by the Naval Administration.
- Spaces containing emergency sources of power and lighting.
- Wheelhouse and chartroom.
- Spaces containing the ship's radio equipment.
- Fire-extinguishing rooms, fire control stations, fire extinguishing equipment rooms
- Control room for propulsion machinery when located outside the propulsion machinery space.
- Spaces containing centralised fire alarm equipment.
- Spaces containing centralised emergency public address system stations and equipment.
- Spaces containing naval systems for detection, command, defence, offence, communication, combat or
- weapon/control operation (e.g. COC)
- Spaces containing centralised ship's operation equipment (e.g. COP)

(2) Stairways

- Interior stairways, lifts, totally enclosed emergency escape trunks, and escalators (other than those wholly contained within the machinery spaces) and enclosures thereto.
- In this connection a stairway which is enclosed at only one level shall be regarded as part of the space from which it is not separated by a fire door.

(3) Corridors

- Corridors and lobbies.

(4) Evacuation stations and external escape routes

- Survival craft stowage area.
- Open deck spaces and passageway forming lifeboat and liferaft embarkation and lowering stations.
- Muster stations, internal and external.
- External stairs and open decks used for escape routes.
- The ship's side to the waterline in the lightest seagoing condition, superstructure and deckhouse sides situated below and adjacent to the life raft and evacuation slide embarkation areas.

(5) Open deck spaces

- Open deck spaces and passageway clear of lifeboat and liferaft embarkation and lowering stations.
- Air spaces (the space outside superstructures and deckhouses).

(6) Accommodation spaces of minor fire risk • Cabins containing furniture and furnishings of restricted fire risk. • Offices and dispensaries containing furniture and furnishings of restricted fire risk. • Public spaces containing furniture and furnishings of restricted fire risk and having a deck area of less than 50 m^2.
(7) Accommodation spaces of moderate fire risk • Public spaces containing furniture and furnishings of restricted fire risk and having a deck area of 50 m^2 or more. • Isolated lockers and small store-rooms in accommodation spaces having areas less than 4 m^2 (in which flammable liquids are not stowed). • Cleaning gear lockers (in which flammable liquids are not stowed). • Laboratories (in which flammable liquids are not stowed). • Pharmacies. • Small drying rooms (having a deck area of 4 m^2 or less). • Specie rooms. • Operating rooms.
(8) Sanitary and similar spaces • Communal sanitary facilities, showers, baths, water closets, etc. • Small laundry rooms. • Private sanitary facilities shall be considered a portion of the space in which they are located.
(9) Tanks, voids and auxiliary machinery spaces having little or no fire risk • Water tanks forming part of the ship's structure. • Voids and cofferdams. • Auxiliary machinery spaces which do not contain machinery having a pressure lubrication system and where storage of combustibles is prohibited, such as: • ventilation and air-conditioning rooms; • windlass room; • steering gear room; • stabiliser equipment room; • electrical propulsion motor room; • rooms containing section switchboards and purely electrical equipment other than oil-filled electrical transformers (above 10 kVA); • shaft alleys and pipe tunnels; • spaces for pumps and refrigeration machinery (not handling or using flammable liquids). • Closed trunks serving the spaces listed above. • Other closed trunks such as pipe and cable trunks.

(10) Auxiliary machinery spaces, cargo spaces, cargo and other oil tanks and other similar spaces of moderate fire risk • Cargo oil tanks. • Cargo holds, trunkways and hatchways. • Refrigerated chambers. • Oil fuel tanks (where installed in a separate space with no machinery). • Shaft alleys and pipe tunnels allowing storage of combustibles. • Auxiliary machinery spaces as in category (9) which contain machinery having a pressure lubrication system or where storage of combustibles is permitted. • Oil fuel filling stations. • Spaces containing oil-filled electrical transformers (above 10 kVA). • Spaces containing turbine and reciprocating steam engine driven auxiliary generators and/or small internal combustion engines of power output up to 110 kW driving generators, sprinkler, drencher or fire pumps, bilge pumps, etc. • Closed trunks serving the spaces listed above.
(11) Machinery spaces and galleys • Main propulsion machinery rooms (other than electric propulsion motor rooms) and boiler rooms. • Auxiliary machinery spaces other than those in categories (9) and (10) which contain internal combustion machinery or other oil-burning, heating or pumping units. • Oil fuel and lube oil pump rooms and aircraft refuelling stations • Galleys and annexes. • Trunks and casings to the spaces listed above.
(12) Store-rooms, workshops, pantries, etc. • Pantries not annexed to galleys. • Main laundry. • Large drying rooms (having a deck area of more than 4 m^2) • Miscellaneous stores. • Mail and baggage rooms. • Garbage rooms. • Workshops (not part of machinery spaces, ro-ro spaces, hangars, galleys, etc.). • Lockers and store-rooms having areas greater than 4 m^2, other than those spaces that have provisions for the storage of flammable liquids.
(13) Other spaces in which flammable liquids are stowed • Paint lockers. • Store-rooms containing flammable liquids (including dyes, medicines, etc.). • Laboratories (in which flammable liquids are stowed).
(14) Special purpose spaces • Aircraft or helicopter hangars • Closed Ro-ro spaces • Aircraft or Helicopter decks • Closed vehicle and boat spaces (including unmanned vehicles) • RAS station
(15) Explosion risk spaces • Integral magazines – those forming an integral part of the ship; • Independent magazines – that are non-integral, portable magazines with a capacity of $3m^3$ or greater; Magazine boxes – that are non-integral, portable magazines with a capacity of less than $3m^3$.

7.3.3 Where a single value is shown for the fire integrity of a boundary between two spaces, that value shall apply in all cases;

7.3.4 Notwithstanding the provisions of paragraph 6 there are no special requirements for material or integrity of boundaries where only a dash appears in the tables;

7.3.5 The Naval Administration shall determine in respect of category (5) spaces whether the insulation values in Table 8-2 shall apply to ends of deckhouses and superstructures, and whether the insulation values in Table 8-3 shall apply to open deck spaces. In no case shall the requirements of category (5) of Tables 8-2 or 8-3 necessitate enclosure of spaces, which in the opinion of the Naval Administration need not be enclosed.

7.4 Continuous "B" class ceilings or linings, in association with the relevant decks or bulkheads, may be accepted as contributing wholly or in part, to the required insulation and integrity of a division.

8 Protection of stairways and lifts in accommodation area

8.1 Stairways shall be within enclosures formed of "A" class divisions, with positive means of closure at all openings, except that a stairway connecting only two decks need not be enclosed, provided the integrity of the deck is maintained by proper bulkheads or self-closing doors in one 'tween-deck space. When a stairway is closed in one 'tween-deck space, the stairway enclosure shall be protected in accordance with Table 8-3.

8.2 Lift trunks shall be so fitted as to prevent the passage of smoke and flame from one ‘tween-deck to another and shall be provided with means of closing so as to permit the control of draught and smoke. Machinery for lifts located within stairway enclosures shall be arranged in a separate room, surrounded by steel boundaries, except that small passages for lift cables are permitted. Lifts which open into spaces other than corridors, public spaces, special category spaces, stairways and external areas shall not open into stairways included in the means of escape.

9 Continuous Fire Shelter

9.1 Notwithstanding the provisions of the applicable tables, the fire resistance of divisions bounding primary escape routes shall not decrease from their level of origin to the evacuation stations.

Table 8-2: Bulkheads bounding neither vertical zones nor horizontal zones (Type A ships)

SPACES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Control stations (1)	A-0	A-0	A-0	A-0	A-0	A-60	A-60	A-0	A-0	A-60	A-60	A-60	A-60	A-60	A-30
Stairways (2)		A-0 [a]	A-0	A-0	A-0	A-0	A-15	A-0	A-0	A-15	A-30	A-15	A-30	A-30	A-30
Corridors (3)			B-15	A-60	A-0	B-15	B-15	B-15	A-0	A-15	A-30	A-0	A-30	A-30	A-30
Evacuation stations and external escape routes (4)				-	A-0	A-60 [b]	A-60 [b]	A-60 [b]	A-0	A-0	A-60 [b]	A-60 [b]	A-60 [b]	A-60 [b]	A-30 [b]
Open deck spaces (5)					-	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0
Accommodation spaces of minor fire risk (6)						B-0	B-0	C	A-0	A-0	A-30	A-0	A-30	A-30	A-30
Accommodation spaces of moderate fire risk (7)							B-0	C	A-0	A-15	A-60	A-15	A-60	A-60	A-30
Sanitary and similar spaces (8)								C	A-0	A-0	A-0	A-0	A-0	A-0	A-0
Tanks, voids and auxiliary machinery spaces having little or no fire risk (9)									A-0 [a]	A-0	A-0	A-0	A-0	A-0	A-0
Auxiliary machinery spaces, cargo spaces, cargo and other oil tanks and other similar spaces of moderate fire risk (10)										A-0 [a]	A-0	A-0	A-15	A-30	A-30
Machinery spaces and galleys(11)											A-30 [a]	A-0	A-60	A-60	A-60
Storerooms, workshops, pantries, etc.(12)												A-0 [a]	A-0	A-30	A-30
Other spaces in which flammable liquids are stowed (13)													A-30	A-60	A-30
Special purpose spaces (14)														A-30 [a]	A-30
Explosive risk spaces (15)															A-30

Note to Table 8-2:

[a] Highlighted cells are above SOLAS requirements

Where adjacent spaces are in the same numerical category and letter "a" appears, a bulkhead or deck between such spaces need not be fitted if deemed unnecessary by the Naval Administration. For example, in category (11) a bulkhead need not be required between a galley and its annexed pantries provided the pantry bulkheads and decks maintain the integrity of the galley boundaries. A bulkhead is, however, required between a galley and a machinery space, or between two different machinery spaces, e.g. main propulsion room and Diesel Generator room or oil pump room, even though both spaces are in category (11)

[b] The ship's side, to the waterline in the lightest seagoing condition, superstructure and deckhouse sides situated below and adjacent to the liferaft and evacuation slide embarkation areas may be reduced to A-30.

Table 8-3: Decks not forming steps in main vertical zones nor bounding horizontal zones (Type A ships)

SPACE below	SPACE above														
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Control stations (1)	A-30	A-30	A-15	A-0	A-0	A-0	A-15	A-0	A-0	A-0	A-60	A-0	A-60	A-30	A-30
Stairways (2)	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-30	A-0	A-30	A-0	A-30
Corridors (3)	A-15	A-0	A-60	A-60	A-0	A-0	A-15	A-0	A-0	A-0	A-30	A-0	A-30	A-0	A-30
Evacuation stations and external escape routes (4)	A-0	A-0	A-0	A-0	-	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-30
Open deck spaces (5)	A-0	A-0	A-0	A-0	-	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0
Accommodation spaces of minor fire risk (6)	A-60	A-15	A-0	A-60	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-15	A-30
Accommodation spaces of moderate fire risk (7)	A-60	A-15	A-15	A-60	A-0	A-0	A-15	A-0	A-0	A-0	A-0	A-0	A-0	A-30	A-30
Sanitary and similar spaces (8)	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0
Tanks, voids and auxiliary machinery spaces having little or no fire risk (9)	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0 [a]	A-0	A-0	A-0	A-0	A-0	A-30
Auxiliary machinery spaces, cargo spaces, cargo and other oil tanks and other similar spaces of moderate fire risk (10)	A-60	A-60	A-60	A-60	A-0	A-0	A-15	A-0	A-0	A-0 [a]	A-0	A-0	A-30	A-0	A-30
Machinery spaces and galleys(11)	A-60	A-60	A-60	A-60	A-0	A-60	A-60	A-0	A-0	A-30	A-30 [a]	A-0	A-60	A-60	A-60
Storerooms, workshops, pantries, etc.(12)	A-60	A-30	A-15	A-60	A-0	A-30	A-60	A-30	A-0	A-0	A-0	A-0	A-0	A-0	A-30
Other spaces in which flammable liquids are stowed (13)	A-60	A-60	A-60	A-60	A-0	A-30	A-60	A-0	A-0	A-0	A-0	A-0	A-0	A-30	A-30
Special purpose spaces (14)	A-60	A-60	A-60	A-60	A-0	A-30	A-60	A-0	A-0	A-0	A-0	A-30	A-30	A-0	A-30
Explosive risk spaces (15)	A-30	A-30	A-30	A-30	A-0	A-30	A-30	A-0	A-30	A-30	A-30	A-60	A-30	A-30	A-30

Note to Table 8-3:

[a] Highlighted cells are above SOLAS requirements

Where adjacent spaces are in the same numerical category and letter "a" appears, a bulkhead or deck between such spaces need not be fitted if deemed unnecessary by the Naval Administration. For example, in category (11) a bulkhead need not be required between a galley and its annexed pantries provided the pantry bulkheads and decks maintain the integrity of the galley boundaries. A bulkhead is, however, required between a galley and a machinery space, or between two different machinery spaces, e.g. main propulsion room and Diesel Generator room or oil pump room, even though both spaces are in category (11)

[b] The ship's side, to the waterline in the lightest seagoing condition, superstructure and deckhouse sides situated below and adjacent to the liferaft and evacuation slide embarkation areas may be reduced to A-30.

10 Construction and arrangement of saunas

10.1 The perimeter of the sauna shall be of "A" class boundaries and may include changing rooms, showers and toilets. The sauna shall be insulated to "A-60" standard against other spaces except those inside of the perimeter and spaces of categories (5), (9) and (10).

10.2 Bathrooms with direct access to saunas may be considered as part of them. In such cases, the door between sauna and the bathroom need not comply with fire safety requirements.

10.3 The traditional wooden lining on the bulkheads and ceiling are permitted in the sauna. The ceiling above the oven shall be lined with a non-combustible plate with an air gap of at least 30 mm. The distance from the hot surfaces to combustible materials shall be at least 500 mm or the combustible materials shall be protected (e.g. non-combustible plate with an air gap of at least 30 mm).

10.4 The traditional wooden benches are permitted to be used in the sauna.

10.5 The sauna door shall open outwards by pushing.

10.6 Electrically heated ovens shall be provided with a timer.

<u>Thermal and structural boundaries for Type B and Type C ships</u>

11 Bulkheads within a main vertical zone

11.1 In Type B ships, the hull, superstructure and deckhouses in way of accommodation and service spaces shall be subdivided into main vertical zones by at least "A-60" class divisions.

11.2 As far as practicable, the bulkheads forming the boundaries of the main vertical zones above the submergence limit shall be in line with watertight subdivision bulkheads situated immediately below the submergence limit.

11.3 Such bulkheads shall extend from deck to deck and to the shell or other boundaries.

11.4 On spaces designed for special purposes, such as vehicle spaces, ro-ro vehicle spaces or hangars, where the provision of main vertical zone bulkheads would defeat the purpose for which the ship is intended, equivalent means for controlling and limiting a fire shall be substituted and specifically approved by the Naval Administration. Service spaces and ship stores shall not be located on ro-ro decks unless protected in accordance with the applicable regulations.

12 Bulkheads within accommodation area

12.1 Bulkheads required to be "B" class divisions shall extend from deck to deck and to the shell or other boundaries. Where a continuous "B" class ceiling or lining is fitted which is at least of the same fire resistance as the adjoining bulkhead, the bulkhead may terminate at the continuous ceiling or lining with the agreement of the Naval Administration.

12.2 Bulkheads not required by this or other regulations to be "A" or "B" class divisions, shall be of at least "C" class construction.

13 Fire integrity of bulkheads and decks

13.1 The minimum fire integrity of bulkheads and decks shall be as prescribed in tables 8-5 and 8-6.

13.2 Where, due to any particular structural arrangements in the ship, difficulty is experienced in determining from the tables the minimum fire integrity value of any divisions, such values shall be determined to the satisfaction of the Naval Administration.

13.3 The following requirements shall govern application of the tables:

13.3.1 Tables 8-5 and 8-6 shall apply respectively to the bulkheads and decks separating adjacent spaces;

13.3.2 For determining the appropriate fire integrity standards to be applied to divisions between adjacent spaces, such spaces are classified according to their fire risk as shown in categories (1) to (11) below. Where the contents and use of a space are such that there is a doubt as to its classification for the purpose of this regulation, or where it is possible to assign two or more classifications to a space, it shall be treated as a space within the relevant category having the most stringent boundary requirements. Smaller, enclosed rooms within a space that have less than 30% communicating openings to that space are considered separate spaces. The fire integrity of the boundary bulkheads and decks of such smaller rooms shall be as prescribed in tables 8-5 and 8-6. The title of each category is intended to be typical rather than restrictive. The number in parentheses preceding each category refers to the applicable column or row in the tables;

Table 8-4: Categorisation of spaces according to fire risk

(1) Control stations

- Damage control stations: continuously manned control station in which are centralised the control and indicator of functions and operations for fire , flooding alarms, essential machineries, NBC protection, public address etc. as may be deemed necessary by the Naval Administration.
- Spaces containing emergency sources of power and lighting.
- Wheelhouse and chartroom.
- Spaces containing the ship's radio equipment.
- Fire-extinguishing rooms, fire control stations, fire extinguishing equipment rooms.
- Control room for propulsion machinery when located outside the propulsion machinery space.
- Spaces containing centralised fire alarm equipment.
- Spaces containing centralised emergency public address system stations and equipment.
- Spaces containing naval systems for detection, command, defence, offence, communication, combat or weapon/control operation (e.g. COC).
- Spaces containing centralised ship's operation equipment (e.g. COP).

(2) Corridors

- Corridors and lobbies.

(3) Accommodation spaces • Cabins containing furniture and furnishings of restricted fire risk. • Offices and dispensaries containing furniture and furnishings of restricted fire risk. • Public spaces containing furniture and furnishings of restricted fire risk • Isolated lockers and small store-rooms in accommodation spaces having areas less than 4 m^2 (in which flammable liquids are not stowed). • Cleaning gear lockers (in which flammable liquids are not stowed). • Laboratories (in which flammable liquids are not stowed). • Pharmacies. • Small drying rooms (having a deck area of 4 m^2 or less). • Specie rooms. • Operating rooms. • Saunas • Film stowage and shops
(4) Stairways and evacuation stations • Interior stairways, lifts, totally enclosed emergency escape trunks, and escalators (other than those wholly contained within the machinery spaces) and enclosures thereto. • In this connection a stairway which is enclosed at only one level shall be regarded as part of the space from which it is not separated by a fire door. • External stairs and open decks used for escape routes. • Passageway forming lifeboat and liferaft embarkation and lowering stations. • Survival craft stowage area. • Muster stations, internal and external. • The ship's side to the waterline in the lightest seagoing condition, superstructure and deckhouse sides situated below and adjacent to the liferaft and evacuation slide embarkation areas.
(5) Service spaces (low risk) • Main laundry • Drying rooms. • Miscellaneous stores. • Mail and baggage rooms. • Garbage rooms. • Lockers and store-rooms having areas less than 4 m^2
(6) Machinery spaces of category A • Main propulsion machinery rooms (other than electric propulsion motor rooms) and boiler rooms. • Auxiliary machinery spaces other than those in category (7) which contains internal combustion machinery or other oil-burning, heating or pumping units. • Oil fuel and lube oil pump rooms and aircraft refuelling stations • Trunks and casings to the spaces listed above.

(7) Other machinery spaces • Ventilation and air-conditioning rooms; • Windlass room; • Steering gear room; • Stabilizer equipment room; • Electrical propulsion motor room; • Rooms containing section switchboards and purely electrical equipment other than oil-filled electrical transformers (above 10 kVA); • Shaft alleys and pipe tunnels; • Spaces for pumps and refrigeration machinery • Oil fuel filling stations. • Spaces containing oil-filled electrical transformers (above 10 kVA). • Spaces containing turbine and reciprocating steam engine driven auxiliary generators and/or small internal combustion engines of power output up to 110 kW driving generators, sprinkler, drencher or fire pumps, bilge pumps, etc. • Tanks, voids and water tanks • Cofferdams • Trunks serving the spaces listed above.
(8) Service spaces (high risk) • Galleys and annexes. • Pantries • Paint lockers. • Store-rooms having areas more than 4 m^2 • Store-rooms containing flammable liquids (including dyes, medicines, etc.). • Laboratories (in which flammable liquids are stowed). • Workshops (not part of machinery spaces, ro-ro spaces, hangars, galleys, etc.)
(9) Open deck spaces • Open deck spaces and passageway clear of lifeboat and liferaft embarkation and lowering stations. • Air spaces (the space outside superstructures and deckhouses).
(10) Special spaces • Aircraft or helicopter hangars • Closed Ro-ro spaces • Aircraft or Helicopter decks • Closed vehicle and boat spaces (including unmanned vehicles) • RAS station
(11) Explosion risk spaces • Integral magazines – those forming an integral part of the ship; • Independent magazines – that are non-integral, portable magazines with a capacity of $3m^3$ or greater; • Magazine boxes – that are non-integral, portable magazines with a capacity of less than $3m^3$.

13.4 Continuous "B" class ceilings or linings, in association with the relevant decks or bulkheads, may be accepted as contributing, wholly or in part, to the required insulation and integrity of a division.

14 Continuous Fire Shelter

14.1 Notwithstanding the provisions of the applicable tables, the fire resistance of divisions bounding primary escape routes shall not decrease from their level of origin to the evacuation stations.

Table 8-5: Bulkheads in Type B and C ships

SPACES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Control stations (1)	A-0	A-0	A-60	A-0	A-15	A-60	A-15	A-60	*	A-60	A-30
Corridors (2)		C	B-0	A-0	B-0	A-60	A-0	A-15	*	A-30	A-30
Accommodation spaces (3)			C	A-0	B-0	A-60	A-0	A-15	*	A-30	A-30
Stairways (4)				A-0	A-0	A-60	A-0	A-0	*	A-30	A-30
Service spaces (low risk) (5)					C	A-60	A-0	A-0	*	A-0	A-30
Machinery spaces of category A (6)						A-30 [a]	A-0	A-60	*	A-60	A-60
Other machinery spaces (7)							A-0 [a]	A-0	*	A-0	A-30
Service spaces (high risk) (8)								A-0 [a]	*	A-30	A-30
Open decks (9)									*	A-30	A-0
Special purpose spaces (10)									-	A-30 [a]	A-30
Explosive risk spaces (11)											A-30

Table 8-6: Decks in Type B and C ships

SPACE below	SPACE above										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Control stations (1)	A-0	A-0	A-0	A-0	A-0	A-60	A-0	A-0	*	A-60	A-30
Corridors (2)	A-0	*	*	A-0	*	A-60	A-0	A-0	*	A-30	A-30
Accommodation spaces (3)	A-60	A-0	*	A-0	*	A-60	A-0	A-0	*	A-30	A-30
Stairways (4)	A-0	A-0	A-0	A-0	A-0	A-60	A-0	A-0	*	A-30	A-30
Service spaces (low risk) (5)	A-15	A-0	A-0	A-0	*	A-60	A-0	A-0	*	A-0	A-30
Machinery spaces of category A (6)	A-60	A-60	A-60	A-60	A-60	A-30 [a]	A-60	A-60	*	A-60	A-60
Other machinery spaces (7)	A-15	A-0	A-0	A-0	A-0	A-0	A-0	A-0	*	A-0	A-30
Service spaces (high risk) (8)	A-60	A-0	A-0	A-0	A-0	A-60	A-0	A-0	*	A-30	A-30
Open decks (9)	*	*	*	*	*	*	*	A-0	*	*	A-0
Special purpose spaces (10)	A-60	A-30	A-30	A-30	A-0	A-60	A-0	A-30	*	A-30 [a]	A-30
Explosive risk spaces (11)	A-30	A-30	A-30	A-30	A-30	A-30	A-30	A-30	A-0	A-30	A-30

Note to Tables 8-5 and 8-6:

[a] Highlighted cells are above SOLAS requirements

Where spaces are of the same numerical category and note [a] appears, a bulkhead or deck of the rating shown in the tables is only required when the adjacent spaces are for a different purpose (e.g. in category (8)). A galley next to a galley does not require a bulkhead but a galley next to a paint room requires an "A-0" bulkhead.

* Where an asterisk appears in the tables, the division is required to be of steel or other equivalent material but is not required to be of "A" class standard. However, where a deck, except an open deck, is penetrated for the passage of electric cables, pipes and vent ducts, such penetrations should be made tight to prevent the passage of flame and smoke. Divisions between control stations (emergency generators) and open decks may have air intake openings without means for closure, unless a fixed gas fire-fighting system is fitted.

The ship's side, to the waterline in the lightest seagoing condition, superstructure and deckhouse sides situated below and adjacent to the liferaft and evacuation slide embarkation areas may be reduced to A-30.

<u>For Type B ships</u>

15 Protection of stairways and lifts in accommodation area

15.1 Stairways shall be within enclosures formed of "A" class divisions, with positive means of closure at all openings, except that a stairway connecting only two decks need not be enclosed, provided the integrity of the deck is maintained by proper bulkheads or self-closing doors in one 'tween-deck space. When a stairway is closed in one 'tween-deck space, the stairway enclosure shall be protected in accordance with Table 8-3.

15.2 Lift trunks shall be so fitted as to prevent the passage of smoke and flame from one ‘tween-deck to another and shall be provided with means of closing so as to permit the control of draught and smoke. Machinery for lifts located within stairway enclosures shall be arranged in a separate room, surrounded by steel boundaries, except that small passages for lift cables are permitted. Lifts which open into spaces other than corridors, public spaces, special category spaces, stairways and external areas shall not open into stairways included in the means of escape.

For Type C ships

16 Protection of stairways and lift trunks in accommodation spaces, service spaces and control stations

16.1 Stairways which penetrate only a single deck shall be protected, at a minimum, at one level by at least "B-0" class divisions and self-closing doors. Lifts which penetrate only a single deck shall be surrounded by "A-0" class divisions with steel doors at both levels. Stairways and lift trunks which penetrate more than a single deck shall be surrounded by at least "A-0" class divisions and be protected by self-closing doors at all levels.

Thermal and structural boundaries for ships not constructed of steel

17 Structural Fire Protection - Main structure

17.1 The structural fire protection times for separating bulkheads and decks shall be in accordance with Table 8-8, and the structural fire protection times are all based on providing protection for a period of 60 minutes as referred to in the definition of Structural Fire Protection time. If any other lesser structural fire protection time is determined for cargo ships, then the times given below may be amended pro rata. In no case shall the structural fire protection time be less than 30 minutes.

17.2 In using Table 8-8, it shall be noted that the title of each category is intended to be typical rather than restricted. For determining the appropriate fire integrity standards to be applied to boundaries between adjacent spaces, where there is doubt as to their classification for the purpose of this section, they shall be treated as spaces within the relevant category having the most stringent boundary requirement.

17.3 In approving structural fire protection details, the Naval Administration shall have regard to the risk of heat transmission at intersections and terminal points of required thermal barriers.

17.4 When a space is divided by partial bulkheads into two (or more) smaller areas such that they form enclosed spaces, then the enclosed spaces shall be surrounded by bulkheads and decks in accordance with Table 8-8, as applicable. However, if the separating bulkheads of such spaces are at least 30% open, then the spaces may be considered as the same space.

18 Tables for structural fire protection times

18.1 Cabinets or lockers having a deck area of less than 2 m^2 may be accepted as part of the space they serve provided they have open ventilation to the space and do not contain any material or equipment which could be a fire risk.

19 Fire-resisting divisions

19.1 Areas of major and moderate fire hazard shall be enclosed by fire-resisting divisions complying with the requirements listed in the Regulation 1 definitions except where the omission of any such division would not affect the safety of the ship. These requirements need not apply to those parts of the structure in contact with water at the lightweight condition, but due regard shall be given to the effect of temperature of hull in contact with water and heat transfer from any uninsulated structure in contact with water to insulated structure above the water.

19.2 Fire-resisting bulkheads and decks shall be constructed to resist exposure to the standard fire test for a period of 30 minutes for areas of moderate fire hazard and 60 minutes for areas of major fire hazards except as provided in paragraph 17.1.

Thermal and structural boundaries for ships not constructed of steel

20 As far as practicable, the bulkheads forming the boundaries of the fire control zones above the submergence limit shall be in line with watertight subdivision bulkheads situated immediately below the submergence limit. The length and width of fire control zones may be extended to a maximum of 40 metres in order to bring the ends of fire control zones to coincide with watertight subdivision bulkheads. The length or width of a fire control zone is the maximum horizontal distance between the furthermost points of the bulkheads bounding it. Such bulkheads shall extend from deck to deck and to the shell or other boundaries.

21 In addition to the fire resisting divisions specified by the rules, other load carrying structures shall be provided with fire insulation, unless it can be documented, for all parts of the vessel, that a fire in two adjacent compartments will not threaten the structural integrity of the vessel.

22 For the purpose of these rules, cabins and corridors shall be considered as areas of minor fire hazard. Divisions enclosing these spaces shall be smoke tight.

23 Fire integrity of bulkheads and decks

23.1 The minimum fire integrity of bulkheads and decks shall be as prescribed in Table 8-8.

23.2 Where, due to any particular structural arrangements in the ship, difficulty is experienced in determining from the tables the minimum fire integrity value of any divisions, such values shall be determined to the satisfaction of the Naval Administration.

23.3 The following requirements shall govern application of the tables:

23.3.1 Table 8-8 shall apply to the bulkheads and decks separating adjacent spaces;

23.3.2 For determining the appropriate fire integrity standards to be applied to divisions between adjacent spaces, such spaces are classified according to their fire risk as shown in categories A to F below.

Table 8-7: Categorisation of spaces according to fire risk

(A) "Areas of major fire hazard" include the following spaces: • machinery spaces • ro-ro spaces • spaces containing dangerous goods • special category spaces • store-rooms containing flammable liquids • galleys • trunks in direct communication with the above spaces. • Ammunition spaces • RAS station • Aviation facilities
(B) "Areas of moderate fire hazard" include the following spaces: • auxiliary machinery spaces • bond stores containing packaged beverages with alcohol content not exceeding 24% by volume • accommodation containing sleeping berths • service spaces • trunks in direct communication with the above space.

(C)"Areas of minor fire hazard" include the following spaces:

- auxiliary machinery spaces
- cargo spaces
- fuel tank compartments
- public spaces
- tanks, voids and areas of little or no fire risk
- corridors and stairway enclosures
- trunks in direct communication with the above spaces.

(D) “Control stations” include the following areas:

- Damage control stations: continuously manned control station in which are centralised the control and indicator of functions and operations for fire , flooding alarms, essential machineries, NBC protection, public address etc. as may be deemed necessary by the Naval Administration.
- Spaces containing emergency sources of power and lighting.
- Wheelhouse and chartroom.
- Spaces containing the ship’s radio equipment.
- Fire-extinguishing rooms, fire control stations, fire extinguishing equipment rooms
- Control room for propulsion machinery when located outside the propulsion machinery space.
- Spaces containing centralised fire alarm equipment.
- Spaces containing centralised emergency public address system stations and equipment.
- Spaces containing naval systems for detection, command, defence, offence, communication, combat or weapon/control operation (e.g. COC)
- Spaces containing centralised ship’s operation equipment (e.g. COP)

(E) “Evacuation stations and external escape routes” include the following areas:

- Survival craft stowage area.
- Open deck spaces and passageway forming lifeboat and life raft embarkation and lowering stations.
- Assembly stations, internal and external.
- External stairs and open decks used for escape routes.
- The ship’s side to the waterline in the lightest seagoing condition, superstructure and deckhouse sides situated below and adjacent to the life raft and evacuation slide embarkation areas.

(F) "Open spaces" include the following areas:

- Open deck spaces and passageway clear of lifeboat and life raft embarkation and lowering stations.
- Air spaces (the space outside superstructures and deckhouses).

Table 8-8: Structural fire protection times for separating bulkheads and decks for ships not constructed of steel

	A	B	C	D	E	F
Areas of major fire hazard A	60 1), 2) / 60 1), 2)	30 / 60 1)	3) / 60 1), 8)	3), 4) / 60 1)	3) / 60 1)	- / 60 1), 7), 9)
Areas of moderate fire hazard B		2), 6) / 2), 6)	3) / 6)	3), 4) / 60	3) / 6)	- / 3)
Areas of minor fire hazard C			3) / 3)	3), 4) / 30 8)	3) / 3)	- / 3)
Control stations D				3), 4) / 3), 4)	3) / 3), 4)	- / 3)
Evacuation stations and escape routes E					3) / 3)	- / 3)
Open spaces F						- / -

Note to Table 8-8:

The figures on either side of the diagonal line represent the required structural fire protection time for the protection system on the relevant side of the division. When steel construction is used and two different structural fire protection times are required for a division in the table, only the greater one need be applied.

Table 8-9: Structural fire protection times

(1) The upper side of the decks of special category spaces, ro-ro spaces and open ro-ro spaces need not be insulated.
(2) Where adjacent spaces are in the same alphabetical category and a note 2 appears, a bulkhead or deck between such spaces need not be fitted if deemed unnecessary by the Naval Administration. For example, a bulkhead need not be required between two store-rooms. A bulkhead, is however, required between a machinery space and a special category space even through both spaces are in the same category.
(3) No structural fire protection requirements; however, a smoke-tight division made of non-combustible or fire restricting material is required.

(4) Control stations which are also auxiliary machinery spaces shall be provided with 30 minutes structural fire protection.
(5) There are no special requirements for material or integrity of boundaries where only a dash appears in the tables.
(6) The fire protection time is 0 minutes and the time for prevention of passage of smoke and flame is 30 minutes as determined by the first 30 minutes of the standard fire test.
(7) When steel construction is used, fire resisting divisions adjacent to void spaces need not comply with point 5 of the definitions of Fire Resisting Divisions in Regulation 1.
(8) The fire protection time may be reduced to 0 minutes for those parts of open ro-ro spaces which are not essential parts of the ship's main load bearing structure, where passengers have no access to them and the crew need not have access to them during any emergency.
(9) On Type B ships not constructed of steel, this value may be reduced to 0 minutes where the ship is provided with only a single public space (excluding lavatories) protected by a sprinkler system and adjacent to the operating compartment

<u>Penetration in fire-resisting divisions and prevention of heat transmission in all Ship Types except ships not constructed of steel</u>

24 Where "A" class divisions are penetrated, such penetrations shall be tested in accordance with the FTP Code, or other standard as required by the Naval Administration. In the case of ventilation ducts, paragraphs 36.2 and 38.1 apply. However, where a pipe penetration is made of steel or equivalent material having a thickness of 3 mm or greater and a length of not less than 900 mm (preferably 450 mm on each side of the division), and no openings, testing is not required. Such penetrations shall be suitably insulated by extension of the insulation at the same level of the division.

Note: Tests on penetrations shall be representative of the division in which the penetration will be fitted. Many penetration systems require additional insulation particularly if the fire hazard is from the non-insulated side of the bulkhead.

Note: The Naval Administration may require doors in fire resisting divisions to have a smoke tight, gastight or watertight integrity or be operable following fire exposure. Doors in watertight subdivisions are to comply with Ch III Reg 2 Para 18. Tests to demonstrate capability post fire will need to be undertaken to the standard defined by the Naval Administration. Tests are generally to be in accordance with IMO Resolution A.754(18).

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25 Where "B" class divisions are penetrated for the passage of electric cables, pipes, trunks, ducts, etc., or for the fitting of ventilation terminals, lighting fixtures and similar devices, arrangements shall be made to ensure that the fire resistance is not impaired, subject to the provisions of paragraph 38.2. Pipes other than steel or copper that penetrate "B" class divisions shall be protected by either:

25.1 a fire tested penetration device, suitable for the fire resistance of the division pierced and the type of pipe used provided the penetration is installed & insulated as tested; or

25.2 a steel sleeve, having a thickness of not less than 1.8 mm and a length of not less than 900 mm for pipe diameters of 150 mm or more and not less than 600 mm for pipe diameters of less than 150 mm (preferably equally divided to each side of the division). The pipe shall be connected to the ends of the sleeve by flanges or couplings; or the clearance between the sleeve and the pipe shall not exceed 2.5 mm; or any clearance between pipe and sleeve shall be made tight by means of non-combustible or other suitable material.

26 Uninsulated metallic pipes penetrating "A" or "B" class divisions shall be of materials having a melting temperature which exceeds 950ºC for “A-0” and 850ºC for “B-0” class divisions.

27 In approving structural fire protection details, the Naval Administration shall have regard to the risk of heat transmission at intersections and terminal points of required thermal barriers. The insulation of a deck or bulkhead shall be carried past the penetration, intersection or terminal point for a distance of at least 450 mm in the case of steel and aluminium structures. If a space is divided with a deck or a bulkhead of "A" class standard having insulation of different values, the insulation with the higher value shall continue on the deck or bulkhead with the insulation of the lesser value for a distance of at least 450 mm.

Protection of penetrations in fire resisting divisions in ships not constructed of steel

28 Where a fire-resisting division is penetrated by pipes, ducts, electrical cables etc., arrangements shall be made to ensure that the fire-resisting integrity of the division is not impaired, and necessary testing shall be carried out in accordance with the FTP Code or other standard as required by the Naval Administration.

Protection of Openings in Fire-Resisting Divisions in all Ship Types

29 General

29.1 Openings shall be provided with permanently attached means of closing which shall be at least as effective for resisting fires as the divisions in which they are fitted, Hatches between cargo, special category, store, and baggage spaces, and openings between such spaces and the weather decks need not be fitted with a closing appliance effective for resisting fire.

29.2 Doors and hatches in fire-resisting divisions are to be type approved. The fire resistance of doors and hatches shall be determined in accordance with the FTP Code, or other standard as required by the Naval Administration. Doors and hatches in A class Divisions are to be smoke tight during the fire exposure test.

Note: The Naval Administration may require doors in fire resisting divisions to have a smoke tight, gastight or watertight integrity or be operable following fire exposure. Doors and hatches in watertight subdivisions are to comply with Ch III Reg 2 Para 18. Tests to demonstrate capability post fire will need to be undertaken to the standard defined by the Naval Administration.

In general, doors and hatches are to be fire tested in accordance with IMO Resolution A.754(18).

Smoke tight is defined as having a leakage rate not greater then that defined in BS 476 Pt31 section 31.1 (1983). 3m^3/m/hr. Gas tight and water tight doors can be assumed to be smoke tight.

29.3 The construction of doors, hatches and frames in "A" class divisions with the means of securing them when closed, shall provide resistance to fire equivalent to that of the divisions in which they are situated, and shall be constructed of steel or other equivalent material.

Note: The Naval Administration may permit a limited number of large hydraulic watertight doors or hatches constructed of steel without insulation or demonstrated fire resistance.

29.4 Doors, hatches and frames in "B" class divisions and means of securing them shall provide a method of closure which shall have resistance to fire equivalent to that of the divisions, in which they are fitted, except that ventilation openings may be permitted in the lower portion of doors. Where such openings are in or under a door, the total net area of any such opening or openings shall not exceed 0.05 m^2. Alternatively, a non-combustible air balance duct routed between the cabin and the corridor, and located in the lower part of the bulkhead is permitted where the cross-sectional area of the duct does not exceed 0.05 m^2. All ventilation openings shall be fitted with a grill made of non-combustible material. Doors in "B" class divisions shall be non-combustible. Doors approved without the sill being part of the frame, shall be installed such that the gap under the door does not exceed 25mm.

29.5 The requirements for Fire integrity of the outer boundaries of a ship shall not apply to external doors, hatches, glass partitions, windows and side scuttles, provided that there are no requirements for such boundaries to have fire integrity to protect life saving arrangements as defined in paragraph 33.3 or specific requirements from the Naval Administration for high risk spaces such as flight decks or Ro-Ro spaces.

29.6 The Naval Administration may permit the use of combustible materials in doors separating cabins from the individual interior sanitary spaces such as showers.

29.7 It shall be possible for each fire door and hatch to be opened and closed from each side of the bulkhead by one person only.

29.8 Special care is to be put into fastening arrangement of steel door and hatch frames in aluminium and composite bulkheads to avoid heat bridges that may threaten the integrity of the division in a fire.

Note: Fire doors and hatches of aluminium or composites may be permitted in fire-resisting divisions if successfully tested in their bulkhead in accordance with IMO Resolution A.754(18) and to the satisfaction of the Naval Administration.

30 Manual doors in fire resisting divisions

30.1 Manually operated watertight doors and hatches should be insulated as far as practicable to meet the fire resisting performance of the division of which it is a part.

Note: Manually operated watertight doors or hatches of steel construction without fire insulation may be accepted by the Naval Administration if there is no risk of igniting combustible materials on the other side of the fire-resisting divisions. If the bulkhead is not constructed of steel, the fastening of the door is arranged to avoid excessive heat transfer to the bulkhead.

30.2 Where required to be self-closing, doors and hatches shall be capable of closing against an inclination of 3.5° opposing closure.

30.3 Doors or hatches required to be self-closing and requiring hold-back arrangements are to be fitted with remotely operated release devices of the fail-safe type. The controls for remote release shall be located outside the space concerned, where they will not be cut off in the event of fire in the space it serves. The door or hatch shall also be capable of release individually from a position at both sides of the door. Release switches shall have an on-off function to prevent automatic resetting of the system.

30.4 Where manual hold backs or hooks are required for operational purposes, suitable arrangements and procedures are to be developed and agreed with the Naval Administration.

30.5 Doors and hatches for emergency escape trunks need not be fitted with a fail-safe hold-back facility and a remotely operated release device.

30.6 Where manual fire doors or hatches without self closing mechanisms are fitted the arrangements to contain the fire shall be in accordance with Naval Administration requirements such that they maintain the integrity of the division.

30.7 Double-leaf doors equipped with a latch necessary for their fire integrity shall have a latch that is automatically activated by the operation of the doors when released by the system.

Note; the Naval Administration may require doors to operate at larger angles of heel or with faster response times for certain operating scenarios.

31 Powered doors in main fire divisions

31.1 Where powered fire doors or hatches are fitted they shall satisfy the following requirements:

31.1.1 the doors and hatches shall be self-closing and be capable of closing with an angle of inclination of up to 3.5º opposing closure;

31.1.2 the approximate time of closure for hinged fire doors and hatches shall be no more than 40 seconds and no less than 10 seconds from the beginning of their movement with the ship in upright position. The approximate uniform rate of closure for sliding doors and hatches shall be of no more than 0.2 m/s and no less than 0.1 m/s with the ship in upright position;

31.1.3 the controls for operation of the door or hatch shall be located outside the space concerned, where they will not be cut off in the event of fire in the space it serves;

31.1.4 a door or hatch closed remotely from the central control station shall be capable of being reopened from both sides of the door or hatch by local control. After such local opening, the door or hatch shall automatically close again;

31.1.5 indication must be provided at the fire door and hatch indicator panel in the continuously manned central control station whether each door or hatch is closed; the release mechanism shall be so designed that the door or hatch will automatically close in the event of disruption of the control system or central power supply;

31.1.6 local power accumulators for power-operated doors and hatches shall be provided in the immediate vicinity of the doors or hatch to enable the operation after disruption of the control system or central power supply at least ten times (fully opened and closed) using the local controls;

31.1.7 disruption of the control system or central power supply at one door or hatch shall not impair the safe functioning of the other doors and hatches;

31.1.8 Power-operated doors or hatches shall be equipped with an alarm that sounds at least 5 seconds but no more than 10 seconds after the door or hatch being released from the central control station and before the door begins to move and continues sounding until the door is completely closed;

31.1.9 a door or hatch designed to re-open upon contacting an object in its path shall re-open not more than 1 metre from the point of contact;

31.1.10 double-leaf doors equipped with a latch necessary for their fire integrity shall have a latch that is automatically activated by the operation of the doors when released by the system;

31.1.11 doors or hatches giving direct access to special category spaces which are power-operated and automatically closed need not be equipped with the alarms and remote-release mechanisms.

31.1.12 the components of the local control system shall be accessible for maintenance and adjusting;

31.1.13 power-operated doors and hatches shall be provided with a control system of an approved type which shall be able to operate in case of fire and be in accordance with the FTP Code or other standard as required by the Naval Administration. This system shall satisfy the following requirements:

31.1.13.1 the control system shall be able to operate the door or hatch at the temperature of at least 200°C for at least 60 minutes, served by the power supply;

31.1.13.2 the power supply for all other doors or hatches not subject to fire shall not be impaired;

31.1.13.3 at temperatures exceeding 200°C the control system shall be automatically isolated from the power supply and shall be capable of keeping the door or hatch closed up to at least 945°C.

Note: Powered doors, doors or hatches of steel construction without fire insulation may be accepted by the Naval Administration if there is no risk of igniting combustible materials on the other side of the fire-resisting division. If the bulkhead is not constructed of steel, the fastening of the door is arranged to avoid excessive heat transfer to the bulkhead.

32 Protection of openings in machinery space cargo, explosive risk and special purpose space boundaries in all Ship Types

32.1 Doors and hatches, in the boundaries of Category A machinery space, spaces of major fire hazard and other high risk spaces nominated by the Naval Administration, shall be so arranged that positive closure is assured in case of fire in the space by power-operated closing arrangements in accordance with paragraph 31 or by the provision of self-closing arrangements in accordance with Paragraph 30.

32.2 Indicators shall be provided on the navigating bridge or continuously manned control centre which shall indicate when any fire door or hatch leading to or from a machinery, major fire hazard, cargo, explosive risk or special purpose space is closed.

32.3 The number of skylights, doors, hatches, ventilators, openings in funnels to permit exhaust ventilation and other openings to machinery spaces shall be reduced to a minimum consistent with the needs of ventilation and the proper and safe working of the ship.

32.4 Skylights shall be of steel and shall not contain glass panels.

32.5 Windows shall not be fitted in machinery space boundaries except for viewing ports in doors on the boundary and control rooms contained within the machinery spaces.

32.6 Viewing ports in fire-resisting divisions in machinery spaces are to be type approved and the fire resistance determined in accordance with the FTP Code, or other standard as required by the Naval Administration.

Note: The Naval Administration may require the glass to be protected from blast or pressure by a screw down cover or alternative arrangement.

33 Windows, viewing ports and side scuttles

33.1 Windows, viewing ports and side scuttles in bulkheads within accommodation and service spaces and control stations other than those to which the provisions of paragraph 29.5 and of paragraph 34.4 apply, shall be so constructed as to preserve the integrity requirements of the type of bulkheads in which they are fitted, this being determined in accordance with the FTP Code, or other standard as required by the Naval Administration.

33.2 Notwithstanding the requirements of tables 8-1 to 8-4, windows and side scuttles in bulkheads exposed to the weather, separating accommodation and service spaces and control stations shall be constructed with frames of steel or other suitable material. The glass shall be retained by a metal glazing bead or angle.

33.3 Windows facing life-saving appliances, embarkation and assembly stations, external stairs and open decks used for escape routes, and windows situated below liferaft and escape slide embarkation areas shall have fire integrity as required in Table 8-1. Where dedicated sprinkler heads are provided for windows, "A-0" windows may be accepted as equivalent. To be considered under this paragraph, the sprinkler heads must either be:

33.3.1 dedicated heads located above the windows, and installed in addition to the conventional ceiling sprinklers; or

33.3.2 conventional ceiling sprinkler heads arranged such that the window is protected by an average application rate of at least 5 l/m^2 and the additional window area is included in the calculation of the area of coverage Windows located in the ship's side below the lifeboat embarkation area shall have fire integrity at least equal to "A-0" class.

34 Additional Requirements for Type A and Type B ships not constructed of steel

34.1 All fire doors and hatches fitted in main vertical zone bulkheads, boundaries of major fire hazards, galley boundaries and stairway enclosures shall be so arranged that positive closure is assured in case of fire in the space by power-operated closing arrangements or by the provision of self-closing doors and hatches.

34.2 For Type A and Type B ships, cabin doors in "B" class divisions shall be of a self closing type.

34.3 The means of control provided for closing power-operated doors, hatches or actuating release mechanisms shall be situated at one continuously manned central control station or grouped in as few positions as possible to the satisfaction of the Naval Administration. Such positions shall have safe access from the open deck. Actuating release mechanisms shall operate simultaneously or in groups and shall be capable of release individually from a position at both sides of the door or hatch. Release switches shall have an on-off function to prevent automatic resetting of the system.

34.4 In Type B ships, where a space is protected by an automatic water extinguishing fire detection and alarm system, complying with the provisions the FSS Code or other standard as required by the Naval Administration, or fitted with a continuous "B" class ceiling, openings in decks not forming steps in main vertical zones nor bounding horizontal zones shall be closed reasonably tight rather then smoke and gas tight and such decks shall meet the "A" class integrity requirements in so far as is reasonable and practicable in the opinion of the Naval Administration.

34.5 For Type A and Type B ships, except for watertight doors, weather tight doors (semi-watertight doors), doors leading to the open deck and doors which need to be gastight, all "A" class doors located in stairways, public spaces and main vertical zone bulkheads in escape routes shall be equipped with a self-closing hose port of material, construction and fire resistance which is equivalent to the door into which it is fitted, and shall be a 150 mm square clear opening with the door closed and shall be inset into the lower edge of the door, opposite the door hinges or, in the case of sliding doors, nearest the opening.

Note: The Naval Administration may require hose ports to be fitted in Non watertight or gas tight doors and bulkhead through connectors adjacent to watertight and gas tight doors, depending on the fire fighting philosophy adopted. Where hose ports or bulkhead through connectors are used consideration need to be given to preserving, smoke, gas, water and fire integrity of the boundary.

34.6 The Naval Administration may require hatch coamings to be fitted with waterwall devices to assist in fire fighting where defined in Concept of Operations Statement.

34.7 Where manually operated fire doors or hatches are fitted with self closing arrangement, they are to satisfy the following:

34.7.1 the approximate time of closure for hinged fire doors or hatches shall be no more than 40 seconds and no less than 10 seconds from the beginning of their movement with the ship in upright position;

34.7.2 remote-released sliding doors or hatches shall be equipped with an alarm that sounds at least 5 seconds, but no more than 10 seconds, after the door is released from the central control station and before the door begins to move and which continues sounding until the door is completely closed;

34.7.3 indication must be provided at the fire door and hatch indicator panel in the continuously manned central control station whether each door or hatch is closed; the release mechanism shall be so designed that the door or hatch will automatically close in the event of disruption of the control system or central power supply.

Machinery Enclosures in all Ship Types

Note: Machinery Enclosures are optional but where fitted the requirements for Machinery enclosures must be applied. Machinery may be installed in an enclosure for the reduction of noise, for operation in a CBRN environment and/or to provide a fire boundary.

35 Construction

35.1 Enclosures are to be constructed of non-combustible materials.

35.2 For non steel ships, enclosures are to be constructed of Fire-restricting or non-combustible materials.

35.3 The Naval Administration may require the enclosure to provide a Category “A-0” fire boundary (smoke tight, non-combustible for ships not constructed of steel) for the protection of the enclosure and surrounding space.

35.4 For all enclosures containing gas turbines, uptakes and downtakes are to be “A-0” including the seals (smoke tight, non-combustible for ships not constructed of steel).

35.5 Means of enclosure ventilation shall be fitted with suitable closing devices for fire and smoke control purposes which shall operate automatically on activation of the fire extinguishing system. Manual operation from outside the machinery space shall also be possible. Any trunking to a damper that has been fitted on the enclosure boundary in preference to the compartment boundary is to be “A-0” (smoke tight, non-combustible for ships not constructed of steel).

35.6 Enclosures fitted with gaseous fire extinguishing systems or with requirements to operate in a CBRN environment are, as far as reasonably practicable, to be gas tight.

35.7 Arrangements are to be provided to prevent the spray of flammable liquids onto insulation.

35.8 Insulation shall be impervious to oil or oil vapours.

35.9 Where operation in a CBRN environment is required, the ventilation and air pressurisation arrangements are to prevent contamination of the machinery space.

35.10 Means to monitor the enclosure air temperature and differential pressure shall be provided.

35.11 Enclosures shall be fitted with a liquid leakage detection system on drains.

35.12 An access door, adequate internal lighting and observation windows, with suitable fire rating if required by the Naval Administration, are to be located to afford a clear view of both sides of the equipment within the enclosure.

Ventilation systems in all Ship Types except ships not constructed of steel

36 Duct and dampers

36.1 Ventilation ducts shall be of steel or equivalent material. However, short ducts, not generally exceeding 2 metres in length and with a free cross-sectional area not exceeding 0.02 m^2, need not be steel or equivalent subject to the following conditions:

36.1.1 subject to paragraph 36.1.2 the ducts are made of any material which has low flame spread characteristics;

36.1.2 the ducts shall be made of heat resisting non-combustible material, which may be faced internally and externally with membranes having low flame spread characteristics and, in each case, a calorific value not exceeding 45MJ/m^2 of their surface area for the thickness used.

Note: Refer to the recommendations published by the International Organization for Standardization, in particular publication ISO 1716:2002, Determination of Calorific Potential.

36.1.3 the ducts are only used at the end of the ventilation device;

36.1.4 the ducts are not situated less than 600 mm, measured along the duct, from an opening in an "A" or "B" class division including continuous "B" class ceiling.

36.2 The following arrangements shall be tested in accordance with the FTP Code, or other standard as required by the Naval Administration:

36.2.1 fire dampers, including their relevant means of operation;

36.2.2 duct penetrations through "A" class divisions. However, the test is not required where steel sleeves are directly joined to ventilation ducts by means of riveted or screwed flanges or by welding.

37 Arrangement of ducts

37.1 The ventilation systems for machinery spaces of category A, galleys, special purpose spaces and ammunition spaces shall, in general, be separated from each other and from the ventilation systems serving other spaces. Except that the galley ventilation systems on Type C ships, need not be completely separated, but may be served by separate ducts from a ventilation unit serving other spaces. In any case, an automatic fire damper shall be fitted in the galley ventilation duct near the ventilation unit. Ducts provided for the ventilation of machinery spaces of category A, galleys, special purpose spaces and ammunition spaces shall not pass through accommodation spaces, service spaces or control stations unless they comply with the conditions specified in paragraphs 37.1.1 to 37.1.4 or 37.2.1 and 37.2.2 below:

37.1.1 the ducts are constructed of steel having a thickness of at least 3 mm and 5 mm for ducts the widths or diameters of which are up to and including 300 mm and 760 mm and over respectively and, in the case of such ducts, the widths or diameters of which are between 300 mm and 760 mm having a thickness obtained by interpolation;

37.1.2 the ducts are suitably supported and stiffened;

37.1.3 the ducts are fitted with automatic fire dampers close to the boundaries penetrated;

37.1.4 the ducts are insulated to "A-60" class standard from the machinery spaces, galleys, vehicle spaces, ro-ro spaces or special category spaces to a point at least 5 metres beyond each fire damper;

37.2 or:

37.2.1 the ducts are constructed of steel in accordance with paragraphs 37.1.1 and 37.1.2 above;

37.2.2 the ducts are insulated to "A-60" class standard throughout the accommodation spaces, service spaces or control stations;

37.2.2.1 except that penetrations of main zone divisions shall also comply with the requirements of paragraph 48.

37.3 Ducts provided for ventilation to accommodation spaces, service spaces or control stations shall not pass through machinery spaces of category A, galleys, special purpose spaces and ammunition spaces unless they comply with the conditions specified in paragraphs 37.3.1 to 37.3.3 or 37.3.4 and 37.3.5 below:

37.3.1 the ducts where they pass through a machinery space of category A, galley, vehicle space, ro-ro space or special category space are constructed of steel in accordance with paragraphs 37.1.1 and 37.1.2;

37.3.2 automatic fire dampers are fitted close to the boundaries penetrated;

37.3.3 the integrity of the machinery space, galley, vehicle space, ro-ro space or special category space boundaries is maintained at the penetrations;

or:

37.3.4 the ducts where they pass through a machinery space of category A, galleys, special purpose spaces and ammunition spaces are constructed of steel in accordance with paragraphs 37.1.1 and 37.1.2.

37.3.5 the ducts are insulated to "A-60" standard within the machinery space, galley, vehicle space, ro-ro space or special category space; except that penetrations of main zone divisions shall also comply with the requirements of paragraph 48.

38 Details of duct penetrations

38.1 Where a thin plated duct with a free cross-sectional area equal to, or less than, 0.02 m^2 passes through "A" class bulkheads or decks, the opening shall be lined with a steel sheet sleeve having a thickness of at least 3 mm and a length of at least 200 mm, divided preferably into 100 mm on each side of the bulkhead or, in the case of the deck, wholly laid on the lower side of the decks pierced. Where ventilation ducts with a free cross-sectional area exceeding 0.02 m^2 pass through "A" class bulkheads or decks, the opening shall be lined with a steel sheet sleeve. However, where such ducts are of steel construction and pass through a deck or bulkhead, the ducts and sleeves shall comply with the following:

38.1.1 The sleeves shall have a thickness of at least 3 mm and a length of at least 900 mm. When passing through bulkheads, this length shall be divided preferably into 450 mm on each side of the bulkhead. These ducts, or sleeves lining such ducts, shall be provided with fire insulation. The insulation shall have at least the same fire integrity as the bulkhead or deck through which the duct passes;

38.1.2 Ducts with a free cross-sectional area exceeding 0.075 m^2 shall be fitted with fire dampers in addition to the requirements of paragraph 38.1.1. The fire damper shall operate automatically, but shall also be capable of being closed manually from both sides of the bulkhead or deck. The damper shall be provided with an indicator which shows whether the damper is open or closed. Fire dampers are not required, however, where ducts pass through spaces surrounded by "A" class divisions, without serving those spaces, provided those ducts have the same fire integrity as the divisions which they pierce. Fire dampers shall be easily accessible. Where they are placed behind ceilings or linings, these ceilings or linings shall be provided with an inspection door on which a plate reporting the identification number of the fire damper is provided. The fire damper identification number shall also be placed on any remote controls required.

38.2 Ventilation ducts with a free cross-sectional area exceeding 0.02 m^2 passing through "B" class bulkheads shall be lined with steel sheet sleeves of 900 mm in length divided preferably into 450 mm on each side of the bulkheads unless the duct is of steel for this length.

Note: The Naval Administration may permit a reduced sleeve length if it can be demonstrated that the fire integrity is equivalent to the bulkhead or deck through which the duct passes.

<u>Ventilation systems – additional requirements for Type A ships</u>

39 The ventilation system of a Type A ship shall be in compliance with the following additional requirements.

40 In general, the ventilation fans shall be so disposed that the ducts reaching the various spaces remain within the main vertical zone.

41 Where ventilation systems penetrate decks, precautions shall be taken, in addition to those relating to the fire integrity of the deck required by paragraphs 24 and 34.4, to reduce the likelihood of smoke and hot gases passing from one 'tween-deck space to another through the system. In addition to insulation requirements contained in paragraphs 39 to 44, vertical ducts shall, if necessary, be insulated as required by the appropriate tables 8-1 and 8-2.

42 Except in cargo spaces, ventilation ducts shall be constructed of the following materials:

42.1 ducts not less than 0.075 m^2 in free cross-sectional area and all vertical ducts serving more than a single 'tween-deck space shall be constructed of steel or other equivalent material;

42.2 ducts less than 0.075 m^2 in free cross-sectional area other than the vertical ducts referred to in paragraph 42.1 shall be constructed of steel or equivalent materials. Where such ducts penetrate "A" or "B" class division due regard shall be given to ensuring the fire integrity of the division;

42.3 short length of duct, not in general exceeding $0.02m^2$ in free cross-sectional area nor 2 metres in length, need not be steel or equivalent provided that all of the following conditions are met:

42.3.1 subject to paragraph 42.3.2 the duct is constructed of any material which has low flame spread characteristics;

42.3.2 the ducts shall be made of heat resisting non-combustible material, which may be faced internally and externally with membranes having low flame spread characteristics and, in each case, a calorific value not exceeding $45MJ/m^2$ of their surface area for the thickness used.

Note: Refer to the recommendations published by the International Organization for Standardization, in particular publication ISO 1716:2002, Determination of Calorific Potential.

42.3.3 the duct is used only at the terminal end of the ventilation system;

42.3.4 the duct is not located closer than 600mm measured along its length to a penetration of an "A" or "B" class division, including continuous "B" class ceilings.

43 Stairway enclosures shall be ventilated and served by an independent fan and duct system which shall not serve any other spaces in the ventilation systems.

44 Exhaust ducts shall be provided with hatches for inspection and cleaning. The hatches shall be located near the fire dampers.

<u>Exhaust ducts from galley ranges and laundries - requirements for Type A ships</u>

45 Exhaust ducts from galley ranges shall meet the requirements of paragraphs 37.2.1 and 37.2.2 and shall be fitted with:

45.1 a grease trap readily removable for cleaning unless an alternative approved grease removal system is fitted;

45.2 a fire damper located in the lower end of the duct which is automatically and remotely operated, and in addition a remotely operated fire damper located in the upper end of the duct;

45.3 a fixed means for extinguishing a fire within the duct;

45.4 remote-control arrangements for shutting off the exhaust fans and supply fans, for operating the fire dampers mentioned in paragraph 45.2 and for operating the fire extinguishing system, which shall be placed in a position close to the entrance to the galley. Where a multi-branch system is installed, a remote means located with the above controls shall be provided to close all branches exhausting through the same main duct before an extinguishing medium is released into the system;

45.5 suitably located hatches for inspection and cleaning.

46 Exhaust ducts from ranges for cooking equipment installed on open decks shall conform to paragraph 45, as applicable, when passing through accommodation spaces or spaces containing combustible materials.

47 Exhaust ducts from main laundries shall be fitted with:

47.1 Filters readily removable for cleaning purposes;

47.2 A fire damper located in the lower end of the duct which is automatically and remotely operated;

47.3 Remote-control arrangements for shutting off the exhaust fans and supply fans from within the space and for operating the fire damper mentioned in paragraph 37.3.2; and

47.4 Suitably located hatches for inspection and cleaning.

Ventilation systems – additional Requirements for Type A and Type B ships

48 Where it is necessary that a ventilation duct passes through a main vertical zone division, a fail-safe automatic closing fire damper shall be fitted adjacent to the division. The damper shall also be capable of being manually closed from each side of the division. The operating position shall be readily accessible and be marked in red light-reflecting colour. The duct between the division and the damper shall be of steel or other equivalent material and, if necessary, insulated to comply with the requirements of paragraph 24. The damper shall be fitted on at least one side of the division with a visible indicator showing whether the damper is in the open position.

Exhaust ducts from galley ranges - requirements for Type C ships

49 Where they pass through accommodation spaces or spaces containing combustible materials, the exhaust ducts from galley ranges shall be constructed of "A" class divisions. Each exhaust duct shall be fitted with:

49.1 a grease trap readily removable for cleaning;

49.2 a fire damper located in the lower end of the duct and, in addition, a fire damper in the upper end of the duct;

49.3 arrangements, operable from within the galley, for shutting off the exhaust fans;

49.4 fixed means for extinguishing a fire within the duct.

Ventilation systems for ships not constructed of steel

50 The main inlets and outlets of all ventilation systems shall be capable of being closed from outside the spaces being ventilated. In addition, such openings to areas of major fire hazard shall be capable of being closed from a continuously manned control station.

51 All ventilation fans shall be capable of being stopped from outside the spaces which they serve, and from outside the spaces in which they are installed. Ventilation fans serving areas of major fire hazard shall be capable of being operated from a continuously manned control station. The means provided for stopping the power ventilation to the machinery space shall be separated from the means provided for stopping ventilation of other spaces.

52 Areas of major fire hazard and spaces serving as muster stations shall have independent ventilation systems and ventilation ducts. Ventilation ducts for areas of major fire hazard shall not pass through other spaces, unless they are contained within a trunk or in an extended machinery space or casing insulated in accordance with Table 8-7; ventilation ducts of other spaces shall not pass through areas of major fire hazard. Ventilation outlets from areas of major fire hazard shall not terminate within a distance of 1m from any control station, evacuation station or external escape route. In addition, exhaust ducts from galley ranges shall be fitted with:

52.1 a grease trap readily removable for cleaning unless an alternative approved grease removal system is fitted;

52.2 a fire damper located in the lower end of the duct which is automatically and remotely operated, and in addition a remotely operated fire damper located in the upper end of the duct;

52.3 a fixed means for extinguishing a fire within the duct;

52.4 remote control arrangements for shutting off the exhaust fans and supply fans, for operating the fire dampers mentioned in paragraph 52.2 and for operating the fire-extinguishing system, which shall be placed in a position close to the entrance to the galley. Where a multi-branch system is installed, means shall be provided to close all branches exhausting through the same main duct before an extinguishing medium is released into the system;

52.5 suitably located hatches for inspection and cleaning.

53 Where a ventilation duct passes through a fire-resisting division, a fail safe automatic closing fire damper shall be fitted adjacent to the division. The duct between the division and the damper shall be of steel or other equivalent material and insulated to the same standard as required for the fire resisting division. The fire damper may be omitted where ducts pass through spaces surrounded by fire-resisting divisions without serving those spaces providing that the duct has the same structural fire protection time as the divisions it penetrates. Where a ventilation duct passes through a smoke-tight division, a smoke damper shall be fitted at the penetration unless the duct which passes through the space does not serve that space.

54 Where ventilation systems penetrate decks, the arrangements shall be such that the effectiveness of the deck in resisting fire is not thereby impaired and precautions shall be taken to reduce the likelihood of smoke and hot gases passing from one between-deck space to another through the system.

55 All dampers fitted on fire-resisting or smoke-tight divisions shall also be capable of being manually closed from each side of the division in which they are fitted, except for those dampers fitted on ducts serving spaces not normally manned such as stores and toilets that may be manually operated only from outside the served spaces. All dampers shall also be capable of being remotely closed from the continuously manned control station.

56 Ducts shall be made of non-combustible or fire restricting materials. Short ducts, however, may be of combustible materials subject to the following conditions:

56.1 their cross-section does not exceed 0.02 m^2;

56.2 their length does not exceed 2 m;

56.3 they may only be used at the terminal end of the ventilation system;

56.4 they shall not be situated less than 600 mm from an opening in a fire-resisting or fire restricting division; and

56.5 their surfaces have low flame spread characteristics.

57 Dampers in fire-resisting divisions are to be of an approved type. Special care is to be put into fastening arrangement of steel ducts and steel frames in aluminium and composite structures to avoid heat bridges that may threaten the integrity of the division in a fire.

58 Supply and exhaust ducts for gas turbines may be accepted without dampers, provided the integrity of the ducts are maintained throughout the spaces they penetrate. Supply ducts for gas turbines need not be fire insulated outside the machinery spaces, provided their integrity is maintained inside the machinery spaces.

Plan appraisal, survey and testing

59 The ship systems, equipment and material are to be approved in accordance with the agreed standards, criteria and/or procedures, and will include:

59.1 Plan approval and survey during manufacture, 59.2 Testing certificates of insulating materials, fire doors and fire dampers,

59.3 Installation Survey

59.4 On board testing of fire doors and fire dampers alarms and controls.

Plan appraisal survey and testing

60 Plans showing the general ship arrangement, details of proposed insulation arrangements are to be submitted for appraisal.

61 Details of tests and certification for insulating materials, penetrations and closures in fire or smoke boundaries are to be submitted for appraisal.

62 After installation onboard, independent verification of the functioning of closures in fire and smoke boundaries is to be carried out.

Regulation 9 Fire Fighting

Functional Objective

1 Suppression, containment and quick extinction of fires shall be effective within the space of origin.

Performance Requirements

2 For all foreseeable fire hazards there shall be defined effective and proportionate means of extinguishing each such fire.

3 Fixed fire-extinguishing systems shall be installed, having due regard to the risk of ignition, fire growth potential, casualty potential, and operational importance of the protected spaces.

4 Fire fighting systems and appliances are to be readily available throughout the ship.

5 Fire extinguishing systems are to be suitable for application at the initiation of a fire and for all stages through to the maximum potential escalation.

6 Automatic activation of fire fighting systems should have due regard for the function of the space and or equipment protected.

7 Fire fighting media should have due regard for the fire risk and the function of the space and or equipment protected.

8 Selection of fire fighting media should have due regard to potential environmental impact, toxicity of the agent and its fire breakdown products and potential short and long term effects on space recovery.

9 Means of purging spaces with a gaseous fire fighting system should be provided operable outside the space.

10 Reversionary means of fire fighting are to be provided to mitigate the failure of fixed systems.

11 Fire extinguishing systems and appliances are to be demonstrated in accordance with a recognised standard and shall be tested periodically.

Solutions

12 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

Water Supply Systems

13 Ships shall be provided with fire pumps, fire mains, hydrants and hoses complying with the applicable requirements of this regulation.

14 The fire main shall be capable of immediately supplying water for a fire incident response. Water shall be immediately available from the hydrants. A continuously pressurised fire main, with start of at least one fire pump upon loss of pressure is considered to meet this requirement. Other equally reliable arrangements can be accepted.

15 Fire mains and hydrants

15.1 Materials readily rendered ineffective by heat shall not be used for fire mains and hydrants unless adequately protected. Materials used for fire mains and hydrants shall be suitable protected against corrosion. The pipes and hydrants shall be so placed that the fire hoses may be easily coupled to them. The arrangement of pipes and hydrants shall be such as to avoid the possibility of freezing. Suitable drainage provisions shall be provided for fire main piping. Isolation valves shall be installed for all open deck fire main branches used for purposes other than fire fighting. In ships where deck cargo may be carried, the positions of the hydrants shall be such that they are always readily accessible and the pipes shall be arranged as far as practicable to avoid risk of damage by such cargo. Where such systems are routed through spaces containing High Voltage equipment, materials and connections are to be approved by the Naval Administration.

Notes: If trace heating is employed this system must form part of the essential safety function.

15.2 Diameter of fire mains

15.2.1 The diameter of the fire main and water service pipes shall be sufficient for the effective distribution of the maximum required discharge from two fire pumps operating simultaneously or maximum design flow through the system, whichever is greater.

15.2.2 For All ships not constructed of steel

15.2.2.1 The fire main, including supports, couplings and valves shall be made of fire resistant and corrosion resistant materials, such as CuNi. Other materials may be considered for vessels with single fire zone and limited survivability. Such materials shall comply with IMO Resolution A.753(18), L3 (test in wet condition, 30 minutes) or other standard defined by the Naval Administration.

15.3 Isolating valves and relief valves

15.3.1 Isolating valves to separate the section of the fire main within the machinery space containing the main fire pump or pumps from the rest of the fire main shall be fitted in an easily accessible and tenable position outside the machinery spaces. The fire main shall be so arranged that when the isolating valves are shut all the hydrants on the ship, except those in the machinery space referred to above, can be supplied with water by another fire pump or an emergency fire pump. The emergency fire pump, its seawater inlet, and suction and delivery pipes and isolating valves shall be located outside the machinery space. If this arrangement cannot be made, the sea-chest may be fitted in the machinery space if the valve is remotely controlled from a position in the same compartment as the emergency fire pump and the suction pipe is as short as practicable. Short lengths of suction or discharge piping may penetrate the machinery space, provided they are enclosed in a substantial steel casing or are insulated to ‘‘A-60’’ class standards. The pipes shall have substantial wall thickness, but in no case less than 11 mm, and shall be welded except for the flanged connection to the sea inlet valve.

15.3.2 The spindles of manually operated valves shall be easily accessible and all valves shall be clearly marked.

15.3.3 The position and number of isolating valves is to be agreed by the Naval Administration in accordance with the arrangement of safety zones.

15.3.4 A valve shall be fitted to serve each fire hydrant so that any fire hose may be removed while the fire pumps are in operation.

15.3.5 Relief valves shall be provided in conjunction with fire pumps if the pumps are capable of developing a pressure exceeding the design pressure of the water service pipes, hydrants and hoses. These valves shall be so placed and adjusted as to prevent excessive pressure in any part of the fire main system. The Naval Administration may allow system arrangements to be such that re-circulation provides the required pressure relief.

15.4 Number and position of hydrants

15.4.1 The number and position of hydrants shall be such that at least two jets of water not emanating from the same hydrant, one of which shall be from a single length of hose, may reach any part of the ship normally accessible to the passengers or crew while the ship is being navigated and any part of any cargo space when empty, any ro–ro space or any vehicle space, in which latter case the two jets shall reach any part of the space, each from a single length of hose. Furthermore, such hydrants shall be positioned near the accesses to the protected spaces.

Note: Where the Naval Administration fire safety policy requires it, the hydrants may be located outside the protected space.

15.4.2 All hydrants onboard shall have the same diameter. All couplings on nozzles, hoses and hydrants shall be interchangeable. A spanner is to be provided adjacent to each fire hydrant.

15.4.3 In addition to the requirements stated above, Type A and Type B Ships shall comply with the following:

15.4.3.1 In the accommodation, service and machinery spaces, the number and position of hydrants shall be such that the requirements above may be complied with when all watertight doors and all doors in main vertical zone bulkheads are closed;

15.4.3.2 Where access is provided to a machinery space of category A at a low level from an adjacent shaft tunnel, two hydrants shall be provided external to, but near the entrance to, that machinery space. Where such access is provided from other spaces, in one of those spaces two hydrants shall be provided near the entrance to the machinery space of category A. Such provision need not be made where the tunnel or adjacent spaces are not part of the escape route.

15.5 System Pressure and Pressure at hydrants

15.5.1 With the two pumps simultaneously delivering water through the nozzles specified in paragraph 19 with the quantity of water as specified in paragraph 15.2, through any adjacent hydrants, the following minimum pressures shall be maintained at all hydrants:

15.5.1.1 the maximum pressure at any hydrant shall not exceed that at which the effective control of a fire hose can be demonstrated;

15.5.1.2 For Type A and Type B ships

15.5.1.2.1 0.40 N/mm^2 or greater if required to provide effective operation of the fire fighting equipment.

15.5.1.3 For Type C ships

15.5.1.3.1 0.27 N/mm^2 or greater if required to provide effective operation of the fire fighting equipment.

15.6 International shore connection

15.6.1 Ships shall be provided with at least one international shore connection complying with the FSS Code.

15.6.2 Facilities shall be available enabling such a connection to be used on either side of the ship.

15.6.3 Where required by the Naval Administration ships shall carry hose couplings in accordance with STANAG 1169 *Firefighting Equipment and Principles for Harmonization of Present and Future Equipment and Materials, Edition 1* or other standard defined by the Naval Administration.

16 Fire pumps

16.1 Pumps accepted as fire pumps

16.1.1 Sanitary, ballast, bilge or general service pumps may be accepted as fire pumps, provided that they are not normally used for pumping oil and that if they are subject to occasional duty for the transfer or pumping of oil fuel, suitable change-over arrangements are fitted.

16.2 Number of fire pumps

16.2.1 Ships shall be provided with independently driven fire pumps to meet the performance and redundancy requirements defined by the Naval Administration with a minimum as follows:

16.2.1.1 for Type A and B ships at least three independently driven fire pumps;

16.2.1.2 for Type C ships at least two independently driven fire pumps.

16.2.2 The number and location of fire pumps and their associated sources of power must be consistent with the vessel Concept of Operations Statement, action preparations and survivability requirements. Where fire pumps may also be used as bilge/ballast pumps, simultaneous fire and bilge/ballast pumping requirements must be accommodated.

16.3 Arrangement of Fire pumps

16.3.1 Fire pumps shall not be fitted forward of the collision bulkhead or of its vertical extension, except that the Naval Administration may grant special dispensations for emergency fire pumps, if one needs to be provided.

16.3.2 For Type A and Type B ships

16.3.2.1 The arrangement of sea connections, fire pumps and their sources of power shall be so as to ensure that in the event of a fire in any one compartment, at least two fire pumps will remain operational.

16.3.3 For Type C ships with a single fire zone,

16.3.3.1 if a fire in any one compartment could put all the pumps out of action, there shall be an alternative means consisting of an emergency fire pump arranged in accordance with the FSS Code, providing a capacity not less than 25m3/hr and shall be capable of delivering at least the two jets of water required by 15.4.1 at the hydrants furthest from the emergency fire pump or alternative standard defined by the Naval Administration with its source of power and sea connection located outside the space where the main fire pumps or their sources of power are located subject to the requirements of paragraph 15.3.1.

16.3.3.2 Where other pumps, such as general service, bilge and ballast, etc., are fitted in a machinery space, arrangements shall be made to ensure that at least one of these pumps, having the capacity and pressure required by paragraphs 15.5.1.3.1 and 16.4 is capable of providing water to the fire main.

16.3.4 For All ships not constructed of steel

16.3.4.1 The arrangement of the pumps shall be such that in the event of a fire in any one compartment, all the fire pumps will not be put out of action. In general there should be no more than one fire pump in any one watertight space.

16.4 Total capacity of required fire pumps

16.4.1 The required fire pumps shall be capable of delivering for fire-fighting purposes a quantity of water, at the pressure specified in paragraph 15.5.

16.4.2 The sea water requirements of all consumers on the fire main system are to be considered to ensure that sufficient water and pressure for all fire fighting and operational scenarios, as identified in the Concept of Operations Statement, is available, when fire fighting systems are run concurrently with other essential sea water consumers.

Note: The capacity of the bilge system shall be designed accordingly.

16.4.3 For ships with a single fire zone each pump is to have at least 40% of the total required capacity defined in paragraphs 16.4.1 and 16.4.2.

16.4.4 For ships with two or more fire zones, the capacity of pumps is to be such that with any one fire zone out of action the remaining pumps are to provide the total required capacity defined in paragraphs 16.4.1 and 16.4.2.

16.4.5 Each fire pump is to have a capacity of at least 25 m3/h and shall be capable of delivering at least the two jets of water required by paragraph 15.4.1.

16.5 Requirements for the space containing the emergency fire pump

16.5.1 The space containing the emergency fire pump shall not be contiguous to the boundaries of machinery spaces of category A or those spaces containing main fire pumps. Where this is not practicable, the common bulkhead between the two spaces shall be insulated to a standard of structural fire protection equivalent to that required for a control station.

16.5.2 No direct access shall be permitted between the machinery space and the space containing the emergency fire pump and its source of power. When this is impracticable, the Naval Administration may accept an arrangement where the access is by means of an airlock with the door of the machinery space being of ‘‘A-60’’ class standard and the other door being at least steel, both reasonably gastight, self-closing and without any hold-back arrangements. Alternatively, the access may be through a watertight door capable of being operated from a space remote from the machinery space and the space containing the emergency fire pump and unlikely to be cut off in the event of fire in those spaces. In such cases, a second means of access to the space containing the emergency fire pump and its source of power shall be provided.

16.5.3 Ventilation arrangements to the space containing the independent source of power for the emergency fire pump shall be such as to preclude, as far as practicable, the possibility of smoke from a machinery space fire entering or being drawn into that space.

Fire hoses and nozzles

17 General specifications

17.1 Fire hoses shall be of non-perishable material approved by the Naval Administration and shall be sufficient in length to project a jet of water to any of the spaces in which they may be required to be used. Each hose shall be provided with a nozzle and the necessary couplings. Hoses specified in this regulation as ‘‘fire hoses’’ shall, together with any necessary fittings and tools, be kept ready for use in conspicuous positions near the water service hydrants or connections. Additionally, in interior locations, fire hoses shall be connected to the hydrants at all times. Fire hoses shall have a length of at least 10 metres, but not more than:

17.1.1 15 metres in machinery spaces;

17.1.2 20 metres in other spaces and open decks;

17.1.3 25 metres for open decks on ships with a maximum breadth in excess of 30 metres.

17.2 Unless one hose and nozzle is provided for each hydrant in the ship, there shall be complete interchangeability of hose couplings and nozzles.

18 Number and diameter of fire hoses

18.1 Ships shall be provided with fire hoses, the number and diameter of which shall be to the satisfaction of the Naval Administration.

18.2 For Type A and Type B ships the number of hoses are to be in no case less than the following:

18.2.1 At least one fire hose for each of the hydrants required by paragraph 15.4 and these hoses shall be used only for the purposes of extinguishing fires or testing the fire-extinguishing apparatus at fire drills and surveys.

18.3 For Type C Ships,

18.3.1 The number of fire hoses to be provided shall be one for each 30 metre length of the ship and one spare, but in no case less than five in all. This number does not include any hoses required in any engine-room or boiler room.

18.4 The Naval Administration may increase the number of hoses required so as to ensure that hoses in sufficient number are available and accessible at all times, having regard to the type of ship and the Concept of Operations Statement.

18.5 For ships carrying dangerous goods additional requirements are contained in Regulation 13 and Chapter X.

19 Size and types of nozzles

19.1 The size and types of nozzles are to be in accordance with Naval Administration requirements. Where not specified they shall comply with the following:

19.1.1 For the purposes of this regulation, standard nozzle sizes shall be 12 mm, 16 mm and 19 mm or as near thereto as possible.

19.1.2 For accommodation and service spaces, a nozzle size greater than 12 mm need not be used.

19.1.3 For machinery spaces and exterior locations, the nozzle size shall be such as to obtain the maximum discharge possible from two jets at the pressure mentioned in paragraph 15.5 from the smallest pump, provided that a nozzle size greater than 19 mm need not be used.

19.1.4 Nozzles shall be of an approved dual-purpose type (i.e. spray/jet type) incorporating a shutoff.

20 For All ships not constructed of steel:

20.1 An approved fire hose and nozzle in accordance with the FSS Code or other standard approved by the Naval Administration shall be connected to each hydrant at all times. Hydrant and hoses shall be installed in dedicated cabinets or clearly marked safety lockers or other arrangement defined by the Naval Administration. Fire hoses with a diameter exceeding 38 mm shall not be installed in accommodation areas unless specifically required by the Naval Administration.

Portable fire extinguishers

21 General Requirements

21.1 The number and types of extinguishers carried on board are to be agreed with Naval Administration but are not be less than the requirements of this regulation;

Note: Guidance is provided for types of extinguisher in IMO Resolution A.951(23).

21.2 Portable fire extinguishers shall comply with the requirements of the FSS Code or other standard as defined by the Naval Administration.

22 Arrangement of fire extinguishers

22.1 Accommodation spaces, service spaces and control stations shall be provided with portable fire extinguishers of appropriate types and in accordance with the requirements of IMO MSC/Circ.1275 or other standard defined by the Naval Administration. Ships of all types shall carry at least five portable fire extinguishers.

22.2 One of the portable fire extinguishers intended for use in any space shall be stowed near the entrance to that space.

22.3 Unless specifically agreed by the Naval Administration, carbon dioxide fire extinguishers shall not be placed in accommodation spaces. In control stations and other spaces containing electrical or electronic equipment or appliances necessary for the safety of the ship, fire extinguishers shall be provided whose extinguishing media are neither electrically conductive nor harmful to the equipment and appliances.

22.4 Fire extinguishers shall be situated ready for use at easily visible places, which can be reached quickly and easily at any time in the event of a fire, and in such a way that their serviceability is not impaired by the weather, vibration or other external factors. Portable fire extinguishers shall be provided with devices which indicate whether they have been used.

23 Spare charges and extinguishers

23.1 The number and location of spare charges is to be not less than:

23.2 100% of the first ten extinguishers and 50% of the remaining fire extinguishers capable of being recharged on board. Instructions for recharging shall be carried on board.

23.3 For fire extinguishers which cannot be recharged on board or where charges are not carried, additional portable fire extinguishers of the same quantity, type, capacity and number as determined in paragraph 23.2 above shall be provided in lieu of spare charges.

Note: In general spare extinguishers should be distributed throughout the vessel.

Fixed fire-extinguishing systems

24 Types of fixed fire-extinguishing systems

24.1 A fixed fire-extinguishing system required for machinery spaces and high risk spaces may be any of the following systems:

24.1.1 a fixed gas fire-extinguishing system complying with the provisions of the FSS Code and IMO MSC/Circ.848 or other standard as defined by the Naval Administration;

24.1.2 a fixed high-expansion foam fire-extinguishing system complying with the provisions of the FSS Code or other standard as defined by the Naval Administration;

24.1.3 a fixed pressure water-spraying fire-extinguishing system complying with the provisions of the FSS Code and IMO MSC/Circ.1165 or other standard as defined by the Naval Administration.

24.1.4 an aerosol fire-extinguishing system complying with the provisions of the FSS Code and IMO MSC/Circ.1270 or other standard as defined by the Naval Administration.

24.2 a fixed water based suppression system required by paragraph 34 for control stations, accommodation and service spaces complying with the provisions of IMO Resolution A.800 or other standard as defined by the Naval Administration.

24.3 A fixed local application system for machinery and equipment complying with the provisions of the FSS Code and IMO MSC/Circ.913 or other standard as defined by the Naval Administration.

Note: The Naval Administration may require the operability of a compartment to be maintained following a fire and therefore, if required, this should be taken into consideration when selecting fixed fire protection systems, for example, the use of gaseous systems in electrical spaces. Where such systems are used, suitable warning notices are to be displayed and operating procedures established to isolate the affected space. Reference is to be made to the material safety datasheet and OEM information for release and subsequent clean up.

24.4 Where a fixed fire-extinguishing system not required by this chapter is installed, it shall meet the requirements of the relevant regulations of this chapter.

24.5 Fire-extinguishing systems using Halon and perfluorocarbons shall be prohibited except where specifically agreed by the Naval Administration.

24.6 In general, the Naval Administration shall not permit the use of steam as a fire-extinguishing medium in fixed fire-extinguishing systems. Where the use of steam is permitted by the Naval Administration, it shall be used only in restricted areas as an addition to the required fire-extinguishing system and shall comply with the requirements of the FSS Code or other standard agreed by the Naval Administration.

24.7 Fixed fire-extinguishing systems are to be operable from a local control position which is appropriate for the fire hazard that may exist and remote control from the continuously manned control stations. System plans shall be displayed at each operating station.

25 Requirements for Gaseous Systems

25.1 Where a fixed gas fire-extinguishing system is used, openings which may admit air to, or allow gas to escape from a protected space shall be capable of being closed and reopened from outside the protected space. Means are to be provided for removing gas from spaces protected by fixed gas extinguishing systems.

25.2 Gaseous systems are to have audible and visual alarms that indicate before activation at all operating locations, within the protected space and at the continuously manned control station.

Note: The Naval Administration may not require the time delay required by the FSS Code before operation of a fixed gaseous system.

25.3 For All ships not constructed of steel

25.3.1 Where gas or aerosol systems are used, the quantity of extinguishing medium shall be sufficient to provide two independent discharges. The second discharge into the space shall only be activated manually from a position outside the space being protected. Where the space has a local fire suppression system installed, in accordance with paragraph 28 a second discharge is not required.

Note: The Naval Administration may restrict the use of some gaseous systems due to by-product production that is potentially dangerous to personnel and difficult to remove from equipment after a fire, e.g. Hydrogen Fluoride. The Naval Administration may impose requirements for ventilation and clean up of the space or equipment following a gaseous system release.

Note: Consideration should be given to the over pressurisation of compartments (particularly ammunition spaces) with gaseous suppression systems, or compartments fitted with water based suppression systems with a high discharge rate.

26 Requirements for Water Systems

26.1 Pumps, other than those serving the fire main, required for the provision of water for fire-extinguishing systems required by this regulation, their sources of power and their controls shall be installed outside the space or spaces protected by such systems and shall be so arranged that a fire in the space or spaces protected will not put any such system out of action.

26.2 Suitable arrangements shall be made for the drainage of water discharged when the system is activated. Where this is not practicable, documentation shall be submitted to confirm that the sprinkler system can be operated (with full pump capacity) without impairing the stability of the vessel for a minimum of 30 minutes or the Evacuation time defined in Ch VII. Whichever is greater.

27 For All ships not constructed of steel

27.1 All extinguishing systems shall be designed with 100% redundancy. Water based systems shall have 100% redundancy in pump units, including control systems. A pressure accumulator with water storage capacity is not required.

27.2 Water based systems requiring fresh water shall be connected to dedicated water tanks with capacity for minimum 5 minutes operation for the largest space to be protected and automatic switch-over to sea-water supply. Such systems can alternatively be provided with a manual switchover and fresh water supply tanks design for 15 minutes operation.

Note: Utility service tanks with low-level alarms can be considered as equivalent to dedicated tanks.

Note: Consideration should be given to the over pressurisation of compartments (particularly ammunition spaces) with water based suppression systems with a high discharge rate.

Note: The Naval Administration may require a similar level of redundancy for all fire fighting systems on other ship types.

28 Requirements for Fixed local application fire-extinguishing systems

28.1 Machinery spaces of Category A above 500 m^3 in volume shall, in addition to the fixed fire-extinguishing system required in paragraph 29.1, be protected by an approved type of fixed water-based (or equivalent) local application fire-extinguishing system, based on the guidelines developed by the IMO* or other standard as defined by the Naval Administration. In the case of periodically unattended machinery spaces, the fire-extinguishing system shall have both automatic and manual release capabilities. In the case of continuously manned machinery spaces, the fire-extinguishing system is only required to have a manual release capability.

Note: *Refer to the Guidelines for the approval of fixed water-based local application fire-fighting systems for use in category A machinery spaces (IMO MSC/Circ.913).

28.2 Fixed local application fire-extinguishing systems are to protect areas such as the following without the necessity of engine shutdown, personnel evacuation, or sealing of the spaces:

28.2.1 the fire hazard portions of internal combustion machinery used for the ship's main propulsion and power generation;

28.2.2 boiler fronts;

28.2.3 the fire hazard portions of incinerators;

28.2.4 purifiers for oil fuel.

28.3 Activation of any local application system shall give a visual and distinct audible alarm in the protected space and at continuously manned stations. The alarm shall indicate the specific system activated. The system alarm requirements described within this paragraph are in addition to, and not a substitute for, the detection and fire alarm system required elsewhere in this chapter.

<u>Fire-extinguishing arrangements in machinery spaces and other High Risk Spaces</u>

29 Machinery spaces containing oil-fired boilers or oil fuel units

29.1 Fixed fire-extinguishing systems

29.1.1 Machinery spaces of category A containing oil-fired boilers or oil fuel units shall be provided with any one of the fixed fire-extinguishing systems in paragraph 24.1. In each case, if the machinery spaces are not entirely separate, or if oil fuel can drain from the boiler room into the main machinery space, the combined spaces shall be considered as one compartment.

29.2 Additional fire-extinguishing arrangements

29.2.1 There shall be in each boiler room or at an entrance outside of the boiler room at least one portable foam applicator unit complying with the provisions of the FSS Code or other standard defined by the Naval Administration.

29.2.2 There shall be at least two portable foam extinguishers or equivalent in each firing space in each boiler room and in each space in which a part of the oil fuel installation is situated. There shall be not less than one approved foam-type extinguisher of at least 135 litre capacity or equivalent in each boiler room. These extinguishers shall be provided with hoses on reels suitable for reaching any part of the boiler room. In the case of domestic boilers of less than 175 kW an approved foam-type extinguisher of at least 135 litre capacity is not required.

30 Machinery spaces containing internal combustion machinery

30.1 Fixed fire-extinguishing systems:

30.1.1 Machinery spaces of category A containing internal combustion machinery shall be provided with one of the fixed fire-extinguishing systems in paragraph 24.1.

30.2 Additional fire-extinguishing arrangements:

30.2.1 There shall be at least one portable foam applicator unit complying with the provisions of the FSS Code or other standard defined by the Naval Administration.

30.2.2 There shall be in each such space approved foam-type fire extinguishers, each of at least 45 litre capacity or equivalent, sufficient in number to enable foam or its equivalent to be directed onto any part of the fuel and lube oil pressure systems, gearing and other fire hazards. In addition, there shall be provided a sufficient number of portable foam extinguishers or equivalent which shall be so located that no point in the space is more than 10 metres walking distance from an extinguisher and that there are at least two such extinguishers in each such space.

30.2.3 For Type C ships the Naval Administration may accept alternative arrangements.

31 Machinery spaces containing steam turbines or enclosed steam engines

31.1 Fixed fire-extinguishing systems:

31.1.1 In spaces containing steam turbines or enclosed steam engines used for main propulsion or other purposes having in the aggregate a total output of not less than 375 kW, one of the fire-extinguishing systems specified in paragraph 24.1 shall be provided if such spaces are periodically unattended.

31.2 Additional fire-extinguishing arrangements:

31.2.1 There shall be approved foam fire extinguishers, each of at least 45 litre capacity or equivalent, sufficient in number to enable foam or its equivalent to be directed on to any part of the pressure lubrication system, on to any part of the casings enclosing pressure-lubricated parts of the turbines, engines or associated gearing, and any other fire hazards. However, such extinguishers shall not be required if protection, at least equivalent to that required by this subparagraph, is provided in such spaces by a fixed fire extinguishing system fitted in compliance with paragraph 24.1.

31.2.2 There shall be a sufficient number of portable foam extinguishers or equivalent which shall be so located that no point in the space is more than 10 metres walking distance from an extinguisher and that there are at least two such extinguishers in each such space, except that such extinguishers shall not be required in addition to any provided in compliance with paragraph 30.2.2.

32 Machinery Enclosures

32.1 Machinery enclosures shall be provided with a fixed local application system in accordance with paragraph 28 and, if required the Naval Administration, shall also be supplied by the fixed fire extinguishing system fitted to protect the machinery space within which the enclosure is contained.

32.2 The local application system shall be initiated automatically in accordance with Regulation 7, paragraph 16 unless agreed otherwise by the Naval Administration and also be operable both remotely and locally (from within the machinery space containing the enclosure).

32.3 Machinery within the enclosure shall be shut down automatically on activation of the fire extinguishing system, unless continued operation of the machinery is agreed with the Naval Administration.

32.4 If continued operation of machinery with fire extinguishing systems activated is required, consideration shall be given to:

32.4.1 the capacity of the installed system;

32.4.2 the impact of cooling on the machinery.

33 Other machinery and high risk spaces

33.1 Where, in the opinion of the Naval Administration, a fire hazard exists in any machinery or high risk space for which no specific provisions for fire-extinguishing appliances are prescribed in paragraphs 29 to 31, there shall be provided in, or adjacent to, that space such a number of approved portable fire extinguishers or other means of fire extinction as the Naval Administration may deem sufficient.

33.2 Other spaces

33.2.1 Where spaces are required for the operational capability of the ship additional means of fire extinction may be required by the Naval Administration.

Fire-suppression systems

34 A fixed water based suppression system is to be fitted in accordance with the following requirements.

34.1 For Type A ships

34.1.1 An automatic water based suppression, fire detection and fire alarm system is to be fitted, The system is to be of an approved type complying with the requirements of the FSS Code, or other standard defined by the Naval Administration, in all control stations, accommodation and service spaces, including corridors and stairways. Alternatively, control stations, where water may cause damage to essential equipment, may be fitted with an approved fixed fire-extinguishing system of another type. Spaces having little or no fire risk such as voids, public toilets, carbon dioxide rooms and similar spaces need not be fitted with an automatic sprinkler system.

34.2 For Type B and C ships

34.2.1 The scope of any water based suppression, fire detection and fire alarm system shall be determined by the Naval Administration. The system if fitted is to be of an approved type complying with the requirements of the FSS Code, or other standard defined by the Naval Administration.

34.3 For All ships not constructed of steel

34.3.1 All public spaces, cabins and service spaces, storage rooms other than those required to have a fixed fire fighting system, and similar spaces shall be protected by a fixed water based suppression system meeting Standards for fixed sprinkler systems for high speed-craft, IMO Resolution MSC.44(65). Areas of no fire risk and areas with minor fire risk and limited area such as void spaces and bathrooms within cabins need not to be provided with sprinklers.

Note: See IMO MSC/Circ.912, Interpretation of standards for fixed sprinkler system for high-speed craft (Resolution MSC.44(65)).

34.3.2 Only automatic water suppression systems are accepted. The system is to cover the largest area of the following:

34.3.2.1 75 m^2;

34.3.2.2 area covered by four largest sprinkler heads;

34.3.2.3 largest public space including largest space adjacent to this.

34.3.3 The fresh water supply shall be arranged as for water based fixed fire extinguishing systems. Dedicated water tanks with capacity for minimum 5 minutes operation of demanded pumps shall be provided.

Note: The Naval Administration may allow the reduction of FW capacity for smaller ships where there are limitations on vessel weight.

Fire-extinguishing arrangements in other High Risk Spaces

35 Spaces containing flammable liquid

35.1 Paint lockers shall be protected by:

35.1.1 a carbon dioxide system, designed to give a minimum volume of free gas equal to 40% of the gross volume of the protected space;

35.1.2 a dry powder system, designed for at least 0.5 kg powder/m^3;

35.1.3 a water spraying or sprinkler system, designed for 5 litres/m^2/minute. Water spraying systems may be connected to the fire main of the ship; or

35.1.4 a system providing equivalent protection, as determined by the Naval Administration.

35.2 In all cases, the system shall be operable from outside the protected space.

35.3 Flammable liquid lockers shall be protected by an appropriate fire-extinguishing arrangement approved by the Naval Administration.

35.4 For lockers of a deck area of less than 4 m^2, which do not give access to accommodation spaces, a portable carbon dioxide fire extinguisher sized to provide a minimum volume of free gas equal to 40% of the gross volume of the space may be accepted in lieu of a fixed system. A discharge port shall be arranged in the locker to allow the discharge of the extinguisher without having to enter into the protected space. The required portable fire extinguisher shall be stowed adjacent to the port. Alternatively, a port or hose connection may be provided to facilitate the use of fire main water.

35.5 Sonar cable installations can be accepted if solely located on open deck and not containing liquids with flashpoint under 100°C. Alternatively, designs complying with the requirements for seismic cable installations will be accepted.

35.6 Requirements for seismic cables containing flammable liquids: Storage space for seismic cables, gun deck and other areas where equipment containing flammable liquids are handled or stored, shall be protected by fixed fire extinguishing system. Special attention shall be given to vessels with a wooden gun deck above the steel deck, allowing for flammable liquid to collect in the closed space. In such cases the fixed fire extinguishing is also to protect the space below the wooden deck.

Note: One suitable fire extinguishing system is a low expansion foam system with the following capacity:

- 3 litre/minute/m^2 of streamer deck area
- 10 litre/minute/ m^2 of cable reels area.

Sufficient foam concentrate to ensure at least 20 minutes of foam generation.

36 Fire extinguishing arrangements in Galleys

36.1 Deep-fat cooking equipment shall be fitted with the following:

36.1.1 an automatic or manual fire-extinguishing system tested to an international standard acceptable to the Naval Administration;

Note: Refer to the recommendations by the International Organisation for Standardisation, in particular publication ISO 15371:2000, Fire-extinguishing systems for protection of galley deep-fat cooking equipment - fire tests.

36.1.2 a primary and backup thermostat with an alarm to alert the operator in the event of failure of either thermostat;

36.1.3 arrangements for automatically shutting off the electrical power upon activation of the fire-extinguishing system;

36.1.4 an alarm for indicating operation of the fire-extinguishing system in the galley where the equipment is installed;

36.1.5 controls for manual operation of the fire-extinguishing system which are clearly labelled for ready use by the crew.

37 Fire-extinguishing arrangements in general cargo spaces

37.1 For Type A and Type B ships

37.1.1 Except as provided for in paragraph 37.3, the cargo spaces of shall be protected by a fixed fire-extinguishing system appropriate to the fire risk in the space complying with the provisions of the FSS Code or other standard defined by the Naval Administration.

37.2 The Naval Administration may apply the above requirement to other ship types as deemed necessary.

37.3 Fixed gas fire-extinguishing systems for dangerous goods

37.3.1 A ship engaged in the carriage of dangerous goods in any cargo spaces shall be provided with a fixed carbon dioxide or inert gas fire-extinguishing system complying with the provisions of the FSS Code or with a fire-extinguishing system which, in the opinion of the Naval Administration, gives equivalent protection for the cargoes carried.

38 Fire-extinguishing arrangements for ships with a function of bulk fuel carriage

38.1 A fixed deck foam system complying with the requirements of the FSS Code or other standard defined by the Naval Administration, shall be fitted on open decks that form the upper boundary of bulk fuel storage tanks and in way of fuel filling and discharging points.

39 Fire-extinguishing arrangements in other spaces

39.1 All switchboards shall be enclosed by cabinets made of steel or materials having equivalent fire resistance.

39.2 All switchboard cabinets shall be provided with a fire detection system in accordance with Regulation 7.

39.3 All switchboard cabinets above 0.5 m3 shall be provided with fixed fire extinguishing system suitable for such spaces.

Note: Fixed fire extinguishing requirements for High voltage equipment may need special consideration, arrangements are to be agreed with the Naval Administration based on the equipment type and fire risk.

Note: A modular gas fire extinguishing system is recommended.

Location of Fire Stations

40 Where fire stations are required by the Naval Administration, they shall be located above the submergence limit.

41 The arrangement of the fire stations shall be such that all the equipment is easily accessible and ready for immediate use. There shall be arrangements for hanging up protective clothing in a suspended position.

42 For All ships not constructed of steel

42.1 each fire station shall be provided with 3 fire hoses, including nozzles and spanners, 2 portable extinguishers (12 kg powder or equivalent) and three emergency breathing apparatus (as defined by the FSS Code or other standard as agreed by the Naval Administration).

42.2 Other arrangements (type of equipment and numbers) may be accepted in lieu of the above when this is according to the agreed standard.

Fire-fighter's outfits and Breathing Apparatus

43 Types of fire fighter's outfits

43.1 Fire fighter's outfits shall comply with the FSS Code or other standard defined by the Naval Administration.

43.2 For All ships not constructed of steel

43.2.1 Each of the breathing apparatus sets shall be provided with cylinders of 1,800 litres capacity. The total weight of one apparatus (including cylinder, valves and mask) is not to exceed 12.0 kg. Two spare cylinders shall be provided for each apparatus. All cylinders, apparatus and valves shall be of the same type. Apparatus with less capacity and less weight may be accepted if they are deemed to be more suitable for the intended service and more spare cylinders are provided.

44 Number of fire fighter's outfits

44.1 The number and location of fire fighter's outfits are to be in accordance with Naval Administration requirements. Ships shall carry at least three.

44.2 For All ships not constructed of steel

44.2.1 At least three sets of fire fighter's outfit are to be provided for each fire control zone.

44.3 The Naval Administration may require additional sets of personal equipment and breathing apparatus, having due regard to the size and type of the ship.

44.4 Two spare charges shall be provided for each required breathing apparatus. Type B and Type C ships that are equipped with suitably located means for fully recharging the air cylinders free from contamination need carry only one spare charge for each required apparatus. For Type A ships, at least two spare charges for each breathing apparatus shall be provided.

44.5 When more than one fire control zone is provided, the fire fighter's outfits shall be divided between two fire stations placed at a safe distance from each other. The fire stations shall be clearly marked. On vessels with only one fire control zone and one locker for fire fighter's outfit, this locker shall have access from open deck or wheelhouse.

44.6 In addition, for Type A and Type B ships there shall be provided:

44.6.1 For every 80m, or part thereof, of the aggregate of the lengths of all Public spaces and service spaces on the deck which carries such spaces or, if there is more than one such deck, on the deck which has the largest aggregate of such lengths, two fire fighter's outfits and, in addition, two sets of personal equipment. Each set shall comprise the items stipulated in the FSS Code or other standard defined by the Naval Administration.

44.6.2 For Type A ships, two additional fire fighter's outfits shall be provided for each main vertical zone. However, for stairway enclosures which constitute individual main vertical zones and for the main vertical zones in the fore or aft end of a ship which do not contain spaces of categories (6), (7),or (11) defined in Regulation 8 Table 8-1, no additional fire fighter's outfits are required;

44.6.3 For Type A ships, for each pair of breathing apparatus, one water fog applicator which shall be stored adjacent to such apparatus. The Naval Administration may relax this requirement based on the ship type and alternative arrangements.

44.7 Type A ships shall be fitted with a suitably located means for fully recharging breathing air cylinders, free from contamination. Similar arrangements for Type B and C ships may be required by the Naval Administration. This means for recharging shall be either:

44.7.1 breathing air compressors supplied from the main and emergency switchboard, or independently driven, with a minimum capacity of 60 litres/minute per required breathing apparatus, not to exceed 420 litres/minute; or

44.7.2 self-contained high-pressure storage systems of suitable pressure to recharge the breathing apparatus on board, with a capacity of at least 1,200 litres per required breathing apparatus, not to exceed 50,000 litres of free air.

45 Storage of fire fighter's outfits

45.1 The fire fighter's outfits or sets of personal equipment shall be kept ready for use in an easily accessible location that is permanently and clearly marked.

45.2 At least two fire fighter's outfits and, in addition, one set of personal equipment shall be available at any one position. At least two fire fighter's outfits shall be stored in each main vertical zone.

Hose Reel Assemblies

46 The location and type of hose reel assemblies is to be in accordance with a standard acceptable to the Naval Administration.

Additional Naval Requirements

47 In the design of a naval ship the electrical fire hazards shall be identified and suitable means of dealing with these hazards included in the design. Mitigations shall include appropriate automatic fault protection systems and effective means of dealing with the potential fires, recognising the ship safety and mission criticality of the equipment, including equipment that may be exposed to the effects of the fire or the extinguishing media, and maintaining risk to personnel As Low As Reasonably Practicable. These may comprise: use of generic portable equipment, local application (in cabinet) systems or compartment flood systems, both manual and automatic initiation.

48 Fire fighting systems shall be demonstrably effective against the hazards in accordance with a recognised standard or by other means acceptable to the Naval Administration.

Note: Examination of the causes of fires on ships indicates that electrical equipment is a significant contributor ranging from equipment failures to mal-operation and errors in specification and execution of maintenance procedures.

Electrical fire hazards range from high voltage, high power propulsion machinery, including rotating machinery and power electronics, through to low voltage, low power personal electronic equipment and associated chargers.

The initiating fault may be immediately apparent or latent; may be immediately de-energised through manual or automatic means (arc fault detection, trips, etc.) or may continue to be energised through Uninterruptible Power supplies or residual stored energy.

Plan appraisal survey and testing

49 Plans of fixed fire fighting arrangements and details of fire fighting equipment are to be submitted for appraisal.

50 The proposed test plan for installation and in-service testing of fixed fire fighting systems is to be submitted for appraisal.

51 After installation onboard, Independent verification of the functioning of the fixed fire fighting systems are to be carried out in accordance with the agreed test programme.

Note: A combination of full scale trials, partial system tests, pressure tests and air tests may be required in the test plan.

Note: Refer to the Guidelines on maintenance and inspection of fire protection systems and appliances (IMO MSC/Circ.850).

Regulation 10 Maintain Capability

Functional Objective

1 In case of Fire, the capability of essential safety functions and other defined services can be maintained and/or recovered to a minimum level as specified in this regulation or to a specified level consistent with the Concept of Operations Statement, whichever is the most strict.

Performance Requirements

2 The purpose of the regulation is to provide for the following functions to a specified level consistent with the Concept of Operations Statement.

2.1 Ship's safe return to port under its own propulsion after a casualty that does not exceed the casualty threshold.

2.2 Safe areas within the ship that maintain basic services to ensure that the health and effectiveness of persons on board is maintained after a casualty that does not exceed the casualty threshold.

2.3 Systems required to remain operational to support the orderly evacuation and abandonment of the ship, if the casualty threshold, is exceeded.

3 The Naval Administration may define other ship functions that need to be maintained after a casualty that does not exceed the casualty threshold.

Solutions

4 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

<u>Application</u>

5 Common requirements to all Ship Types: continuation or recovery of the safety and services related systems to a specified level consistent with the Concept of Operations Statement.

6 Requirements for ships with length greater than or equal to 120 metres: continuation or recovery of those systems that are required to allow a safe return to port under its own propulsion after a fire related casualty that does not exceed the casualty threshold, and also provides functional requirements and performance standards for safe areas on board of the ship. Muster stations are to be regarded as safe areas.

7 Ships constructed on or after 1 January 2009 having a length between perpendiculars of 120 metres or more or having three or more main vertical zones shall comply with the provisions of this regulation.

Note: The Naval Administration may require ships to comply with the requirements of this regulation based on the area of operation such as Arctic waters and distance from safe areas or ports as defined in the Concept of Operations Statement.

Casualty threshold, safe return to port and safe areas

8 Purpose

8.1 The purpose of this part of this regulation is to establish design criteria for a ship's safe return to port under its own propulsion after a casualty that does not exceed the casualty threshold and also provides functional requirements and performance standards for safe areas.

9 Casualty threshold

9.1 The casualty threshold, in the context of a fire, includes:

9.1.1 loss of space of origin up to the nearest "A" class boundaries, which may be a part of the space of origin, if the space of origin is protected by a fixed fire extinguishing system; or

9.1.2 loss of the space of origin and adjacent spaces up to the nearest "A" class boundaries, which are not part of the space of origin.

10 Safe return to port

Note: Refer to the Performance standards for the systems and services to remain operational on passenger ships for safe return to port and orderly evacuation and abandonment after a casualty (IMO MSC/Circ.1214).

10.1 When fire damage does not exceed the casualty threshold, the ship shall be capable of returning to port while providing a safe area as defined in Regulation 1. To be deemed capable of returning to port, the following systems shall remain operational in the remaining part of the ship not affected by fire:

10.1.1 propulsion;

10.1.2 propulsion control and essential electrical systems;

10.1.3 steering systems and steering-control systems;

10.1.4 navigational systems;

10.1.5 systems for fill, transfer and service of oil fuel;

10.1.6 internal communication between the navigating bridge, engineering spaces, damage control stations, fire-fighting and damage control teams, and as required for personnel notification and mustering;

10.1.7 external communication;

10.1.8 fire main system;

10.1.9 fixed fire-extinguishing systems;

10.1.10 fire and smoke detection system;

10.1.11 bilge and ballast system;

10.1.12 power-operated watertight and semi-watertight doors;

10.1.13 systems intended to support “safe areas” as indicated in paragraph 11.1.2;

10.1.14 flooding detection systems;

10.1.15 escape, evacuation and rescue;

10.1.16 systems to maintain conditions for embarked dangerous goods;

10.1.17 anchoring arrangements;

10.1.18 other systems determined by the Naval Administration to be vital to damage control efforts.

11 Safe area(s)

11.1 Functional requirements:

11.1.1 The safe area(s) shall generally be internal space(s); however, the use of an external space as a safe area may be allowed by the Naval Administration taking into account any restriction due to the area of operation and relevant expected environmental conditions.

11.1.2 The safe area(s) shall provide all occupants with the following basic services to ensure that the health of persons on board is maintained:

11.1.2.1 sanitation;

11.1.2.2 water;

11.1.2.3 food;

11.1.2.4 alternate space for medical care;

11.1.2.5 shelter from the weather;

11.1.2.6 means of preventing heat stress and hypothermia;

11.1.2.7 light;

11.1.2.8 ventilation.

Note: Refer to the Performance standards for the systems and services to remain operational for safe return to port and orderly evacuation and abandonment after a casualty (IMO MSC/Circ.1214)

11.1.3 Ventilation design shall reduce the risk that smoke and hot gases could affect the use of the safe area(s).

11.1.4 Means of access to life-saving appliances shall be provided from each area identified or used as a safe area, taking into account that a main vertical zone may not be available for internal transit.

11.1.5 Alternate space for medical care shall conform to a standard acceptable to the Naval Administration.

Note: Refer to the Guidance on the establishment of medical and sanitation related programmes for passenger ships (IMO MSC/Circ.1129)

Design criteria for systems to remain operational after a fire casualty

12 Purpose

12.1 The purpose of this part of this regulation is to provide design criteria for systems required to remain operational for supporting the orderly evacuation and abandonment of a ship, if the casualty threshold, is exceeded.

13 Systems

13.1 In case any one main vertical zone is unserviceable due to fire, the following systems shall be so arranged and segregated as to remain operational:

13.1.1 fire main;

13.1.2 internal communications (in support of fire-fighting as required for personnel notification and evacuation);

13.1.3 means of external communications;

13.1.4 bilge systems for removal of fire-fighting water;

13.1.5 lighting along escape routes, at assembly stations and at embarkation stations of life-saving appliances;

13.1.6 guidance systems for evacuation shall be available.

13.2 The above systems shall be capable of operation for at least 3 hours based on the assumption of no damage outside the unserviceable main vertical zone. These systems are not required to remain operational within the unserviceable main vertical zones.

13.3 Cabling and piping within a trunk constructed to an "A-60" standard shall be deemed to remain intact and serviceable while passing through the unserviceable main vertical zone for the purposes of paragraph 13.1. An equivalent degree of protection for cabling and piping may be approved by the Naval Administration.

Damage control station on Type A ships

14 Purpose

14.1 The purpose of this regulation is to provide a reversionary space to assist with the management of emergency situations in addition to the central control station.

15 Location

15.1 The damage control station shall be located in a separate damage control zone from the central control station.

15.2 The layout and ergonomic design of the damage control station shall take into account the guidelines developed by the Naval Administration.

Note: Guidance on the layout of ship safety centres for passenger ships is being developed by the IMO

16 Layout

16.1 Means of communication between the damage control station, the central control station, the navigation bridge, the storage room(s) for fire extinguishing system(s) and fire station(s) shall be provided.

16.2 The full functionality (operation, control, monitoring or any combination thereof, as required) of the safety systems listed below shall be available from the damage control station and central control station:

16.2.1 fire detection and alarm system;

16.2.2 fire pumps and emergency fire pumps;

16.2.3 fire main isolation and monitoring;

16.2.4 fixed fire fighting, sprinkler and local application systems;

16.2.5 fire door indicator panels;

16.2.6 fire door closure;

16.2.7 all powered ventilation systems;

16.2.8 flooding detection systems;

16.2.9 internal and external watertight door indicator panels, leakage detection and CCTV;

16.2.10 internal and external watertight door closures;

16.2.11 general emergency alarm system;

16.2.12 main broadcast system;

16.2.13 internal communication systems;

16.2.14 shore telephones when alongside;

16.2.15 emergency evacuation systems;

16.2.16 CCTV where required by this chapter.

Plan appraisal survey and testing

17 Plans showing safe areas and details of the services maintained are to be submitted for appraisal.

18 A description of the systems to be maintained following an incident plus system arrangements and where required supporting failure mode and effects analyses are to be submitted for appraisal.

19 The proposed test plan for installation and in-service testing is to be submitted for appraisal.

20 After installation onboard, independent verification is required to demonstrate that the required functions can be achieved for the casualty threshold.

Regulation 11 Not Used

Regulation 12 Provision of Operational Information

Functional Objective

1 Information shall be provided to address operational effectiveness, readiness and training of crew for the installed fire safety arrangements.

Performance Requirements

2 To operate, maintain and monitor the effectiveness of the fire safety measures the ship is provided with, the following requirements shall be met:

2.1 Information for the operation including: operating locations, performance capability, limitations and restrictions of all fire protection systems, fire fighting systems and appliances shall be provided.

2.2 Information for the maintenance of all fire protection systems, fire-fighting systems and appliances shall be provided and incorporated into the ships maintenance plan.

2.3 Information for the safe testing of fire protection systems, fire-fighting systems and appliances shall be provided, including recommended test schedules which are to be incorporated in the ship's maintenance plan.

3 Instructions for training and drills of persons on board in correct procedures under simulated emergency conditions are to be provided.

4 Information and instructions for proper ship and handling operations of cargo or other dangerous goods carried in relation to fire safety are to be provided.

Solutions

5 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

Operational readiness and maintenance

6 General requirements

6.1 At all times while the ship is in-service, the fire protection systems and fire-fighting systems and appliances shall be maintained ready for use.

7 Operational readiness

7.1 The following fire protection systems shall be kept in good order so as to ensure their required performance if a fire occurs:

7.1.1 structural fire protection including fire-resisting divisions, and protection of openings and penetrations in these divisions;

7.1.2 fire detection and fire alarm systems;

7.1.3 means of escape systems and appliances.

7.2 Fire-fighting systems and appliances, Personal Protective Equipment and breathing apparatus shall be kept in good working order and readily available for immediate use. Portable extinguishers which have been discharged shall be immediately recharged or replaced with an equivalent unit.

8 Maintenance, testing and inspections

8.1 Maintenance, testing and inspections shall be carried out based on the guidelines approved by the Naval Administration and in a manner having due regard to ensuring the reliability of fire-fighting systems and appliances.

Note: Refer to the Guidelines on maintenance and inspection of fire protection systems and appliances (IMO MSC/Circ.850).

8.2 The maintenance plan shall be kept on board the ship and shall be available for inspection whenever required by the Naval Administration.

8.3 The maintenance plan shall include at least the following fire protection systems and fire-fighting systems and appliances, where installed:

8.3.1 fire mains, fire pumps and hydrants including hoses, nozzles and international shore connections;

8.3.2 fixed fire detection and fire alarm systems;

8.3.3 flammable gas and hydrocarbon detectors;

8.3.4 fixed fire-extinguishing systems and other fire extinguishing appliances;

8.3.5 automatic water extinguishing, fire detection and fire alarm systems;

8.3.6 inert gas systems;

8.3.7 deck foam systems;

8.3.8 fire safety arrangements in pump rooms;

8.3.9 ventilation systems including fire and smoke dampers, fans and their controls;

8.3.10 emergency shutdown of fuel supply;

8.3.11 fire doors, including their controls;

8.3.12 general emergency alarm systems;

8.3.13 main broadcast system;

8.3.14 portable fire extinguishers including space charges;

8.3.15 fire fighter’s outfits including PPE and breathing apparatus;

8.3.16 fire, search and rescue equipment;

8.3.17 penetrations with closing devices.

8.4 The maintenance programme may be computer-based.

Instructions, on-board training and drills

9 Purpose

9.1 The purpose of this section of this regulation is to mitigate the consequences of fire by means of proper instructions for training and drills of persons on board in correct procedures under emergency conditions. For this purpose, the crew shall have the necessary knowledge and skills to handle fire emergency cases.

10 General requirements

10.1 Instructions, duties and organisation

10.1.1 Crew members shall receive instruction on fire safety on board the ship.

10.1.2 Crew members shall receive instructions on their assigned duties.

10.1.3 Parties responsible for fire-extinguishing shall be organised. These parties shall have the capability to complete their duties at all times while the ship is in service.

10.2 Onboard training and drills

10.2.1 Crew members shall be trained to be familiar with the arrangements of the ship as well as the location and operation of any fire-fighting systems and appliances that they may be called upon to use.

10.2.2 Training in the use of the emergency escape breathing devices shall be considered as part of on-board training.

10.2.3 Performance of crew member's assigned fire-fighting duties shall be periodically evaluated by conducting on-board training and drills to identify areas in need of improvement, to ensure competency in fire-fighting skills is maintained, and to ensure the operational readiness of the fire-fighting organisation.

10.2.4 For a ship in-service, on-board training in the use of the ship's fire-extinguishing systems and appliances shall be given as soon as possible but not later than two weeks after a crew member joins the ship. However, if the crew member is on a regularly scheduled rotating assignment to the ship, such training shall be given not later than two weeks after the time of first joining the ship. Instructions in the use of the ship's fire-extinguishing appliances shall be given at the same interval as the drills. Individual instruction may cover different parts of the ship's fire-extinguishing appliances, but all the ship's fire-extinguishing appliances shall be covered within any period of two months.

10.2.5 Fire drills

10.2.5.1 Fire drills shall, as far as practicable, be conducted as if there were an actual emergency.

10.2.5.2 For a ship in-service, every crew member shall participate in at least one fire drill every month. The drills of the crew shall take place within 24 hours of the ship leaving a port if more than 25% of the crew have not participated in fire drills on board that particular ship in the previous month. When a ship enters service for the first time, after modification of a major character or when a new crew is engaged, these drills shall be held before sailing. The Naval Administration may accept other arrangements that are at least equivalent for those classes of ships for which this is impracticable.

10.2.5.3 Fire drills should be planned in such a way that due consideration is given to regular practice in the various emergencies that may occur depending on the type of ships and the cargo.

10.2.5.4 Each fire drill shall include:

10.2.5.4.1 crew members reporting to stations and preparing for their assigned duties;

10.2.5.4.2 starting of a fire pump, using at least the two required jets of water to show that the system is in proper working order;

10.2.5.4.3 checking of fireman's outfit and other personal rescue equipment;

10.2.5.4.4 checking of relevant communication equipment;

10.2.5.4.5 checking the operation of watertight doors, fire doors, fire dampers and main inlets and outlets of ventilation systems in the drill area;

10.2.5.4.6 checking the necessary arrangements for subsequent abandoning of the ship.

10.2.5.5 The equipment used during drills shall immediately be brought back to its fully operational condition and any faults and defects discovered during the drills shall be remedied as soon as possible.

10.2.6 Records

10.2.6.1 The date and details of fire drills and on-board training shall be recorded in such log-book as may be prescribed by the Naval Administration. If a full drill or training session is not held at the appointed time, an entry shall be made in the log-book stating the circumstances and the extent of the drill or training session held.

10.3 Training manuals

10.3.1 A training manual shall be provided in each crew mess room and recreation room or in each crew cabin.

10.3.2 The training manual shall be written in the working language of the ship.

10.3.3 The training manual, which may comprise several volumes, shall contain the instructions and information required in paragraph 10.3.4 in easily understood terms and illustrated wherever possible. Any part of such information may be provided in the form of audio-visual aides in lieu of the manual.

10.3.4 The training manual shall explain the following in detail:

10.3.4.1 general fire safety practice and precautions related to the dangers of smoking, electrical hazards, flammable liquids and similar common shipboard hazards;

10.3.4.2 general instructions on fire-fighting activities and fire-fighting procedures including procedures for notification of a fire and use of manually operated call points;

10.3.4.3 meanings of the ship's alarms;

10.3.4.4 operation and use of fire-fighting systems and appliances;

10.3.4.5 operation and use of fire doors;

10.3.4.6 operation and use of fire and smoke dampers.

10.4 Fire control plans

Note: Refer to Graphical symbols for fire control plans, adopted by the IMO by Resolution A.952(23).

10.4.1 General arrangement plans shall be permanently exhibited for the guidance of the ship's officers, showing clearly for each deck the control stations, the various fire sections enclosed by "A" class divisions, the sections enclosed by "B" class divisions together with particulars of the fire detection and fire alarm systems, the sprinkler installation, the fire-extinguishing appliances, means of access to different compartments, decks, etc., and the ventilating system including particulars of the fan control positions, the position of dampers and identification numbers of the ventilating fans serving each section. Alternatively, at the discretion of the Naval Administration, the aforementioned details may be set out in a booklet, a copy of which shall be supplied to each officer, and one copy shall at all times be available on board in an accessible position. Plans and booklets shall be kept up to date; any alterations thereto shall be recorded as soon as practicable. Description in such plans and booklets shall be in the language or languages required by the Naval Administration. If the language is neither English nor French, a translation into one of those languages shall be included.

10.4.2 A duplicate set of fire control plans or a booklet containing such plans shall be permanently stored in a prominently marked weathertight enclosure outside the deckhouse for the assistance of shore-side fire-fighting personnel.

Note: Refer to the Guidance concerning the location of fire control plans for assistance of shoreside fire-fighting personnel (IMO MSC/Circ.451).

11 Additional requirements for Type A and Type B Ships

11.1 Fire drills

11.1.1 For a ship in-service, a fire drill shall take place weekly for the benefit of non-crew members. These drills shall have due regard to notification of non-crew members and movement of non-crew members to muster stations and evacuation decks. The entire crew need not be involved in every drill, but each crew member must participate in a fire drill each month as required in paragraph 10.2.5.2.

11.2 Fire control plans

11.2.1 Plans and booklets required by paragraph 10.4.1 shall provide information regarding fire protection, fire detection and fire extinction.

Note: Refer to the guidelines issued by the IMO as Resolution A.756(18) or other standard agreed by the Naval Administration.

<u>Operations</u>

12 Purpose

12.1 The purpose of this section of this regulation is to provide information and instructions for proper ship operations in relation to fire safety. For this purpose, the following functional requirements shall be met:

12.1.1 fire safety operational booklets shall be provided on board;

12.1.2 flammable vapour releases from cargo tank venting shall be controlled.

13 Fire safety operational booklets

13.1 The required fire safety operational booklet shall contain the necessary information and instructions for the safe operation of the ship in relation to fire safety. The booklet shall include information concerning the crew's responsibilities for the general fire safety of the ship in all conditions. For ships carrying dangerous goods, refer to the requirements of Regulation 13.

13.2 The fire safety operational booklet shall be provided in each crew mess room and recreation room or in each crew cabin.

13.3 The fire safety operational booklet shall be written in the working language of the ship.

13.4 The fire safety operational booklet may be combined with the training manuals required in paragraph 10.3.

13.5 The requirements contained in paragraphs 13.1 to 13.4 may be replaced by an alternative system. In any case the system is to be approved by the Naval Administration.

14 The operational information is to be approved as being compliant with the above requirements.

Regulation 13 Special Requirements

Functional Objective

1 Any special features of the ship shall be consistent with the fire safety goal and other functional requirements of this Chapter. Examples include aviation facilities, magazines and carriage of vehicles, bulk liquids and materials.

Performance Requirements

2 For ships carrying dangerous goods as defined in the Concept of Operations Statement the following functional requirements shall be met in addition to other requirements in this Code:

2.1 fire protection systems shall be provided to protect the ship from the additional fire hazards associated with carriage of these dangerous goods;

2.2 dangerous goods shall be adequately separated from ignition sources;

2.3 appropriate personnel protective equipment shall be provided for the hazards associated with the carriage of dangerous goods.

3 For ships fitted with vehicle, special category and ro-ro spaces as defined in the Concept of Operations Statement, the following functional requirements shall be met:

3.1 fire protection systems shall be provided to adequately protect the ship from the fire hazards associated with vehicle, special category and ro-ro spaces;

3.2 ignition sources shall be separated from vehicle, special category and ro-ro spaces;

3.3 vehicle, special category and ro-ro spaces shall be adequately ventilated.

3.4 vehicle, special category and ro-ro spaces shall not be adjacent to cargo oil tanks.

4 For ships fitted with special facilities for aircraft as defined in the Concept of Operations Statement, the following functional requirements shall be met:

4.1 Aircraft deck structure must be adequate to protect the ship from the fire hazards associated with helicopter operations;

4.2 Fire-fighting appliances shall be provided to adequately protect the ship from the fire hazards associated with aircraft operations;

4.3 Refuelling and hangar facilities and operations shall provide the necessary measures to protect the ship from the fire hazards associated with aircraft operations;

4.4 Operation manuals and training shall be provided.

5 For ships fitted with special facilities for the carriage and transportation of explosives as defined in the Concept of Operations Statement, the following functional requirements shall be met:

5.1 Location of stowage for explosives should take account of other areas of high fire risk and control spaces within the ship.

5.2 Fire protection systems should be fitted to adequately protect the ship from hazards associated with carriage and transportation of explosives.

5.3 Explosives stowage should be adequately protected from the specific risks associated with the particular explosives carried.

6 For ships fitted with well docks and boat handling areas as defined in the Concept of Operations Statement, the following functional requirements shall be met.

6.1 Fire protection systems shall be provided to adequately protect the ship from the fire hazards associated with boat operation and handling.

6.2 Ignition sources shall be separated from well docks and boat handling areas.

6.3 Well docks and boat handling areas shall be adequately ventilated.

Solutions

7 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

<u>Transportation of Dangerous goods as Cargo</u>

8 General Requirements

8.1 The following ship types and cargo spaces shall govern the application of tables 13-1, 13-2 and 13-3:

8.1.1 ships and cargo spaces not specifically designed for the carriage of freight containers, but intended for the carriage of dangerous goods in packaged form including goods in freight containers and portable tanks;

8.1.2 purpose-built container ships and cargo spaces intended for the carriage of dangerous goods in freight containers and portable tanks;

8.1.3 ro-ro ships and ro-ro spaces intended for the carriage of dangerous goods;

8.1.4 ships and cargo spaces intended for the carriage of solid dangerous goods in bulk;

8.1.5 ships and cargo spaces intended for carriage of dangerous goods other than liquids and gases in bulk in ship borne barges.

9 Special requirements

9.1 Unless otherwise specified, the following requirements shall govern the application of tables 13-1, 13-2 and 13-3 to both "on-deck" and "under-deck" stowage of dangerous goods where the numbers of the following paragraphs are indicated in the first column of the tables.

Table 13-1: Application of the requirements to different modes of carriage of dangerous goods in ships and cargo spaces

Where X appears in Table 13-1 it means this requirement is applicable to all classes of dangerous goods as given in the appropriate line of Table 13-3, except as indicated by the notes.

Regulation 13 Paragraph 8		8.1.1	8.1.2	8.1.3		8.1.4	8.1.5
Regulation 13 Paragraph	Open deck spaces 8.1.1 to 8.1.5 inclusive	Not specifically designed	Container cargo spaces	Closed ro-ro spaces5	Open ro-ro spaces	Solid dangerous goods in bulk	Shipbourne vessels
9.2.1	X	X	X	X	X	For application of requirements of regulation 13 to different classes of dangerous goods, see Table 13-2	X
9.2.2	X	X	X	X	X		-
9.2.3	-	X	X	X	X		X
9.2.4	-	X	X	X	X		X
9.3.1	-	X	X	X	X		X[4]
9.4.1	-	X	X	X	-		X[4]
9.5.1	-	X	X[1]	X	-		X[4]
9.5.2	-	X	X[1]	X	-		X[4]
9.6	-	X	X	X	-		-
9.7.1	X	X	X	X	X		-
9.7.2 & 9.7.3	X	X	X	X	X		-
9.8.1	X	X	-	-	X		
9.9.1	X	X	X[2]	X	X		-
9.10.1	-	-	-	X[3]	X		-
9.11.1	-	-	-	X	-		-
9.11.2	-	-	-	X	-		-

Notes:

1 For classes 4 and 5.1 not applicable to closed freight containers.

For classes 2, 3, 6.1 and 8 when carried in closed freight containers the ventilation rate may be reduced to not less than two air changes per hour. For classes 4 and 5.1 liquids when carried in closed freight containers, the ventilation rate may be reduced to not less than two air changes per hour. For the purpose of this requirement a portable tank is a closed freight container.

2 Applicable to decks only.

3 Applies only to closed ro-ro spaces, not capable of being sealed.

4 In the special case where the barges are capable of containing flammable vapours or alternatively if they are capable of discharging flammable vapours to a safe space outside the barge carrier compartment by means of ventilation ducts connected to the barges, these requirements may be reduced or waived to the satisfaction of the Naval Administration.

5 Special category spaces shall be treated as closed ro-ro spaces when dangerous goods are carried.

Table 13-2: Application of the requirements to different classes of dangerous goods for ships and cargo spaces carrying solid dangerous goods in bulk

Class	4.1	4.2	4.3[6]	5.1	6.1	8	9
Regulation 13 Paragraph							
9.2.1	X	X	-	X	-	-	X
9.2.2	X	X	-	X	-	-	X
9.3.1	X	X[7]	X	X[8]	-	-	X[8]
9.5.1	-	X[7]	X	-	-	-	-
9.5.2	X[9]	X[7]	X	X[7.9]	-	-	X[7.9]
9.5.3	X	X	X	X	X	X	X
9.7.1	X	X	X	X	X	X	X
9.9.1	X	X	X	X[7]	-	-	X[10]

Notes:

6 The hazards of substances in this class which may be carried in bulk are such that special consideration must be given by the Naval Administration to the construction and equipment of the ship involved in addition to meeting the requirements enumerated in this table.

7 Only applicable to Seedcake containing solvent extractions, to Ammonium nitrate and to Ammonium nitrate fertilizers.

8 Only applicable to Ammonium nitrate and to Ammonium nitrate fertilizers. However, a degree of protection in accordance with standards contained in the latest version of the International Electrotechnical Commission publication IEC 60079, Electrical Apparatus for Explosive Gas Atmospheres, is sufficient.

9 Only suitable wire mesh guards are required.

10 The requirements of the International Maritime Solid bulk Cargoes (IMSBC) Code, as amended, are sufficient.

Table 13-3: Application of the requirements to different classes of dangerous goods except solid dangerous goods in bulk

Class	1.1 to 1.6	1.4S	2.1	2.2	2.3	2.3	3	3	4.1	4.2	4.3	4.3	5.1	5.2[16]	6.1	6.1	6.1	6.1	8	8	8	8	9
Reg 13 Paragraph					Flammable20	Non-Flammable	FP15 < 23°C	FP15 ≥ 23°C to ≤ 61°C			Liquids21	Solids			Liquids FP15 < 23°C	Liquids FP15 ≥ 23°C to ≤ 60°C	Liquids	Solids	Liquids FP15 < 23°C	LiquidsFP15 ≥ 23°C to ≤ 60°C	Liquids	Solids	
9.2.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
9.2.2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-
9.2.3	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.2.4	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.3.1	X	-	X	-	X	-	X	-	-	-	X[18]	-	-	-	X	-	-	-	X	-	-	-	X[17]
9.4.1	X	X	X	X	-	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	X	X	-
9.5.1	-	-	X	-	-	X	X	-	X[11]	X[11]	X	X	X[11]	-	X	X	-	X[11]	X	X	-	-	X[11]
9.5.2	-	-	X	-	-	-	X	-	-	-	-	-	-	-	X	-	-	-	X	-	--	-	X[17]
9.6	-	-	-	-	-	-	X	-	-	-	-	-	-	-	X	X	X	-	X	X[19]	X[19]	-	-
9.7.1	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X[14]
9.8.1	-	-	-	-	-	-	X	X	X	X	X	X	X	-	X	X	-	-	X	X	-	-	-
9.9.1	X[12]	-	X	X	X	X	X	X	X	X	X	X	X[13]	X	X	X	-	-	X	X	-	-	-
9.10.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Reg 13 Paragraph / Class	1.1 to 1.6	1.4S	2.1	2.2	2.3 Flammable[20]	2.3 Non-Flammable	3 FP[15] < 23°C	3 FP[15] ≥ 23°C to ≤ 61°C	4.1	4.2	4.3 Liquids[21]	4.3 Solids	5.1	5.2[16]	6.1 Liquids FP[15] < 23°C	6.1 Liquids FP[15] ≥ 23°C to ≤ 60°C	6.1 Liquids	6.1 Solids	8 Liquids FP[15] < 23°C	8 Liquids FP[15] ≥ 23°C to ≤ 60°C	8 Liquids	8 Solids	9
9.11.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X[16]	X	X	X	X	X	X	X	X	X
9.11.2	X	X	X	X	X	X	X	X	X	X	X	X	X	X[16]	X	X	X	X	X	X	X	X	X

Notes:

11 When "mechanically-ventilated spaces" are required by the International Maritime Dangerous Goods Code, as amended.

12 Stow 3 metres horizontally away from the machinery space boundaries in all cases.

13 Refer to the International Maritime Dangerous Goods Code, as amended.

14 As appropriate to the goods to be carried.

15 Refers to flashpoint.

16 Under the provisions of the IMDG Code, as amended, stowage of class 5.2 dangerous goods under deck or in enclosed ro-ro spaces is prohibited.

17 Only applicable to dangerous goods evolving flammable vapour listed in the IMDG Code.

18 Only applicable to dangerous goods having a flashpoint less than 23°C.

19 Only applicable to dangerous goods having a subsidiary risk class 6.1.

20 Under the provisions of the IMDG Code, stowage of class 2.3 having subsidiary risk class 2.1 under deck or in enclosed ro-ro spaces is prohibited.

21 Under the provisions of the IMDG Code, stowage of class 4.3 liquids having a flashpoint less than 23°C under deck or in enclosed ro-ro spaces is prohibited.

9.2 Water supplies

9.2.1 Arrangements shall be made to ensure immediate availability of a supply of water from the fire main at the required pressure either by permanent pressurisation or by suitably placed remote arrangements for the fire pumps.

9.2.2 The quantity of water delivered shall be capable of supplying four nozzles of a size and at pressures as specified in Regulation 9, paragraphs 13 to 16, capable of being trained on any part of the cargo space when empty. This amount of water may be applied by equivalent means to the satisfaction of the Naval Administration.

9.2.3 Means shall be provided for effectively cooling the designated underdeck cargo space by at least 5 litres/minute per square metre of the horizontal area of cargo spaces, either by a fixed arrangement of spraying nozzles or flooding the cargo space with water. Hoses may be used for this purpose in small cargo spaces and in small areas of larger cargo spaces at the discretion of the Naval Administration. However, the drainage and pumping arrangements shall be such as to prevent the build-up of free surfaces. The drainage system shall be sized to remove no less than 125% of the combined capacity of both the water spraying system pumps and the required number of fire hose nozzles. The drainage system valves shall be operable from outside the protected space at a position in the vicinity of the extinguishing system controls. Bilge wells shall be of sufficient holding capacity and shall be arranged at the side shell of the ship at a distance from each other of not more than 40 metres in each watertight compartment. If this is not possible, the adverse effect upon stability of the added weight and free surface of water shall be taken into account to the extent deemed necessary by the Naval Administration in its approval of the stability information.

Note: Refer to the Recommendation on fixed fire-extinguishing systems for special category spaces adopted by the IMO by Resolution A.123(V).

9.2.4 Provision to flood a designated under-deck cargo space with suitable specified media may be substituted for the requirements in paragraph 9.2.3.

9.2.5 The total required capacity of the water supply shall satisfy paragraphs 9.2.2 and 9.2.3, if applicable, simultaneously calculated for the largest designated cargo space. The capacity requirements of paragraph 9.2.2 shall be met by the total capacity of the main fire pump(s), not including the capacity of the emergency fire pump, if fitted. If a drencher system is used to satisfy paragraph 9.2.3, the drencher pump shall also be taken into account in this total capacity calculation.

9.3 Sources of ignition

9.3.1 Electrical equipment and wiring shall not be fitted in enclosed cargo spaces or vehicle spaces unless it is essential for operational purposes in the opinion of the Naval Administration. However, if electrical equipment is fitted in such spaces, it shall be of a certified safe type (see note) for use in the dangerous environments to which it may be exposed unless it is possible to completely isolate the electrical system (e.g. by removal of links in the system, other than fuses). Cable penetrations of the decks and bulkheads shall be sealed against the passage of gas or vapour. Through runs of cables and cables within the cargo spaces shall be protected against damage from impact. Any other equipment which may constitute a source of ignition of flammable vapour shall not be permitted.

Note: Refer to the recommendations of the International Electrotechnical Commission, in particular, the latest version of publication IEC 60092, Electrical installations in ships.

9.4 Detection system

9.4.1 Ro-ro spaces shall be fitted with a fixed fire detection and fire alarm system complying with the requirements of the FSS Code or other standard agreed by the Naval Administration. All other types of cargo spaces shall be fitted with either a fixed fire detection and fire alarm system or a sample extraction smoke detection system complying with the requirements of the FSS Code or other standard agreed by the Naval Administration. If a sample extraction smoke detection system is fitted, particular attention shall be made to paragraph 2.1.3 in chapter 10 of the FSS Code in order to prevent the leakage of toxic fumes into occupied areas.

Note: The system shall be designed, constructed and installed so as to prevent the leakage of any toxic or flammable substances or fire-extinguishing media into any accommodation and service space, control station or machinery space.

9.5 Ventilation Arrangement

9.5.1 Adequate power ventilation shall be provided in enclosed cargo spaces. The arrangement shall be such as to provide for at least six air changes per hour in the cargo space based on an empty cargo space and for removal of vapours from the upper or lower parts of the cargo space, as appropriate.

9.5.2 The fans shall be such as to avoid the possibility of ignition of flammable gas air mixtures. Suitable wire mesh guards shall be fitted over inlet and outlet ventilation openings.

9.5.3 Natural ventilation shall be provided in enclosed cargo spaces intended for the carriage of solid dangerous goods in bulk, where there is no provision for mechanical ventilation.

9.6 Bilge pumping

9.6.1 Where it is intended to carry flammable or toxic liquids in enclosed cargo spaces, the bilge pumping system shall be designed to protect against inadvertent pumping of such liquids through machinery space piping or pumps. Where large quantities of such liquids are carried, consideration shall be given to the provision of additional means of draining those cargo spaces.

9.6.2 If the bilge drainage system is additional to the system served by pumps in the machinery space, the capacity of the system shall be not less than 10 m^3/h per cargo space served. If the additional system is common, the capacity need not exceed 25 m^3/h. The additional bilge system need not be arranged with redundancy.

9.6.3 Whenever flammable or toxic liquids are carried, the bilge line into the machinery space shall be isolated either by fitting a blank flange or by a closed lockable valve.

9.6.4 Enclosed spaces outside machinery spaces containing bilge pumps serving cargo spaces intended for carriage of flammable or toxic liquids should be fitted with separate mechanical ventilation giving at least 6 air changes per hour. If the space has access from another enclosed space, the door shall be self-closing.

9.6.5 If bilge drainage of cargo spaces is arranged by gravity drainage, the drainage shall be either led directly overboard or to a closed drain tank located outside the machinery spaces. The tank shall be provided with a vent pipe to a safe location on the open deck. Drainage from a cargo space into bilge wells in a lower space is only permitted if that space satisfies the same requirements as the cargo space above.

9.7 Personnel protection

9.7.1 Four sets of full protective clothing, resistant to chemical attack, shall be provided in addition to the fire fighter's outfits required by Regulation 9, paragraphs 43 to 45 and shall be selected taking into account the hazards associated with chemicals transported and the standards developed by the IMO according to the class and physical state. The protective clothing shall cover all skin, so that no part of the body is unprotected.

Note: For solid bulk cargoes, the protective clothing should satisfy the equipment provisions specified in the respective schedules of the IMSBC Code for the individual substances. For packaged goods, the protective clothing should satisfy the equipment provisions specified in emergency procedures (EmS) of the supplement to the IMDG Code for the individual substances.

9.7.2 At least two self-contained breathing apparatuses additional to those required by Regulation 9 shall be provided. Two spare charges suitable for use with the breathing apparatus shall be provided for each required apparatus.

9.7.3 For Type B and C ships

9.7.3.1 that are equipped with suitably located means for fully recharging the air cylinders free from contamination need carry only one spare charge for each required apparatus.

9.8 Portable fire extinguishers

9.8.1 Portable fire extinguishers with a total capacity of at least 12 kg of dry powder or equivalent shall be provided for the cargo spaces. These extinguishers shall be in addition to any portable fire extinguishers required elsewhere in this chapter.

9.9 Insulation of machinery space boundaries

9.9.1 Bulkheads forming boundaries between cargo spaces and machinery spaces of category A shall be insulated to "A-60" class standard, unless the dangerous goods are stowed at least 3 metres horizontally away from such bulkheads. Other boundaries between such spaces shall be insulated to "A-60" class standard.

9.10 Water spray system

9.10.1 Each open ro-ro space having a deck above it and each space deemed to be a closed ro-ro space not capable of being sealed, shall be fitted with an approved fixed pressure water-spraying system for manual operation which shall protect all parts of any deck and vehicle platform in the space, except that the Naval Administration may permit the use of any other fixed fire-extinguishing system that has been shown by full-scale test to be no less effective. However, the drainage and pumping arrangements shall be such as to prevent the build-up of free surfaces. The drainage system shall be sized to remove no less than 125% of the combined capacity of both the water spraying system pumps and the required number of fire hose nozzles. The drainage system valves shall be operable from outside the protected space at a position in the vicinity of the extinguishing system controls. Bilge wells shall be of sufficient holding capacity and shall be arranged at the side shell of the ship at a distance from each other of not more than 40 metres in each watertight compartment. If this is not possible the adverse effect upon stability of the added weight and free surface of water shall be taken into account to the extent deemed necessary by the Naval Administration in its approval of the stability information.

9.11 Separation of ro-ro spaces

9.11.1 In ships having ro-ro spaces, a separation shall be provided between a closed ro-ro space and an adjacent open ro-ro space. The separation shall be such as to minimize the passage of dangerous vapours and liquids between such spaces. Alternatively, such separation need not be provided if the ro-ro space is considered to be a closed cargo space over its entire length and shall fully comply with the relevant special requirements of this regulation.

9.11.2 In ships having ro-ro spaces, a separation shall be provided between a closed ro-ro space and the adjacent open deck space. The separation shall be such as to minimize the passage of dangerous vapours and liquids between such spaces. Alternatively, a separation need not be provided if the arrangements of the closed ro-ro spaces are in accordance with those required for the dangerous goods carried on adjacent open deck spaces.

10 Documentation

10.1 The Naval Administration shall provide the ship with an annex to the Naval Ship Safety Certificate as evidence of compliance of construction and equipment with the requirements of the dangerous goods section of this regulation.

<u>Protection of vehicle, special category and ro-ro spaces</u>

11 Purpose

11.1 The purpose of this section of this regulation is to provide additional safety measures in order to address the fire safety objectives of this chapter for ships fitted with vehicle, special category and ro-ro spaces. For this purpose, the following functional requirements shall be met:

11.1.1 fire protection systems shall be provided to adequately protect the ship from the fire hazards associated with vehicle, special category and ro-ro spaces;

11.1.2 ignition sources shall be separated from vehicle, special category and ro-ro spaces;

11.1.3 vehicle, special category and ro-ro spaces shall be adequately ventilated.

12 General requirements

12.1 Application

12.1.1 In addition to complying with the requirements of the relevant regulations of this chapter, as appropriate, vehicle, special category and ro-ro spaces shall comply with the requirements of this section of this regulation.

12.2 For Type A and Type B ships

12.2.1 The basic principle underlying the provisions of this regulation is that the main vertical zoning required by Regulation 8 may not be practicable in vehicle spaces of Type A and Type B ships and, therefore, equivalent protection must be obtained in such spaces on the basis of a horizontal zone concept and by the provision of an efficient fixed fire-extinguishing system. Based on this concept, a horizontal zone for the purpose of this regulation may include special category spaces on more than one deck provided that the total overall clear height for vehicles does not exceed 10 metres.

12.2.2 The basic principle underlying the provisions of paragraph 12.2.1 are also applicable to ro-ro spaces.

12.2.3 The requirements of ventilation systems, openings in "A" class divisions and penetrations in "A" class divisions for maintaining the integrity of vertical zones in this chapter shall be applied equally to decks and bulkheads forming the boundaries separating horizontal zones from each other and from the remainder of the ship and to uptakes and downtakes.

13 Precaution against ignition of flammable vapours in closed vehicle spaces, closed ro-ro spaces and special category spaces

13.1 Ventilation systems

Note: For design guidance and operational recommendations for ventilation systems in ro-ro spaces refer to (IMO MSC/Circ.729).

13.1.1 Capacity of ventilation systems

13.1.1.1 There shall be provided an effective power ventilation system sufficient to give at least the following air changes:

13.1.1.1.1 All ships:

13.1.1.1.1.1 special category spaces 10 air changes per hour.

13.1.1.1.2 Type A and B ships:

13.1.1.1.2.1 closed ro-ro and vehicle spaces other than special category spaces 10 air changes per hour.

13.1.1.1.3 Type C ships:

13.1.1.1.3.1 closed ro-ro and vehicle spaces other than special category spaces 6 air changes per hour.

13.1.1.2 The Naval Administration may require an increased number of air changes when vehicles are being loaded and unloaded.

13.1.2 Performance of ventilation systems

13.1.2.1 For Type A and Type B ships,

13.1.2.1.1 the power ventilation system required in paragraph 13.1.1.1 shall be separate from other ventilation systems and shall be in operation at all times when vehicles are in such spaces. Ventilation ducts serving such spaces capable of being effectively sealed shall be separated for each such space. The system shall be capable of being controlled from a position outside such spaces.

13.1.2.2 For Type C ships,

13.1.2.2.1 ventilation fans shall normally be run continuously whenever vehicles are on board. Where this is impracticable, they shall be operated for a limited period daily as weather permits and in any case for a reasonable period prior to discharge, after which period the ro-ro or vehicle space shall be proved gas-free. One or more portable combustible gas detecting instruments shall be carried for this purpose. The system shall be entirely separate from other ventilating systems. Ventilation ducts serving ro-ro or vehicle spaces shall be capable of being effectively sealed for each space. The system shall be capable of being controlled from a position outside such spaces.

13.1.2.3 The ventilation system shall be such as to prevent air stratification and the formation of air pockets.

13.1.3 Indication of ventilation systems

13.1.3.1 Means shall be provided on the navigation bridge to indicate any loss of the required ventilating capacity.

13.1.4 Closing appliances and ducts

13.1.4.1 Arrangements shall be provided to permit a rapid shutdown and effective closure of the ventilation system from outside of the space in case of fire, taking into account the weather and sea conditions.

13.1.4.2 Ventilation ducts, including dampers, within a common horizontal zone shall be made of steel.

13.1.4.3 For Type A and Type B ships,

13.1.4.3.1 ventilation ducts that pass through other horizontal zones or machinery spaces shall be "A-60" class steel ducts constructed in accordance with Regulation 8, paragraph 37.1.

13.1.5 Permanent openings

13.1.5.1 Permanent openings in the side plating, the ends or deckhead of the space shall be so situated that a fire in the space does not endanger stowage areas and embarkation stations for survival craft and accommodation spaces, service spaces and control stations in superstructures and deckhouses above the spaces.

13.2 Electrical equipment and wiring

13.2.1 Except as provided in paragraph 13.2.2, electrical equipment and wiring shall be of a type suitable for use in an explosive petrol and air mixture.

Note: Refer to the recommendations of the latest version of the International Electrotechnical Commission, in particular publication IEC 60079.

Note: Where vehicles only contain fuels above a flashpoint of 60 degrees the Naval Administration may allow relaxation and specify a more appropriate standard.

13.2.2 For spaces, other than special category spaces, below the submergence limit, notwithstanding the provisions in paragraph 13.2.1, above a height of 450 mm from the deck and from each platform for vehicles, if fitted, except platforms with openings of sufficient size permitting penetration of petrol gases downwards, electrical equipment of a type so enclosed and protected as to prevent the escape of sparks shall be permitted as an alternative on condition that the ventilation system is so designed and operated as to provide continuous ventilation of the spaces at the rate of at least ten air changes per hour whenever vehicles are on board.

13.3 Electrical equipment and wiring in exhaust ventilation ducts

13.3.1 Electrical equipment and wiring, if installed in an exhaust ventilation duct, shall be of a type approved for use in explosive petrol and air mixtures and the outlet from any exhaust duct shall be sited in a safe position, having regard to other possible sources of ignition.

13.4 Other ignition sources

13.4.1 Other equipment which may constitute a source of ignition of flammable vapours shall not be permitted.

13.5 Scuppers and discharges

13.5.1 Scuppers shall not be led to machinery or other spaces where sources of ignition may be present.

13.6 Separation of ro-ro spaces

13.6.1 In ships having ro-ro spaces, a separation shall be provided between a closed ro-ro space and an adjacent open ro-ro space. The separation shall be such as to minimize the passage of dangerous vapours and liquids between such spaces. Alternatively, such separation need not be provided if the ro-ro space is considered to be a closed ro-ro space over its entire length and shall fully comply with the relevant special requirements of paragraphs 9.1 to 9.9.

13.6.2 In ships having ro-ro spaces, a separation shall be provided between a closed ro-ro space and the adjacent open deck space. The separation shall be such as to minimize the passage of dangerous vapours and liquids between such spaces.

14 Detection and alarm

14.1 Fixed fire detection, hydrocarbon detection and fire alarm systems

14.1.1 Except as provided in paragraph 14.3.1, there shall be provided a fixed fire detection and fire alarm system complying with the requirements of the FSS Code or other standard agreed by the Naval Administration. The fixed fire detection system shall be capable of rapidly detecting the onset of fire. The type of detectors and their spacing and location shall be to the satisfaction of the Naval Administration taking into account the effects of ventilation and other relevant factors. After being installed the system shall be tested under normal ventilation conditions and shall give an overall response time to the satisfaction of the Naval Administration.

14.1.2 Pump rooms for the treatment, transfer and discharge of vehicle fuel are to be fitted with a fixed hydrocarbon detection system that complies with the FSS code and which alarms at the continuously manned control station.

14.2 Sample extraction smoke detection systems

14.2.1 Except open ro-ro spaces, open vehicle spaces and special category spaces, a sample extraction smoke detection system complying with the requirements of the FSS Code, or other standard agreed by the Naval Administration, may be used as an alternative for the fixed fire detection and fire alarm system required in paragraph 14.1.

14.3 Special category spaces

14.3.1 An efficient fire patrol system shall be maintained in special category spaces. However, if an efficient fire patrol system is maintained by a continuous fire watch at all times during the voyage, a fixed fire detection and fire alarm system is not required.

14.3.2 Manually operated call points shall be spaced so that no part of the space is more than 20 metres from a manually operated call point, and one shall be placed close to each exit from such spaces.

15 Structural fire protection

15.1 For Type A ships,

15.1.1 Notwithstanding the provisions of Regulation 8, the boundary bulkheads and decks of special category spaces and ro-ro spaces shall be insulated to "A-60" class standard. However, where a category (5), (8) or (9) space, as defined in Regulation 8 paragraph 7.3, is on one side of the division the standard may be reduced to "A-0". Where oil fuel tanks are below a special category space or a ro-ro space, the integrity of the deck between such spaces may be reduced to "A-0" standard.

16 Fire-extinction

16.1 Fixed fire-extinguishing systems.

Note: Refer to the Guidelines for the approval of alternative fixed water-based fire-fighting systems for special category spaces (IMO MSC/Circ.914)

16.1.1 Vehicle spaces and ro-ro spaces which are not special category spaces and are capable of being sealed from a location outside of the spaces shall be fitted with a fixed gas fire-extinguishing system which shall comply with the provisions of the FSS Code or other standard agreed by the Naval Administration, except that:

16.1.1.1 if a carbon dioxide system is fitted, the quantity of gas available shall be at least sufficient to give a minimum volume of free gas equal to 45% of the gross volume of the largest such space which is capable of being sealed, and the arrangements shall be such as to ensure that at least two thirds of the gas required for the relevant space shall be introduced within 10 min;

16.1.1.2 any other fixed inert gas fire-extinguishing system or fixed high expansion foam fire-extinguishing system may be fitted provided the Naval Administration is satisfied that an equivalent protection is achieved;

16.1.1.3 as an alternative, a system meeting the requirements of paragraph 16.1.2 may be fitted.

16.1.2 Each open ro-ro space having a deck above it and each space deemed to be a closed ro-ro or vehicle space not capable of being sealed and special category spaces shall be fitted with an approved fixed pressure water spraying system for manual operation which shall protect all parts of any deck and vehicle platform in such spaces. Such water spray systems shall have:

16.1.2.1 a pressure gauge on the valve manifold;

16.1.2.2 clear marking on each manifold valve indicating the spaces served;

16.1.2.3 instructions for maintenance and operation located adjacent to the operating valves or at the activation point;

16.1.2.4 a sufficient number of drainage valves.

Note: For approved fixed pressure water spraying systems refer to the recommendation on fixed fire-extinguishing systems for special category spaces adopted by the IMO by Resolution A.123(V).

16.1.3 The Naval Administration may permit the use of any other fixed fire-extinguishing system that has been shown, by a full-scale test in conditions simulating a flowing petrol fire in a vehicle space or a ro-ro space, to be not less effective in controlling fires likely to occur in such a space.

Note: For other fixed fire-extinguishing systems refer to the guidelines for the approval of alternative fixed water-based fire-fighting systems for special category spaces (IMO MSC/Circ.914).

16.1.4 When fixed pressure water-spraying fire-extinguishing systems are provided, in view of the serious loss of stability which could arise due to large quantities of water accumulating on the deck or decks during the operation of the water-spraying system, the following arrangements shall be provided:

16.1.4.1 Type A and B ships:

16.1.4.1.1 in the spaces above the submergence limit, scuppers shall be fitted so as to ensure that such water is rapidly discharged directly overboard;

16.1.4.1.2 The scuppers on each side of the deck shall have an aggregate capacity of not less than 100% of the maximum flow rate of the fixed fire-extinguishing system water pumps plus the flow from two fire hoses.

16.1.4.1.3 discharge valves for scuppers, fitted with positive means of closing operable from a position above the submergence limit in accordance with the requirements of the International Convention on Load Lines in force, shall be kept open while the ships are at sea;

16.1.4.1.4 any operation of valves referred to in paragraph 16.1.4.1.2 shall be recorded;

16.1.4.1.5 in the spaces below the submergence limit, the Naval Administration may require pumping and drainage facilities to be provided additional to the requirements of Chapter III. In such case, the drainage system shall be sized to remove no less than 125% of the combined capacity of both the water spraying system pumps and the required number of fire hose nozzles. Additionally the drainage system shall be sized to remove no less than 100% of the combined capacity of both sides of the ship. The drainage system valves shall be operable from outside the protected space at a position in the vicinity of the extinguishing system controls. Bilge wells shall be of sufficient holding capacity and shall be arranged at the side shell of the ship at a distance from each other of not more than 40 metres in each watertight compartment;

16.1.4.2 Type C ships:

16.1.4.2.1 the drainage and pumping arrangements shall be such as to prevent the build-up of free surfaces. In such case, the drainage system shall be sized to remove no less than 125% of the combined capacity of both the water spraying system pumps and the required number of fire hose nozzles. Additionally the drainage system shall be sized to remove no less than 100% of the combined capacity of both sides of the ship. The drainage system valves shall be operable from outside the protected space at a position in the vicinity of the extinguishing system controls. Bilge wells shall be of sufficient holding capacity and shall be arranged at the side shell of the ship at a distance from each other of not more than 40 metres in each watertight compartment. If this is not possible the adverse effect upon stability of the added weight and free surface of water shall be taken into account to the extent deemed necessary by the Naval Administration in its approval of the stability information. Such information shall be included in the stability information supplied to the Commanding Officer as required by Chapter III Regulation 8.

Note: Refer to the Recommendation on fixed fire-extinguishing systems for special cargo spaces adopted by the IMO by Resolution A.123(V).

16.1.5 For closed vehicle and ro-ro spaces and special category spaces, where fixed pressure water spraying systems are fitted, means shall be provided to prevent the blockage of drainage arrangements.

16.2 Portable fire-extinguishers

16.2.1 Portable extinguishers shall be provided at each deck level in each hold or compartment where vehicles are carried, spaced not more than 20 metres apart on both sides of the space. At least one portable fire-extinguisher shall be located at each access to such a cargo space.

16.2.2 In addition to the provision of paragraph 16.2.1, the following fire extinguishing appliances shall be provided in vehicle, ro-ro and special category spaces intended for the carriage of vehicles with fuel in their tanks for their own propulsion:

16.2.2.1 at least three water-fog applicators;

16.2.2.2 one portable foam applicator unit complying with the provisions of the FSS Code or other standard agreed by the Naval Administration, provided that at least two such units are available in the ship for use in such ro-ro spaces.

Helicopters, fixed wing aircraft and UAVs

17 Purpose

17.1 The purpose of this section of this regulation is to provide additional measures in order to address the fire safety objectives of this chapter for ships fitted with special facilities for organic aircraft. For this purpose, the following functional requirements shall be met:

17.1.1 aircraft structure must be adequate to protect the ship from the fire hazards associated with aircraft operations;

17.1.2 fire-fighting appliances shall be provided to adequately protect the ship from the fire hazards associated with aircraft operations;

17.1.3 refuelling and hangar facilities and operations shall provide the necessary measures to protect the ship from the fire hazards associated with aircraft operations;

17.1.4 operation manuals and training shall be provided.

18 Application

18.1 In addition to complying with the requirements of this chapter as appropriate, ships equipped with aircraft shall comply with the additional requirements of this section of this regulation.

18.2 Where helicopters land or conduct winching operations on an occasional or emergency basis on ships without organic aircraft facilities, fire-fighting equipment fitted in accordance with the requirements of the fire suppression sections (Regulations 2, 6, 7, 8 & 9) of this chapter may be used. This equipment shall be made readily available in close proximity to the landing or winching areas during helicopter operations.

18.3 Refuelling facilities for fuels with a flashpoint less than 60° are not covered by the Code and are to be to a standard agreed by the Naval Administration.

Note: Acceptable standards such as: Classification Rules.

19 Structure

19.1 Flight decks constructed of steel or other equivalent material

19.1.1 In general, the construction of the flight deck shall be of steel or other equivalent materials. If the flight deck forms the deckhead of a deckhouse, superstructure or weather deck, it shall be insulated to "A-60" class standard.

19.2 Flight decks constructed of aluminium or other low melting point metals

19.2.1 If the Naval Administration permits aluminium or other low melting point metal for construction of the flight deck that is insulated equivalent to steel, the following provisions shall be satisfied:

19.2.1.1 if the flight deck is cantilevered over the side of the ship, after each fire on the ship or on the flight deck,, the flight deck shall undergo a structural analysis to determine its suitability for further use;

19.2.1.2 if the flight deck is located above the ship's deckhouse or similar structure, the following conditions shall be satisfied:

19.2.1.2.1 the deckhouse top and bulkheads under the platform shall have no openings;

19.2.1.2.2 windows under the flight deck shall be provided with steel shutters;

19.2.1.2.3 after each fire on the flight deck or in close proximity, the flight deck shall undergo a structural analysis to determine its suitability for further use.

20 Means of escape

20.1 A flight deck shall be provided with both a main and an emergency means of escape and access for fire fighting and rescue personnel. These shall be located as far apart from each other as is practicable and preferably on opposite sides of the flight deck.

20.2 For a flight deck with multiple landing spots, both a main and an emergency means of escape is to be provided for every landing spot.

21 Fire-fighting appliances

21.1 In close proximity to the flight deck, the following fire-fighting appliances shall be provided and stored near the means of access to that flight deck:

21.1.1 at least two dry powder extinguishers having a total capacity of not less than 45 kg;

21.1.2 carbon dioxide extinguishers of a total capacity of not less than 18 kg or equivalent;

21.1.3 a suitable foam application system consisting of monitors or foam making branch pipes capable of delivering foam to all parts of the flight deck in all weather conditions in which aircraft can operate. The system shall be capable of delivering a discharge rate in accordance with the table below (Table 13-4) for at least five minutes or to a standard as defined by the Naval Administration. For ships with multiple landing spots, the quantity of foam is to be delivered for each landing spot and aircraft storage position.

Note: STANAG 7183 *The Minimum Crash, Fire Fighting and Rescue (CFR) Equipment Standards for Aviation Capable Vessels, Edition 1* may be selected by the Naval Administration.

Table 13-4: Foam Discharge Rate

Category	Helicopter overall length	Discharge rate foam solution (l/min)
H1	Up to but not including 15m	250
H2	From 15m up to but not including 24m	500
H3	From 24m up to but not including 35m	800

21.1.4 the principle agent shall be suitable for use with salt water and conform to performance standards not inferior to those acceptable to the Naval Administration;

21.1.5 at least two nozzles of an approved dual-purpose type (jet/spray) and hoses sufficient to reach any part of the flight deck; For ships with multiple landing spots, two hoses are to be simultaneously applied for each landing spot and aircraft storage position.

21.1.6 in addition to the requirements of Regulation 9 (Fire Fighting), two sets of fire fighter's outfits; For ships with multiple landing spots, two fire fighter's outfits are to be carried for each landing spot and aircraft storage position.

21.1.7 at least the following equipment shall be stored in a manner that provides for immediate use and protection from the elements adjacent to each landing spot:

21.1.7.1 adjustable wrench;

21.1.7.2 blanket, fire resistant;

21.1.7.3 cutters, bolt, 60 cm;

21.1.7.4 hook, grab or salving;

21.1.7.5 hacksaw, heavy duty complete with 6 spare blades;

21.1.7.6 ladder;

21.1.7.7 life line 5 mm diameter × 15 metres in length;

21.1.7.8 pliers, side-cutting;

21.1.7.9 set of assorted screwdrivers;

21.1.7.10 harness knife complete with sheath.

22 Drainage facilities

22.1 Drainage facilities in way of flight deck shall be constructed of steel and shall lead directly overboard independent of any other system and shall be designed so that drainage does not fall onto any part of the ship. Means shall be provided to prevent accidental discharge of oil spills.

Note: Small raised sills or temporary arrangements to provide an oil spill barrier may be used provided these comply with flight deck protuberance requirements.

23 Aircraft refuelling and de-fuelling

23.1 Where the ship has aircraft refuelling facilities, the following requirements shall be complied with:

23.1.1 where portable fuel storage tanks are used, special attention shall be given to:

23.1.1.1 provision of a designated area for the storage of fuel tanks which shall be as remote as is practicable from accommodation spaces, escape routes, muster stations and evacuation stations;

23.1.1.2 design of the tank for its intended purpose;

23.1.1.3 mounting and securing arrangements;

23.1.1.4 electric bonding;

23.1.1.5 inspection procedures;

23.1.1.6 isolation from areas containing a source of vapour ignition;

23.1.1.7 provision of arrangements whereby fuel spillage may be collected and drained to a safe location.

23.1.2 Fuelling pumps shall be provided with means which permit shutdown from a safe remote location in the event of a fire. Where a gravity fuelling system is installed, equivalent closing arrangements shall be provided to isolate the fuel source;

23.1.3 the fuelling unit shall be connected to one tank at a time. The piping between the tank and the fuelling unit shall be of steel or equivalent material, as short as possible, and protected against damage;

23.1.4 electrical fuelling units and associated control equipment shall be of a type suitable for the location and potential hazards;

23.1.5 fuelling units shall incorporate a device which will prevent over-pressurisation of the delivery or filling hose;

23.1.6 equipment used in refuelling operations shall be electrically bonded;

23.1.7 "NO SMOKING" signs shall be displayed at appropriate locations;

23.2 Where low flashpoint fuels are used, de-fuelling and refuelling the equipment and arrangements are to comply with the requirements of Regulation 14. Stowage of other aviation fuels are to comply with the special function bulk fuel carriage.

Note: Land based aircraft and UAVs often use low flashpoint fuels.

24 Hangars, aircraft storage and maintenance facilities

24.1 hangar, refuelling and maintenance facilities shall be treated as category ‘A’ machinery spaces with regard to structural fire protection, fixed fire-extinguishing and detection system requirements;

24.2 enclosed hangar facilities or enclosed spaces containing refuelling installations shall be provided with mechanical ventilation, as required by paragraphs 13.1 to 13.3 for closed ro-ro spaces. Ventilation fans shall be of non-sparking type;

24.3 electric equipment and wiring in enclosed hangar or enclosed spaces containing refuelling installations shall comply with paragraphs 13.2 to 13.4;

24.4 Pump rooms for the treatment, transfer and discharge of aircraft fuel are to be fitted with a fixed hydrocarbon detection system that complies with the FSS code and which alarms at the continuously manned control station.

25 Bulk storage

25.1 Arrangements for the storage area of aircraft fuels shall comply with Regulation 3 and where low flash point fuels are used, Regulation 14.

26 Operations manual and fire-fighting service

26.1 Each aircraft facility shall have an operations manual, including a description and a checklist of safety precautions, procedures and equipment requirements.

26.2 The procedures and precautions to be followed during refuelling operations shall be in accordance with recognized safe practices and contained in the operations manual.

26.3 Fire-fighting personnel, consisting of at least two persons trained for rescue and fire-fighting duties, and fire-fighting equipment shall be immediately available at all times when aircraft operations are expected.

26.4 Fire-fighting personnel shall be present during aircraft refuelling operations. However, the fire-fighting personnel shall not be involved with refuelling activities.

26.5 On-board refresher training shall be carried out and additional supplies of fire-fighting media shall be provided for training and testing of the equipment.

Magazines requirements for explosives stowage

Note: These requirements are for the carriage and transportation of explosives and do not cover other operational activities. Additional requirements for magazines and designated danger areas may be applied by the Naval Administration.

27 Explosives associated with the special purpose of the ship should be stored in one of the following categories of magazines:

27.1 Integral magazines - those forming an integral part of the ship;

27.2 Independent magazines - that are non-integral, portable magazines with a capacity of 3 m^3 or greater;

27.3 Magazine boxes - that are non-integral, portable magazines with a capacity of less than 3 m^3.

28 The following minimum provisions should be applied bearing in mind that additional provisions may be required by the Naval Administration dependent on the nature of the explosives.

29 Integral magazines should not be located in close proximity to and never below accommodation spaces and not in close proximity to control spaces.

30 Integral magazines should not be located adjacent to a boiler room, engine room, galley or other space presenting a fire hazard. If it is necessary to construct the magazine in proximity to these areas, a cofferdam of at least 0.6 metres should be provided separating the two spaces. Such a cofferdam should be provided with ventilation and should not be used for stowage. One of the bulkheads forming the cofferdam should be of A-60 construction.

31 Access to integral magazines should preferably be from the open deck, but in no case through spaces mentioned in paragraphs 29 and 30.

32 Independent magazines and magazine boxes should be located on an open deck space in a location protected from direct impact of the sea. The location should provide sufficient protection against warm air or hazardous vapours being emitted from galleys, pump-rooms, etc. Due regard should be paid to the possible risk of subjecting certain explosives to radio emissions.

33 Magazine boxes should be located on an open deck space at least 0.1 metres from the deck and any deck-house and in a position suitable for jettisoning the contents.

34 Integral magazines should be of permanent watertight construction and formed by permanent A-15 class divisions with insulation fitted external to the magazine. A-0 class divisions may be allowed if spaces adjacent to the magazine do not contain flammable products.

Note: The Naval Administration may require an A-60 class division as a minimum for integral magazines.

35 Magazines should be insulated with non-combustible material as necessary to prevent the condensation of moisture.

36 Light fixtures installed in magazines should be equipped with globes and guards. Control of lighting systems should be from outside the magazine. An indication should be provided at the switch location to indicate when circuits are energized. Other electrical equipment and wiring should not be installed within or pass through magazines except electrical cables enclosed in a watertight trunk.

37 Piping of fresh or salt water and drainage systems and piping systems installed in the magazines themselves may be routed through magazines. Piping of other systems should be permitted only if they are enclosed in a watertight trunk.

38 Magazines should be provided with a means whereby they may be securely locked to prevent unauthorized access.

39 Racks, stanchions, battens, or other devices should be installed to provide safe stowage of explosives in their approved shipping containers with a minimum of dunnage.

40 Decks of magazines should be covered with a permanent non-slip, non-spark covering.

41 Independent magazines should be of weather tight metal construction. The interior should be insulated with a non-combustible insulation providing an A-15 standard.

42 The electrical terminals on independent magazines for connection to the ship’s electrical system should be of watertight construction and should bear a label plate denoting the power requirement of the magazine.

43 Independent magazines should bear a label plate stating light weight and maximum allowable weight of explosives.

44 Magazine boxes should be of watertight metal construction having a body and lid thickness of not less than 3 mm. Where the box may be exposed to direct sun, sun shields should be provided.

45 Integral magazines should be provided with natural or mechanical ventilation fitted with flame screen sufficient to maintain the magazine temperature below 38°C.

46 Independent magazines should be provided with efficient natural ventilation fitted with flame screen.

47 In integral and in independent magazines a sprinkler system should be installed with an application rate of at least 24 l/m^2 per minute. Equivalent means may be accepted by the Naval Administration. The controls should be clearly marked as to their function.

48 Integral and independent magazines should be clearly labelled indicating:

48.1 the space is a magazine;

48.2 open lights and flame should be kept away;

48.3 the magazine door should be kept shut;

48.4 matches and lighters should be removed prior to entering;

48.5 not to lift with contents (in the case of independent magazines).

49 Magazine boxes should be clearly labelled indicating:

49.1 the container is a magazine box;

49.2 open lights and flame should be kept away;

49.3 the box should be kept shut.

50 Detonators should be stowed separately from the other explosives based upon manufacturers or Naval Administration instructions.

Boat decks/dock facilities

51 Well docks shall have fire protection to Naval Administration defined standards.

Plan appraisal survey and testing

52 Plans showing the general ship layout, location and arrangement of dangerous goods, vehicle spaces, aviation facilities, munitions storage or boat handling areas are to be submitted for appraisal.

53 Details of ventilation arrangements, detection and alarm systems, fire insulation, fire fighting systems and control arrangement for safety systems are to be submitted for appraisal.

54 Details of tests and certification for materials are to be submitted for appraisal.

55 After installation onboard, independent verification of the functioning of safety systems are to be carried out in accordance with an agreed test programme.

Regulation 14 Carriage of Low Flash Point Fuels in Bulk

Functional Objective

1 Safe storage of bulk quantities of low flash point fuel shall be provided where this is required for operational purposes.

Note: Bulk quantities is used to mean any single tank that will hold more than 150 litres, or is in a position where it cannot be readily jettisoned overboard in the event of a fire in the immediate vicinity. (This regulation extends the maximum amount that can be carried from the limit contained in the UK Maritime and Coastguard Agency Large Commercial Yacht Code (LY2)

Performance Requirements

2 Tanks are not to be located in spaces that would otherwise be categorised as being either of high or moderate fire hazard.

Note: For Type A ships areas of moderate fire hazard are defined as category 7, 11, 13 and 16 in regulation 8. Areas of major fire hazard are defined as category 12, 14 and 15.

For Type B and Type C ships areas of moderate fire hazard are defined as category 7 and 11 in regulation 8. Areas of major fire hazard are defined as category 6, 8 and 10.

3 Spaces containing independent tanks are to be treated as High Fire Risk Spaces and:

3.1 fitted with vapour detection;

3.2 adequately ventilated, with ventilation led to a safe location;

3.3 fitted with a fixed fire detection and extinguishing system;

3.4 electrical systems are to minimise the risk of ignition, including by electro magnetic radiation.

4 Tanks are to be adequately ventilated and the vent led to a safe location.

5 Other spaces connected directly to the tank, are to be treated as being common with equivalent safety arrangements.

6 Means are to be provided to prevent the uncontrolled release of tank contents into the space containing the tank or adjacent spaces.

7 Tanks are to be arranged to prevent the contents being raised to a temperature above the auto-ignition point.

8 Means are to be provided to control the overflow from tanks.

9 Means to allow for safe fuelling and refuelling of equipment are to be provided.

Solutions

10 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

11 Tanks for the carriage of low flash point fuel with a flash point 35°C or above are to be:

11.1 Free standing (not part of ship structure);

11.2 Located in spaces where there are no other sources of fire risk;

11.3 Have a capacity of less than 1000 litres;

11.4 Tank is to be made of steel with minimum wall thickness in accordance with appropriate standard;

Note: Classification Society Rules have requirements for the scantlings of free standing tanks.

11.5 Be fitted with means for remote isolation of filling and suction lines from the tank;

11.6 Venting arrangements are to be to a well ventilated, external location;

11.7 Venting arrangements are to be fitted with a means to prevent ingress of a flame, water or foreign matter to the tank;

11.8 Fitted with bund or saveall with capacity of at least 150% of capacity of tank, fitted around and underneath the tank to contain any leakage either from the tank boundary or tank fittings;

11.9 Fitted with an overflow to a safe space;

11.10 Protected by an automatic water spray system;

11.11 Means to measure level in the tanks are to be provided local to the tank;

11.12 Duplicated, independent means of measuring contents are to be provided.

12 Where tank content indication is provided by a gauge glass, this is to be of a flat glass type and fitted with:

12.1 A self closing valve at the top and bottom of the gauge. The arrangement may incorporate a single point of operation for the valves;

12.2 Protection from mechanical damage;

12.3 Gauge Glass is to meet a suitable fire performance test.

13 Spaces with tanks for the storage of low flash point petroleum products are to comply the requirements of a suitable standard such as the UK Maritime and Coastguard Agency Large Commercial Yacht Code (LY2) Section 14.1.5.

14 Where overflow arrangements are led to another internal tank, means to control the explosive risk of the atmosphere of the tank and adjacent spaces are to be provided.

15 Procedures for the filling of the storage tank and transfer of contents to vehicles, boats or other consumers are to be provided and agreed with the Naval Administration.

16 All safety devices fitted to the tank are to be tested periodically, with a maximum interval of 12 calendar months.

17 Tanks with a flashpoint of less than 35°C are to be specially considered by the Naval Administration.

Plan appraisal survey and testing

18 Plans showing the location and arrangement for storage and handling facilities of low flash bulk fuels are to be submitted for appraisal.

19 Details of ventilation arrangements, detection and alarm systems, fire insulation, fire fighting systems and control arrangement for safety systems are to be submitted for appraisal.

20 Details of tests and certification for materials are to be submitted for appraisal.

21 After installation onboard, independent verification of the functioning of safety systems are to be carried out in accordance with an agreed test programme.

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CHAPTER VII ESCAPE, EVACUATION AND RESCUE

Regulation 0 Goal

1 The arrangements for the Escape, Evacuation and Rescue of embarked persons shall be designed, constructed and maintained to:

1.1 provide effective escape for all embarked persons from all manned spaces to a place of safety in the event of foreseeable accidents and emergencies at least until the threat has receded;

1.2 provide an effective means of evacuation from the ship;

1.3 provide an effective means of recovering persons from the sea.

Regulation 1 General

Functional Objective

1 The purpose of this Regulation is to outline the principles and framework of Chapter VII Escape, Evacuation and Rescue.

Definitions

Note: Definitions which are applicable to all Chapters are located in Chapter I, Regulation 2.

Accommodation Spaces	See definition in Chapter VI Fire Safety.
Anticipated List or Trim for Damaged Conditions	Worst case trim and list as determined from Chapter III and as a minimum shall be 10° of trim and 20° of list either way.
Anti-exposure suit	Protective suit for use by rescue craft crews and MES parties.
Approval Procedure	Procedure that verifies the compliance of a ship with the objectives of this Chapter.
Boarding equipment	MES, ladders, nets, etc.
Catastrophic Failure	Failure which diminishes below an acceptable level the proper operation of any Escape, Evacuation and Rescue measure.
Clear Width of an Escape Route	The net width of an escape route when the width of equipment, handrails and any other items are subtracted.
Climbing net	Net used for disembarkation of persons to the survival craft and for the rescue of persons from the water.
Electrically Powered Directional Sound System	A system which requires electrical power for its operation and uses sound to identify escape routes or escape exits.
Electrically Powered Low Location Lighting System	Low Location Lighting system which requires electrical power for its operation, such as systems using incandescent bulbs, light emitting diodes, electro luminescent strips or lamps, electro fluorescent lamps, etc.
Embarkation Arrangements	Both the evacuation station and boarding equipment.

Embarkation Equipment	Equipment that enables safe transfer of persons into survival craft and aimed at dry-shod embarkation.
Embarkation ladder	Ladder provided at evacuation stations to permit safe access to survival craft after launching.
Embarkation Station	Location on board from which embarked persons can safely evacuate into survival craft. These locations may not be designated for evacuation purposes only and may in some ships be considered to be the whole upper deck.
Emergency Escape Breathing Devices	Device solely provided for local escape purposes.
Enclosed Escape Route	An escape route which offers fire and smoke protection in accordance with the requirements of Chapter VI Fire Safety.
Escape	The movement of persons to a place of relative safety on board the ship following an emergency.
Escape and Evacuation Analysis	Both types of escape and evacuation analysis: simplified (hydraulic representation) and advanced (individuals modelled).
Escape and Evacuation Demonstration	Trial on the ship as built.
Escape and Evacuation Time	Time it takes for persons to undergo all steps of the escape and evacuation process from the initiating announcement to evacuate the ship until the last person has evacuated in a survival craft and all survival craft are cleared from the ship.
Escape, Evacuation and Rescue Equipment Stowage	Tiny stowage such as containers, brackets, racks and other similar stowage locations designated for any Escape, Evacuation and Rescue equipment.
Escape, Evacuation and Rescue Lighting System	Both normal and emergency lighting which are installed for use during Escape, Evacuation and Rescue emergencies. This system may be incorporated in the general lighting system.
Escape, Evacuation and Rescue Measures	Any Escape, Evacuation and Rescue arrangement, equipment or procedure.
Escape Route	A designated route ultimately leading from a compartment to the evacuation station, thereby including both primary and secondary routes, for the purposes of local and global escape.
Evacuation	The movement of persons to a place of relative safety away from the damaged ship.
Evacuation Time	Time required to provide for the evacuation of the total number of embarked persons, including the time for launching, inflating, securing of survival craft alongside ready for evacuation, boarding the survival craft and safely for clearing all survival craft away from the damaged ship. The Evacuation Time is not to be less than the structural fire protection time in Chapter VI.
External Communication System	Includes all Global Maritime Distress and Safety Systems, flares, radios, transponders, day-light signalling lamp, etc.
Fixtures and fittings on Escape Routes	Doors, hatches, stairways, ladders, scuttles, panels, handrails, etc.
FSS Code	IMO Resolution MSC.98(73) “International Code for Fire Safety Systems”.
General Emergency Alarm System	An alarm which is used to notify all embarked persons of an emergency incident.
Headquarters	Compartment from which damage control, fire-fighting or escape and evacuation activities are controlled.

Immersion Suit	Protective suit which reduces the body heat loss of a person wearing it in cold water.
Inspection and Maintenance	All measures for the preservation and/or restoration of the original conditions of the technical elements of a system as well as measures for the determination and evaluation of the actual conditions
Ladders	In accordance with ANEP 26 *Ergonomic Data for Shipboard Space Design in NATO Surface Ships, Edition 1*, acceptance angles for ladders are 75° - 90°.
Launching Arrangements	Launching station and its equipment.
Launching Equipment	Equipment designated for transferring survival and rescue craft from its stowed position safely to the water and from the water to the stowed position.
Launching Stations	Designated positions for launching survival and rescue craft. Launching stations may coincide with evacuation stations.
Low-Location Lighting	Electrically powered lighting or photo luminescent indicators placed throughout a ship to readily identify escape routes and escape exits.
LSA Code	IMO Resolution MSC.48(66) “International Life-Saving Appliance Code”
Main Broadcast System	A system that permits one-way verbal communication to all embarked persons, in merchant shipping known as public address system. Where in any referenced IMO documents the term “public address system” is used, it should be read to mean “main broadcast system” for the purpose of the Code.
Marine Evacuation Systems	Appliance for the rapid transfer of persons from the evacuation station into a floating survival craft.
Marshalling Craft	Designated craft for marshalling survival craft that are not self-propelled, often also rated as rescue craft.
Muster Station	An area of relative safety where embarked persons can be gathered in the event of an emergency and prepared for evacuation. Muster stations may coincide with evacuation stations and are otherwise known as emergency or assembly stations.
Normally Occupied Compartment	Any compartment which regularly occupied by embarked persons.
Novel Life-Saving Measure	Life-saving measure which embodies new features not fully covered by the provisions of this Chapter but which provides an equal or higher standard of safety.
On Board Documentation	Posters, plans and other guidance information on any Escape, Evacuation and Rescue measures.
On Board Two-Way Communication System	System providing two-way verbal transmission and may include fixed or portable system or a combination of both.
Personal Thermal Protection Suits	Suits that are designed to prevent hypothermia and/or cold shock, i.e., immersion suits, anti-exposure suits.
Photo Luminescent Low Location Lighting System	Low Location Lighting system which uses PL material. PL material contains a chemical (example: zinc sulphide) that has the quality of storing energy when illuminated by visible light. The PL material emits light which becomes visible when the ambient light source is less effective. Without the light source to re-energize it, the PL material gives off the stored energy for a period of time with diminishing luminance.
Power Supply to Escape, Evacuation and Rescue Systems	Both normal and emergency electrical supplies essential for Escape, Evacuation and Rescue activities.

Primary Escape Route	The most direct route of escape from a compartment or number of compartments to the evacuation station. The primary escape route may or may not be coincident with the general access arrangements.
Public Address System	see Main Broadcast System.
Recovery Time for a Rescue Craft	Time required to raise the craft to a position where persons can disembark from it to the deck of the naval ship. Recovery time includes the time required to make preparations for recovery on board the rescue craft such as passing and securing a painter, connecting the rescue craft to the launching appliance, and the time to raise the rescue craft. Recovery time does not include the time needed to lower the launching appliance into position to recover the rescue craft.
Rescue	The survival and recovery of persons to a safe haven, which offers an equivalent or higher level of safety than that prior to the incident.
Rescue Arrangements	The rescue station and equipment.
Rescue Craft	Craft to rescue persons over board which may also be used as a marshalling craft.
Rescue Equipment	Any equipment that may be used for the recovery of persons from the sea and/or survival craft, i.e. rescue craft, ladders, scramble nets, life buoys, light markers, harnesses, MES etc.
Routine Escape, Evacuation and Rescue Procedures	All procedures normally performed on board which are to ensure effective Escape, Evacuation and Rescue performance, except inspection, maintenance and training.
Secondary Escape Route	Escape route which provides an alternative option to the primary escape route.
Stairs	In accordance with ANEP 26 *Ergonomic Data for Shipboard Space Design in NATO Surface Ships, Edition 1*, acceptable angles for stairs are 20° - 50°.
Stair Ladders	In accordance with ANEP 26 Ergonomic Data for Shipboard Space Design in NATO Surface Ships Edition 1, acceptable angles for stair ladders are 50° - 75°.
Stretchers	Equipment designated to transport persons who are incapable of walking to muster and/or evacuation stations.
Survival Craft	Any type of craft such as lifeboat (free-fall or davit launched), liferaft or rescue craft, capable of sustaining the lives of persons within, following the evacuation of the main ship.
Way Finding System	Any system which is provided to enable embarked persons to find escape routes and escape exits.

International Maritime Organization (IMO) Documents

Abbreviation	Title	Resolution No. (if applicable)	Amendments incorporated into or reviewed and applicable to ANEP-77	Amendments under review for ANEP-77
FSS Code	**International Code for Fire Safety Systems**	MSC.98(73)	MSC.217(82) MSC.292(87) **MSC.311(88)**	MSC.327(90)
LSA Code	International Life-Saving Appliance (LSA) Code	MSC.48(66)	Amended by MSC.218 (82)	Amended by MSC.207(81)MSC.320(89)
SOLAS	International Convention for the Safety of Life at Sea, Consolidated Edition, 2009	-	MSC.201(81) MSC.204(81) MSC.216(82) Anx 3 MSC.256(84) MSC.257(84) MSC.258(84) MSC.269(85) MSC.282(86) MSC.283(86) MSC.290(87) MSC.291(87) MSC.308(88) MSC.309(88) MSC.317(89)	MSC.325(90)

Abbreviations

DS	Directional Sound
FMEA	Failure Mode Effect Analysis
FSS Code	International Code for Fire Safety Systems
IMO	International Maritime Organisation
ISO	International Organization for Standardization
LSA Code	International Life Saving Appliance Code
MES	Marine Evacuation System
MSC	Maritime Safety Committee

Purpose

2 Escape, Evacuation and Rescue measures are to be in place to ensure that the vessel is as safe as reasonably practicable for all embarked persons to conduct Escape, Evacuation and Rescue, by:

2.1 Allowing embarked persons to escape as effectively as practicable to the evacuation station, whether or not by assembling at a separate muster station first;

2.2 Allowing embarked persons to evacuate as effectively as practicable from the evacuation station of the damaged vessel into survival craft;

2.3 Supporting the life of evacuated persons, who may be in a survival craft, as long as reasonably practicable and commensurate with the anticipated time for rescue; and

2.4 Permitting the rescue of persons from the sea or from survival craft.

General Performance Requirements

3 Naval ships shall be adequately designed, constructed, equipped, maintained and provided with procedures for the Escape, Evacuation and Rescue of all embarked persons following all foreseeable emergency situations and damage conditions.

4 Escape, Evacuation and Rescue measures shall:

4.1 Be robust and have a minimum susceptibility to damage. Redundancy shall be provided to secure Escape, Evacuation and Rescue functionality from catastrophic failure unless the identified mode of failure is extremely improbable;

4.2 Not be affected by the vessel's weapon and sensor systems;

4.3 Present minimum risk of injury to the embarked persons during normal operations, training, maintenance and emergency situations;

4.4 Not have a detrimental impact on other Escape, Evacuation and Rescue measures on board.

5 The provision of Escape, Evacuation and Rescue measures shall reflect:

5.1 The maritime environment: All exposed arrangements or equipment shall be designed and maintained to withstand the development of corrosion, shall be rot-proofed and shall be able to withstand sunlight (including ultra-violet), temperature, humidity, oil and fungal attack without degradation of performance;

5.2 The intended area of operation: Escape, Evacuation and Rescue equipment and their stowages shall be designed, constructed and maintained for the maritime environment to be experienced in the declared areas of operation. Furthermore, evacuation and rescue equipment shall be designed in accordance with the expected maximum time to rescue from shore or other external facilities;

5.3 The embarked persons: i.e. number and distribution of embarked persons, taking into account their physical characteristics, their knowledge of the vessel and its safety equipment;

5.4 Foreseeable emergencies resulting in Escape, Evacuation and Rescue activities: as a minimum these would include list, trim, flooding, fire, smoke, hazardous vapours and obstruction of fixtures and fittings such as doors.

Note: For all references in this Chapter to SOLAS, the following applies: (1) where the IMO document uses the term "passenger", it should be read to mean "non-crew" as defined in Chapter I of this document (2) where the IMO document refers to SOLAS II-1/42 or II-1/43, it should be read to mean Regulation 14 Power Supply to Escape, Evacuation and Rescue Systems.

Solutions

6 Verification that the ship complies with this chapter shall be by the Naval Administration. Provision of evidence to support verification shall be by the owner. All decisions that affect compliance with the requirements of this chapter shall be recorded at all stages from concept to disposal and these records be maintained throughout the life of the ship.

Regulation 2 Escape, Evacuation and Rescue Measures

Functional Objective

1 The ship's Escape, Evacuation and Rescue measures shall comply with the objectives of this Chapter.

Performance Requirements

2 The ship's Escape, Evacuation and Rescue measures are to comply with the objectives of this Chapter including equipment, systems, arrangements and associated procedures.

Solutions

3 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

4 The Escape and Evacuation measures shall be subject to an Escape and Evacuation Analysis and Escape and Evacuation Demonstration as described in Regulation 3 Escape and Evacuation Analysis and Demonstration to ensure that:

4.1 The Evacuation time of the undamaged vessel does not exceed 30 minutes, except for ships with less than two compartment damage stability criteria (see Annex A, paragraphs 4.62 – 4.67) for which the Evacuation time does not to exceed 10 minutes; and

4.2 The combined Escape and Evacuation time of the undamaged vessel does not exceed:

4.2.1 60 minutes for vessels with ro-ro spaces;

4.2.2 60 minutes for vessels with less than 3 main vertical fire zones;

4.2.3 80 minutes for all other vessels.

Note: Vessels with ro-ro spaces will have an escape and evacuation time based on stability performance.

5 Before giving approval, the Naval Administration shall ensure that:

5.1 Equipment and arrangements are tested, to confirm that they comply with the requirements of this Chapter, in accordance with IMO Resolution MSC.81(70) "Revised recommendations on testing of Life-Saving Appliances", modified by IMO Resolution MSC.200(80); or

5.2 Have successfully undergone, to the satisfaction of the Naval Administration, tests which are substantially equivalent to those specified in those recommendations.

6 Before giving approval to novel Escape, Evacuation and Rescue measures, the Naval Administration shall ensure that such measures:

6.1 Provide safety standards at least equivalent to the requirements of this Chapter and have been evaluated and tested in accordance with IMO Resolution A.520(13) "Code of Practice for the Evaluation, Testing and Acceptance of Prototype Novel Life-Saving Appliances and Arrangements"; or

6.2 Have successfully undergone, to the satisfaction of the Naval Administration, evaluation and tests which are substantially equivalent to those recommendations.

7 Escape, Evacuation and Rescue equipment shall be subjected to such product tests as are necessary to ensure that Escape, Evacuation and Rescue equipment is manufactured to the same standards as the approved prototype.

8 Life-saving appliances required by this Chapter for which detailed specifications are not included in this Chapter shall be to the satisfaction of the Naval Administration.

9 Procedures adopted by the Naval Administration for approval shall also include the conditions whereby approval would continue or would be withdrawn.

Regulation 3 Escape and Evacuation Analysis and Demonstration

Functional Objective

1 Escape and Evacuation Analysis and Escape and Evacuation Demonstration shall ensure that effectiveness of escape and evacuation measures are optimised.

Performance Requirements

2 An Escape and Evacuation Analysis shall:

2.1 Optimise the effectiveness of escape and evacuation measures, considering:

2.1.1 normal seagoing conditions;

2.1.2 damaged conditions defined in the Concept of Operations Statement.

2.2 Represent flows of persons during escape and evacuation as factually accurate as possible.

3 An Escape and Evacuation Demonstration shall:

3.1 Verify the accuracy of the Escape and Evacuation Analysis;

3.2 Enable the Naval Administration to identify unforeseen shortcomings of Escape and Evacuation measures;

3.3 Represent flows of persons during escape and evacuation as realistically as possible;

3.4 Not impose unacceptable risks to persons involved in the demonstration.

Solutions

4 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

5 An Escape and Evacuation Analysis and an Escape and Evacuation Demonstration shall be undertaken for all new designs of naval vessels where Escape and Evacuation measures differ substantially from those that have previously undergone an Escape and Evacuation Analysis or an Escape and Evacuation Demonstration. During service, if substantial modifications are made to Escape, Evacuation and Rescue measures, the Escape and Evacuation Analysis and the Escape and Evacuation Demonstration shall be updated, when deemed necessary by the Naval Administration.

6 An Escape and Evacuation Analysis shall be undertaken early in the design process, to investigate possible improvements of the ship's Escape and Evacuation measures.

7 The scope and extent of the Escape and Evacuation Analysis shall be to the satisfaction of the Naval Administration, taking into account the fire and flooding hazards, the layout of the ship and the number of embarked persons.

8 The Escape and Evacuation Analysis shall be undertaken in accordance with the philosophy described in IMO MSC/Circ.1238 "Guidelines for evacuation analysis for new and existing passenger ships", with the following adjustments:

8.1 Target times for escape and evacuation shall be according to Regulation 2 Escape, Evacuation and Rescue Measures;

8.2 The range of watertight integrity conditions which might slow down the escape process shall be included;

8.3 As a minimum, six scenarios (cases 1, 2a, 2b, 3, 4a, 4b) shall be considered for the analysis as follows:

8.3.1 case 1 (normal night cruising), case 2a (normal day cruising) and case 2b (action stations) in accordance with Chapter 13 of the FSS Code. The distribution of persons shall be representative for the vessel's operations; and

8.3.2 cases 3, 4a and 4b (secondary evacuation cases). In these cases only the main vertical zone, which generates the longest travel time, is further investigated. These cases utilize the same population demographics as in case 1 (for case 3), as in case 2a (for case 4a) and as in case 2b (for case 4b). One of the two following alternatives should be considered for case 3, case 4a and case 4b. Alternative 1 should be considered if possible:

8.3.2.1 alternative 1: One complete run of the stairways having largest capacity previously used within the identified main vertical zone is considered unavailable for the simulation; or

8.3.2.2 alternative 2: 50% of the persons in one of the main vertical zones neighbouring the identified main vertical zone are forced to move into the zone and to proceed to the relevant muster station (if provided). The neighbouring zone with the largest population should be selected.

8.3.3 If the total number of embarked persons calculated, as indicated in the above cases, exceeds the maximum number of persons the ship will be certified to carry, the initial distribution of people should be scaled down so that the total number of persons is equal to what the ship will be certified to carry.

8.4 Additional relevant scenarios may be considered as appropriate, in particular Naval Administrations may alter scenarios 3, 4a and 4b for vessels without distinguishable vertical zones to provide equivalent damaged scenarios.

9 The Naval Administration shall verify if the instructions of IMO MSC/Circ.1238 need to be altered to reflect the vessel's procedures during escape and evacuation more accurately, in particular case 2a shall be adjusted to take into account the various possible distributions of embarked persons.

10 The calculated times shall be verified by an Escape and Evacuation Demonstration for the case which the Escape and Evacuation Analysis indicates the greatest Escape and Evacuation time. As far as reasonably practicable the Escape and Evacuation Demonstration shall reflect the Escape and Evacuation Analysis, e.g. initial number and distribution of embarked persons and the escape and evacuation procedures.

11 The Escape and Evacuation Demonstration shall be performed using the survival craft and exits on one side only, using the scenario, which the Escape and Evacuation Analysis indicates the greatest Escape and Evacuation time. Where half trials are impractical, the Naval Administration may consider a partial trial using a route which the Escape and Evacuation Analysis shows to be the most critical.

12 Parts of the Escape and Evacuation Demonstration need not be conducted for similar arrangements that have previously undergone an Escape and Evacuation Demonstration for other vessels subject to the consideration of the Naval Administration.

13 The Escape and Evacuation Demonstration shall be carried out in controlled conditions in the following manner in compliance with the vessel's procedures for escape and evacuation:

13.1 The Escape and Evacuation Demonstration shall commence with the vessel afloat in harbour, in reasonably calm conditions.

13.2 All machinery and equipment shall be operating in normal seagoing condition.

13.3 All exits and doors inside the craft shall be in the same position as they are for the scenario which is being verified. If various conditions are possible, the worst case configuration shall be used.

13.4 The survival craft shall be initially in their stowed positions.

14 The persons selected for the Escape and Evacuation Demonstration shall not have been specially drilled for such an Escape and Evacuation Demonstration other than the normal Escape and Evacuation training undertaken on board. As far as reasonably practicable, the Escape and Evacuation Demonstration shall be undertaken with a representative composition of the embarked persons in terms of physical characteristics, vessel knowledge and training.

15 The Escape and Evacuation Demonstration shall be carried out with due concern for the problems of mass movement or panic acceleration likely to arise in an emergency situation when rapid evacuation is necessary. The demonstrated Escape and Evacuation time shall be the time elapsed from the moment the first announcement to evacuate the vessel is given until the last person has evacuated into survival craft and the last survival craft has been moved clear from the demonstration vessel. It shall include the time for all embarked persons to don life-jackets and personal thermal protection suits, and the time necessary to launch, inflate and secure the survival craft alongside ready for evacuation.

16 The times recorded during an Escape and Evacuation Demonstration shall be compared to the times calculated by an Escape and Evacuation Analysis. If the recorded time is significantly larger than the calculated time and if it is not reasonable to assume that target times as given by Regulation 2 Escape, Evacuation and Rescue Measures shall be met, alternative Escape and Evacuation measures shall be installed and validated by an Escape and Evacuation Demonstration, until the anticipated evacuation time and Escape and Evacuation time for undamaged conditions are to the satisfaction of the Naval Administration.

Regulation 4 Inspection and Maintenance

Functional Objective

1 Inspection and maintenance procedures shall ensure that any Escape, Evacuation and Rescue arrangement or equipment has an availability which is as high as reasonably practicable.

Performance Requirements

2 Escape, Evacuation and Rescue arrangements and equipment shall have a reliability which is as high as reasonably practicable.

Solutions

3 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

4 Unless expressly provided otherwise in this Code, inspection and maintenance shall comply with:

4.1 IMO Resolution A.752(18) "Guidelines for the evaluation, testing and application of low-location lighting on passenger ships", Paragraph 9;

4.2 ISO 15370:2001 "Ships and marine technology – Low-location lighting on passenger ships – Arrangement", Paragraph 8;

4.3 IMO MSC/Circ.955 "Servicing of life-saving appliances and radio communication equipment under the harmonized system of survey and certification (HSSC)".

4.4 IMO MSC/Circ.1093 "Guidelines for periodic servicing and maintenance of lifeboats, launching appliances and on-load release gear";

4.5 IMO MSC/Circ.1047 "Guidelines for monthly shipboard inspection of immersion suits and anti-exposure suits by ship's crews";

4.6 IMO MSC/Circ.849 "Guidelines for the performance, location, use and care of Emergency Escape Breathing Devices (EEBDs)", Paragraph 5.

4.7 IMO Resolution A.761(18) "Recommendations on conditions for the approval of servicing stations for inflatable liferafts" revised by IMO Resolution MSC.81(70).

5 The Naval Administration shall approve the period of acceptability of Escape, Evacuation and Rescue equipment which are subject to deterioration with age. Such Escape, Evacuation and Rescue equipment shall be marked with a means for determining their age or the date by which they shall be replaced.

<u>On board inspection and maintenance</u>

6 Named persons or identified posts on board shall be nominated to ensure that all Escape, Evacuation and Rescue arrangements and equipment are maintained in good condition.

7 Instructions for on board inspection and maintenance of all Escape, Evacuation and Rescue arrangements and equipment shall be provided on board and maintenance shall be carried out accordingly. The Naval Administration may accept a shipboard planned maintenance programme.

8 Instructions for on board maintenance of all Escape, Evacuation and Rescue arrangements and equipment shall be in accordance with the manufacturers' instructions. They shall be easily understood, illustrated wherever possible and, as appropriate, shall include the following for each appliance:

8.1 A checklist for use when carrying out the inspections;

8.2 Maintenance and repair instructions;

8.3 Schedule of periodic maintenance;

8.4 Diagram of lubrication points with the recommended lubricants;

8.5 List of replaceable parts;

8.6 List of sources of spare parts;

8.7 Log for records of inspections and maintenance, including Certificates of Testing, Servicing and Packing, and repair records.

9 Spares and repair equipment shall be provided for Escape, Evacuation and Rescue equipment and their components which are subject to excessive wear or consumption and need to be replaced regularly.

10 A report of all on board inspection and maintenance shall be kept within a log book.

11 Provision shall be made for the periodic testing of the complete Escape, Evacuation and Rescue system and shall include the testing of automatic starting arrangements:

11.1 The following tests and inspections shall be carried out weekly;

11.1.1 All survival craft, rescue craft and launching appliances shall be visually inspected to ensure that they are ready for use. The inspection shall include, but is not limited to, the condition of hooks, their attachment to the boats and the on-load release gear being properly and completely reset;

11.1.2 All engines in survival and rescue craft shall be run for a total period of not less than 3 minutes provided the ambient temperature is above the minimum temperature required for starting and running the engine. During this period of time, it shall be demonstrated that the gear box and gear box train are engaging satisfactorily. If the special characteristics of an outboard motor fitted to a rescue craft would not allow it to be run other than with its propeller submerged for a period of 3 minutes, it shall be run for such period as prescribed in the manufacturer's handbook;

11.1.3 Lifeboats, except free-fall lifeboats, shall be moved from their stowed position, without any embarked persons, to the extent necessary to demonstrate satisfactory operation of launching appliances, if weather and sea conditions so allow;

11.1.4 The general emergency alarm system, main broadcast system and other essential Escape, Evacuation and Rescue communication equipment shall be tested.

11.2 For a ship in-service, the following shall be carried out monthly;

11.2.1 Inspection of all Escape, Evacuation and Rescue arrangements and equipment covered by this Chapter, shall be carried out to ensure that they are complete and in good order;

11.2.2 All lifeboats, except free-fall lifeboats, shall be turned out from their stowed position, without any embarked persons if weather and sea conditions so allow.

12 Way finding systems:

12.1 Where PL LLL is provided through adhesive stickers, their presence shall be checked by a routine inspection.

12.2 All LLL systems should have their luminance tested in accordance with ISO 15370:2001.

13 Emergency Escape Breathing Devices:

13.1 Maintenance and inspection shall be in accordance with the manufacturer's instruction and undertaken by a competent person.

14 Inflatable survival craft containers:

14.1 Shall be handled with care to avoid bumping, especially on deck projections as rough handling may disturb the contents and prevent proper inflation.

15 Where pyrotechnics are stowed within the Escape, Evacuation and Rescue equipment stowages then the following precautions shall be followed:

15.1 No work shall be carried out on the stowages;

15.2 No welding or burning shall take place within a 6 metre radius of the stowage.

16 Launching appliances:

16.1 Shall be serviced at recommended intervals in accordance with instructions for on board maintenance;

16.2 If used for purposes other than rescue and evacuation, shall be designed and surveyed according to the intended duty.

17 Survival craft on load release gear:

17.1 Shall be serviced at recommended intervals in accordance with instructions for on board maintenance.

18 Maintenance of falls:

18.1 Falls used in launching shall be turned end for end at intervals of not more than 30 months and be renewed when necessary due to deterioration of the falls or at intervals of not more than five years, whichever is earlier;

18.2 The Naval Administration may accept in lieu of the “end for ending” required, periodic inspection of the falls and their renewal whenever necessary due to deterioration or at intervals of not more than four years, whichever is earlier.

Shore-based Servicing

19 Certificates of “Servicing and Testing” shall be provided for all Escape, Evacuation and Rescue related equipment as proof that the requirements of this Code have been met. The certificates shall be returned with the equipment when serviced.

20 Every inflatable survival craft, inflatable life-jacket, MES, inflated rescue craft and hydrostatic release units, other than disposable hydrostatic release units, shall be serviced:

20.1 At intervals not exceeding 12 months, where this is impracticable, the Naval Administration may extend this period to 17 months;

20.2 At a servicing station, approved by both the Naval Administration and the manufacturer, that is competent to service them, maintains proper servicing facilities and uses only properly trained personnel.

21 In addition to or in conjunction with the servicing intervals of MES, each MES shall be deployed from the vessel on a rotational basis at intervals to be agreed by the Naval Administration provided that each system shall be deployed at least once every six years.

22 A Naval Administration which approves new and novel inflatable survival craft arrangements may allow for extended service intervals on the following conditions:

22.1 The new and novel survival craft arrangement has proved to maintain the same standard, as required by testing procedure, during extended service intervals;

22.2 The survival craft system shall be checked on board by certified personnel;

22.3 Service at intervals not exceeding five years shall be carried out in accordance with the recommendations of the Naval Administration.

23 All repairs and maintenance of inflated rescue craft shall be carried out in accordance with the manufacturer's instructions. Emergency repairs may be carried out on board the ship; however, permanent repairs shall be effected at an approved servicing station.

24 Launching appliances shall:

24.1 be subjected to a thorough examination at intervals not exceeding 5 years;

24.2 upon completion of the examination be subjected to a dynamic test of the winch brake at maximum lowering speed. The load to be applied shall be the mass of the lifeboat without embarked persons, except at intervals not exceeding five years, the test shall be carried out with a proof load of 1.1 times the maximum working load of the winch;

24.3 If used for purposes other than rescue and evacuation, be designed and surveyed according to the intended duty.

25 Lifeboat on load release gear shall:

25.1 be subjected to a thorough examination and test during the surveys of Chapter I by properly trained personnel familiar with the system;

25.2 be operationally tested under a load of 1.1 times the total mass of the lifeboat when loaded with its full complement of persons and equipment whenever the release gear is overhauled. Overhauling and test shall be carried out at least every five years.

Regulation 5 Routine Escape, Evacuation and Rescue Procedures

Functional Objective

1 Routine Escape, Evacuation and Rescue procedures shall ensure that effective Escape, Evacuation and Rescue measures are available prior to sailing and whilst at sea.

Performance Requirements

2 Routine Escape, Evacuation and Rescue procedures shall:

2.1 Ensure that sufficient Escape, Evacuation and Rescue measures are available on board for the forthcoming operation, considering:

2.1.1 The embarked persons;

2.1.2 The areas of operation.

2.2 Ensure that any Escape, Evacuation and Rescue measures remain fully available during normal operating conditions.

Solutions

3 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

4 Escape, Evacuation and Rescue procedures shall ensure that prior to sailing and whilst at sea:

4.1 All required Escape, Evacuation and Rescue measures are ready for immediate use;

4.2 All Escape, Evacuation and Rescue measures are maintained in good condition by assigned personnel;

4.3 Each person on board is aware of duties assigned to him during the Escape, Evacuation and Rescue process.

5 Prior to sailing, it shall be verified that:

5.1 Escape, Evacuation and Rescue measures are adequate for the forthcoming operation, with respect to:

5.1.1 Number of embarked persons, their characteristics and ship knowledge;

5.1.2 Areas of operation, taking into account the distance to shore, climate conditions, etc.

5.2 Rescue craft are in a state of continuous readiness for launch in less than 5 minutes;

5.3 All embarked persons have received basic Escape, Evacuation and Rescue training according to the requirements of Regulation 7 Training and Drills;

5.4 A sufficient number of skilled persons are on board to be able to conduct any task of the Escape, Evacuation and Rescue process, including to the Escape, Evacuation and Rescue duties in Regulation 7 Training and Drills. Every person shall be familiar with assigned Escape, Evacuation and Rescue duties before the voyage begins;

5.5 All embarked persons are accounted for. This information is recorded both on board and ashore and is to be readily available to search and rescue services when needed;

5.6 Escape routes, emergency exits and other Escape, Evacuation and Rescue arrangements and equipment are unobstructed by fittings, furniture and other obstructions or portable equipment; and

5.7 Equipment on board is securely stowed for sea and nothing impinges on float free stowages.

6 On board procedures shall ensure that whilst at sea:

6.1 Escape routes, emergency exits and other Escape, Evacuation and Rescue arrangements remain unobstructed by fittings, furniture and other obstructions or portable equipment;

6.2 Any equipment on board remains securely stowed for sea and nothing impinges on float free stowages;

6.3 Rescue craft remain in a state of continuous readiness for launch in less than 5 minutes.

Regulation 6 Escape, Evacuation and Rescue Emergency Procedures

Functional Objective

1 Escape, Evacuation and Rescue emergency procedures shall enable assigned crew members perform their assigned Escape, Evacuation and Rescue tasks effectively.

Performance Requirements

2 Escape, Evacuation and Rescue emergency procedures shall:

2.1 Cover all duties in the Escape, Evacuation and Rescue process;

2.2 Be clear and unambiguous;

2.3 Incorporate redundancy.

Solutions

3 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

4 Escape, Evacuation and Rescue emergency procedures shall be provided which specify details of actions to be taken by embarked persons when the general emergency alarm is sounded and shall specify how the order to evacuate ship will be given. The Escape, Evacuation and Rescue emergency procedures shall identify the duties assigned to the different members of the crew including, but not limited to:

4.1 Closing of watertight doors, fire doors, valves, scuppers, sidescuttles, skylights, portholes and other similar openings in the ship;

4.2 Equipping of survival craft and other Escape, Evacuation and Rescue equipment;

4.3 Preparation and launching of survival craft;

4.4 Preparation of other Escape, Evacuation and Rescue equipment;

4.5 Mustering those persons that need to be mustered;

4.6 Use of communication equipment.

5 The Escape, Evacuation and Rescue emergency procedures shall specify substitutes for key persons who may become disabled, taking into account that different emergencies may call for different actions.

6 The Escape, Evacuation and Rescue emergency procedures shall show the duties assigned to crew members in relation to persons who are unfamiliar to the vessel in case of an emergency. These duties shall include:

6.1 Warning persons who are unfamiliar to the vessel;

6.2 Seeing that they are suitably clad and have donned their life-jackets and personal thermal protection suits correctly;

6.3 Assembling persons that need to be mustered at muster stations;

6.4 Controlling the movements of persons unfamiliar to the vessel.

7 Escape, Evacuation and Rescue emergency procedures shall be prepared before the vessel proceeds to sea. If any change takes place which necessitates an alteration in the Escape, Evacuation and Rescue emergency procedures, the procedures shall be revised or new procedures shall be prepared before the vessel proceeds to sea.

8 The approval of the Escape, Evacuation and Rescue emergency procedures shall, amongst others, be based on an Escape and Evacuation Analysis and an Escape and Evacuation Demonstration (Regulation 3 Escape and Evacuation Analysis and Demonstration).

9 An easy-to-use decision support system for emergency management shall be provided to support the Commanding Officer for handling any foreseeable combination of emergency situations. At least the following emergency situations shall be identified:

9.1 Damage to ship, including fire;

9.2 Personnel, cargo and on board weapon related accidents;

9.3 Emergency assistance to other ships.

Regulation 7 Training and Drills

Functional Objective

1 Training and drill procedures shall ensure all embarked persons have sufficient skills to undertake Escape, Evacuation and Rescue.

Performance Requirements

2 Training and drill procedures shall:

2.1 Ensure that all embarked persons are able to conduct basic Escape, Evacuation and Rescue tasks;

2.2 Ensure assigned embarked persons are able to conduct their Escape, Evacuation and Rescue related duties;

2.3 Be available for all Escape, Evacuation and Rescue measures and duties;

2.4 Be clear and understandable;

2.5 Not impose unacceptable risk to the vessel or the embarked persons.

Solutions

3 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

4 Training requirements shall be defined for drills, musters and for the operation, maintenance and testing of specific equipment.

5 Escape, Evacuation and Rescue drills shall, as far as practicable, be conducted as if there were an actual emergency.

6 Information cards, posters or electronic visual programmes may be used to supplement training and drills but may not be used to replace it.

7 The details of all on board Escape, Evacuation and Rescue related training shall be recorded in a log-book as agreed with the Naval Administration.

8 Procedures shall be provided to ensure that equipment used during Escape, Evacuation and Rescue training are immediately brought back to its fully operational condition and any faults and defects discovered during this training shall be remedied as soon as possible.

9 Procedures shall be provided to ensure that every person, including persons not familiar to the vessel such as embarked forces, special personnel or passengers, is given basic Escape, Evacuation and Rescue training within 24 hours of leaving port. This basic Escape, Evacuation and Rescue training shall include but not necessarily be limited to:

9.1 Essential actions each persons should take in an emergency;

9.2 The alarm and main broadcasting signals;

9.3 Location, operation and use of the vessel's personal Escape, Evacuation and Rescue equipment, i.e. Emergency Escape Breathing Devices, personal thermal protection suits and life-jackets;

9.4 Location of the muster stations (if provided) and evacuation stations.

9.5 An abandon ship drill which shall include:

9.5.1 summoning of embarked persons and crew to muster stations with the alarm required by regulation 10 followed by drill announcement on the public address or other communication system and ensuring that they are made aware of the order to abandon ship;

9.5.2 reporting to stations and preparing for the duties described in the muster list;

9.5.3 checking that embarked persons and crew are suitably dressed;

9.5.4 checking that lifejackets are correctly donned;

9.5.5 lowering of at least one lifeboat after any necessary preparation for launching;

9.5.6 starting and operating the lifeboat engine;

9.5.7 operation of davits used for launching liferafts (if fitted);

9.5.8 a mock search and rescue of embarked persons trapped; and

9.5.9 instruction in the use of radio life-saving appliances.

10 Procedures shall be provided to ensure that every embarked person with assigned Escape, Evacuation and Rescue duties is trained for these duties prior to sailing. Escape, Evacuation and Rescue duties which require assigned personnel shall include but not be limited to:

10.1 Operation of main broadcast system, alarm system and other communication equipment;

10.2 Operation of electrically powered way finding system and emergency lighting;

10.3 Operation and launching of evacuation and rescue equipment (including retraction of stabiliser wings when necessary);

10.4 Rescue operations;

10.5 Operating the engine of survival craft and carrying out minor adjustments (at least two persons for every motorized survival craft);

10.6 Distress and safety radio communication;

10.7 Use of stretchers;

10.8 Mustering and assisting persons who are not familiar with the Escape, Evacuation and Rescue measures during Escape, Evacuation and Rescue activities.

11 Procedures shall be provided to ensure that every embarked person is given training at intervals of not more than two months, which shall include but not necessarily be limited to:

11.1 Location, operation and use of the vessels' personal life saving equipment;

11.2 Location of the muster stations (if provided) and evacuation stations;

11.3 Problems of sea survival in particular cold shock, hypothermia, first-aid treatment for hypothermia and other appropriate first-aid procedures.

12 Additional procedures shall be provided to ensure that, every embarked person with assigned Escape, Evacuation and Rescue duties is given training at intervals of not more than two months, which shall include:

12.1 Training in performing their assigned Escape, Evacuation and Rescue duties;

12.2 Special instructions necessary for use of the vessel's evacuation and rescue equipment in severe weather and severe sea conditions.

13 For Emergency Escape Breathing Devices, procedures shall be provided to ensure:

13.1 Embarked persons are trained to immediately don an Emergency Escape Breathing Device prior to exiting a space when the atmosphere becomes life threatening. Such training should be accomplished by scheduling routine escape drills.

13.2 Embarked persons are trained in the use of Emergency Escape Breathing Devices and more specifically that they are provided solely for escape purposes. They are not to be used for heavy duty use such as fire-fighting, rescue or repair work. Additionally, they are not to be used for entering oxygen deficient voids or tanks. Emergency Escape Breathing Devices may be carried by fire-fighting crew for the purpose of providing the device to other embarked persons in need of emergency assistance.

13.3 All Emergency Escape Breathing Device training units are clearly marked “FOR TRAINING PURPOSES ONLY”.

14 For rescue craft onboard a ship in-service, procedures shall be provided to ensure that:

14.1 Rescue craft crew are trained and drilled regularly in the use of the rescue craft where fitted. This training shall include all aspects of rescue, handling, manoeuvring, operating these craft in various conditions, and righting them after capsize. This training may partly take place in special training facilities;

14.2 As far as is reasonable and practicable, rescue craft other than lifeboats which are also rescue craft, are launched each month with their assigned crew on board and manoeuvred in the water. In all cases this requirement shall be complied with at least once every three months;

14.3 If rescue craft launching drills are carried out with the ship making headway, such drills shall, because of the dangers involved, be practised in sheltered waters only and under the supervision of an officer experienced in such drills. Refer to IMO Resolution A.624(15) “Guidelines on training for the purpose of launching lifeboats and rescue boats from ships making headway through the water”

15 For survival craft onboard a ship in-service, procedures shall be provided to ensure that:

15.1 Vessels fitted with lifeboats launch each lifeboat with its assigned operating crew on board and manoeuvred in the water at least once every three months during Escape, Evacuation and Rescue training;

15.2 Lowering into the water, rather than launching of a lifeboat arranged for free-fall launching, is acceptable where free-fall launching is impracticable provided the lifeboat is free-fall launched with its assigned operating crew aboard and manoeuvred in the water at least once every six months. However, in cases where it is impracticable, the Naval Administration may extend this period to 12 months provided that arrangements are made for simulated launching which will take place at intervals of not more than six months.

15.3 If lifeboat or marshalling craft launching drills are carried out with the ship making headway, such drills shall, because of the dangers involved, be practised in sheltered waters only and under the supervision of an officer experienced in such drills. Refer to IMO Resolution A.624(15) “Guidelines on training for the purpose of launching lifeboats and rescue boats from ships making headway through the water”

16 For MES onboard a ship in-service, the following applies:

16.1 Every vessel fitted with a MES shall be provided with on board training aids in the use of the system;

16.2 Training procedures shall include exercising of the procedures required for the deployment of such a system up to the point immediately preceding actual deployment of the system. This aspect of drills shall be augmented by regular instruction using the on-board training aids;

16.3 Additional procedures shall be provided to ensure that every MES party member is trained in the full deployment of a similar system into water, either on board a vessel or ashore, at intervals of not longer than three years.

17 For davit-launched liferafts onboard a ship in-service, procedures shall be provided to ensure that:

17.1 On board training in the use of davit launched liferafts takes place at intervals of not more than four months. Whenever practicable this shall include the inflation and lowering of a liferaft. This liferaft may be a special liferaft intended for training purposes only, which is not part of the ship’s Escape, Evacuation and Rescue equipment; such a special liferaft shall be conspicuously marked.

Regulation 8 Provision of Operational Information

Functional Objective

1 On board documentation shall provide information for the conduct of effective Escape, Evacuation and Rescue activities.

Performance Requirements

2 On board information shall:

2.1 Cover information necessary for embarked persons to conduct Escape, Evacuation and Rescue related activities.

2.2 Be clear and understandable.

2.3 Be readily found and shall be available at locations where they might be needed.

Solutions

3 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

4 On board information relating to any Escape, Evacuation and Rescue measure shall cover adequate information and be sited at locations to facilitate Escape, Evacuation and Rescue evolutions, and shall be easily understood by embarked personnel. The information shall include:

4.1 General description of all Escape, Evacuation and Rescue measures;

4.2 Operational instructions of all Escape, Evacuation and Rescue measures;

4.3 On board training in all steps of the Escape, Evacuation and Rescue process;

4.4 On board inspection and maintenance of all Escape, Evacuation and Rescue measures.

5 Posters or signs shall be provided on conspicuous spaces on or near each Escape, Evacuation and Rescue equipment and shall:

5.1 Illustrate the purpose of controls and procedures for operating the appliance with relevant instructions or warnings;

5.2 Be easily seen under emergency lighting conditions; and

5.3 Be in accordance with IMO Resolution A.760(18) "Symbols Related to Lifesaving Appliances and Arrangements" as amended by IMO MSC.82(70).

6 Escape, Evacuation and Rescue plans shall be provided throughout the vessel, in conspicuous positions. They shall indicate the Escape, Evacuation and Rescue arrangements and equipment including, but not limited to, escape routes and exits, Emergency Escape Breathing Devices, muster stations (if provided), launching stations, survival craft, evacuation stations, boarding systems, life-jackets, personal thermal protection suits and rescue equipment.

7 Strategic positions, such as the operations room, bridge, machinery control-room, engine room, damage control stations, shall in addition to Escape, Evacuation and Rescue plans, be provided with:

7.1 Plans indicating arrangements and operating positions of Escape, Evacuation and Rescue lighting system, Escape, Evacuation and Rescue power supply system, general emergency alarm system, any electrically powered way finding system, main broadcast system and other Escape, Evacuation and Rescue communication systems;

7.2 Guidance on priorities between Escape, Evacuation and Rescue activities and damage control or fire-fighting;

7.3 Muster lists.

8 All accommodation spaces and muster stations (if provided) shall be provided with illustrations and instructions in appropriate languages to inform embarked persons:

8.1 Of the 'You are here' position, the escape routes and the location of muster stations (if provided) and evacuation stations. The plan on which this information is provided shall be prominently displayed and shall be properly oriented in relation to its position on the vessel;

8.2 Of the method of donning personal thermal protection suits and life-jackets;

8.3 Of the essential actions to be taken in an emergency.

9 An Escape, Evacuation and Rescue training manual shall be provided in each crew mess room, containing instructions and information, in easily understood terms illustrated wherever possible, on the Escape, Evacuation and Rescue measures provided in the ship and on the best methods of survival. Any part of such information may be provided in the form of audio-visual aids in lieu of the manual. The following shall be explained in detail:

9.1 Donning of lifejackets and personal thermal protection suits;

9.2 Muster at the assigned stations;

9.3 Boarding, launching and clearing the survival craft including, where applicable, use of MES;

9.4 Method of launching from within the survival craft, where appropriate;

9.5 Release from launching appliances, where appropriate;

9.6 Methods and use of devices for protection in launching areas, where appropriate;

9.7 Illumination in launching areas;

9.8 Use of all survival equipment;

9.9 Use of all detection equipment;

9.10 With the assistance of illustrations, the use of Escape, Evacuation and Rescue communication equipment;

9.11 Use of drogues;

9.12 Use of engine and accessories;

9.13 Recovery of survival craft including stowage and securing;

9.14 Hazards of exposure and the need for warm clothing;

9.15 Best use of the survival craft facilities in order to survive;

9.16 Methods of retrieval, including the use of helicopter rescue gear (slings, baskets, stretchers), breeches-buoy and shore life saving apparatus and ship's line-throwing apparatus;

9.17 All other functions covered in the emergency instructions;

9.18 Instructions for emergency repair of the life-saving appliances.

Regulation 9 Escape, Evacuation and Rescue Equipment Stowages

Functional Objective

1 Escape, Evacuation and Rescue equipment stowages shall protect any on board Escape, Evacuation and Rescue equipment and ensure any on board Escape, Evacuation and Rescue equipment is readily available.

Performance Requirements

2 If applicable, the Escape, Evacuation and Rescue equipment stowages shall protect the stowed equipment as far as possible from:

2.1 External environmental factors such as wash, green water, sea state, icing or wind;

2.2 Vessel's weapon or sensor systems and aircraft down wash or jet blast;

2.3 Fire, smoke or hazardous vapours.

3 Equipment stowages shall:

3.1 Enable stored equipment to be accessible and readily deployed;

3.2 Be robust and have minimum susceptibility to damage;

3.3 Be readily found and unambiguously recognised;

3.4 Allow inspection of the stored equipment;

3.5 Not have a detrimental effect on the stored equipment;

3.6 Not have a detrimental impact on the ready deployment of any other stored equipment in case of an emergency;

3.7 Be free from undue hazards, such as protrusions or obstructions which could cause injury or ensnare clothing, life-jackets or personal thermal protection suits.

3.8 Be able to withstand vessels seakeeping accelerations.

4 Stowages of inflatable survival craft, personal thermal protection suits, life-jackets, life buoys and other external stored equipment shall enable the equipment to float free.

Solutions

5 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

General Stowages

6 Unless expressly provided otherwise in this Code, Escape, Evacuation and Rescue stowages shall comply with the requirements of the LSA Code.

7 Compliance with the performance requirements, other than that for float-free stowages, shall be verified by a risk assessment in combination with demonstrations.

8 Containers, brackets, racks and other similar stowage locations for Escape, Evacuation and Rescue equipment shall be marked with symbols in accordance with the recommendations of the Naval Administration or in accordance with IMO Resolution A.760(18) “Symbols related to life-saving appliances and arrangements” as amended by IMO MSC.82(70). The symbols shall indicate the devices stowed in that location for that purpose. If more than one device is stowed in that location, the number of devices shall also be indicated.

9 Access space shall be arranged around the equipment stowages for inspection and maintenance, training and operating in an emergency.

10 As far as practicable, stowages shall not be located adjacent to any areas of fire or explosion hazard and shall be made of fire retardant material tested to IMO MSC/Circ.1006 Guidelines on Fire Test Procedures for Acceptance of Fire-Retardant Materials for the Construction of Lifeboats or other standard agreed by the Naval Administration.

External Stowages

11 External stowages shall protect the stored equipment for negative effects in performance due to extremes of temperature, humidity and salt water which might be experienced in the declared areas of operation. Combinations of materials, finishes and processes must be carefully chosen to reduce the possibility of problems with corrosion. External stowages shall be rot-proofed and able to withstand sunlight (including ultra-violet), salt water, oil and fungal attack without degradation of performance.

12 External stowages shall remain capable of release and fulfilling their function with the anticipated levels of ice for the prescribed areas of operation.

13 As far as practicable, external stowages shall be located in a secure and sheltered position, in particular:

13.1 Be protected from damage by heavy seas, fire and explosion;

13.2 Be located away from magazines and/or weapon systems, in particular ready use magazines on the upper deck;

13.3 Be located away from aircraft or helicopter operating areas, to minimize the effect of air blast, heat and damage from flying operations and/or accidents, or be protected from the risks associated with flying operations and/or accidents.

14 As far as is practicable, external stowages shall be distributed in the longitudinal direction so as to reduce susceptibility to damage.

Float-free Stowages

15 Stowages of inflatable survival craft shall have float-free arrangements which shall meet LSA Code Paragraph 4.1.6 “Float-free arrangements for liferafts”.

16 Float-free stowages shall be positioned so that the stored equipment will float unobstructed when released hydrostatically. Great care shall be taken to ensure that they cannot snag up on superstructure, out-rigging wires, cables, aerials or float into openings in the vessel that could trap any evacuation or rescue equipment if the vessel was sinking.

17 Stacking of multiple units of float-free stowages is only permitted when it is assured that float-free functionality is not compromised.

18 Any arrangements placed to cover any float free stowages, i.e. for signature reduction, shall have similar float free functionalities.

Survival Craft

19 Each survival craft shall be stowed:

19.1 Taking into account the escape provisions, the size of the vessel and the weather conditions likely to be encountered in its intended area of operation;

19.2 So that neither the survival craft nor its stowage arrangements will interfere with the operation of any other escape or evacuation equipment at any other station;

19.3 As near the water surface as is safe and practicable and, in the case of a survival craft other than a liferaft intended for throw over board launching, in such a position that the survival craft in the embarkation position is not less than 2 metres above the waterline with the ship in the fully loaded condition under anticipated list or trim for damaged conditions, or to the angle at which the vessel’s weather deck edge becomes submerged, whichever is less;

19.4 In a state of continuous readiness so that two crew members can carry out preparations for embarkation and launching in less than 5 min;

19.5 Fully equipped as required by this Chapter and the LSA Code.

19.6 Such that it is protected from damage by fire and explosion. In particular, survival craft on tankers, other than those required by Regulation 24 Survival Craft, shall not be stowed on or above a tank containing explosive or hazardous cargoes.

20 For lifeboats the following applies:

20.1 Lifeboats for lowering down the vessel’s side shall be stowed as far forward of the propeller as practicable;

20.2 Lifeboats shall be stowed attached to launching equipment.

21 For liferaft, the following applies:

21.1 Every liferaft shall be stowed with its painter permanently attached to the vessel;

21.2 Each liferaft or group of liferafts shall be stowed with a float-free arrangement complying with the requirements of Paragraph 4.1.6 “Float-free arrangements for liferafts” of the LSA Code so that each floats free and, if inflatable, inflates automatically when the ship sinks.

21.3 Liferafts shall be so stowed as to permit manual release of one raft or container at a time from their securing arrangements.

21.4 Paragraphs 21.1 to 21.3 above do not apply to liferafts required by Regulation 24 Survival Craft, paragraph 6.3.

22 Davit-launched liferafts shall be stowed within reach of the lifting hooks, unless some means of transfer is provided which is not rendered inoperable within the anticipated list or trim for damaged conditions or by ship motion or power failure.

23 As far as practicable, life rafts intended for throw-overboard launching shall be stowed as to be readily transferable for launching on either side of the vessel.

Rescue craft

24 Rescue craft shall be stowed:

24.1 In a state of continuous readiness for launching in not more than 5 min;

24.2 In a position suitable for launching and recovery;

24.3 So that neither the rescue craft nor its stowage arrangements will interfere with the operation for any escape or evacuation equipment in any other station;

24.4 If it is also a survival craft, in compliance with the requirements of survival craft.

MES

25 Each MES shall be stowed so that neither the passage nor platform nor its stowage or operational arrangements will interfere with the operation of any escape or evacuation equipment at any other launching station.

Life-Jackets

26 To avoid damage and the possibility of premature inflation of automatically inflatable life-jackets, the stowage shall be a compartment or store of appropriate size and properly ventilated. Space shall be left between the life-jackets for air to circulate.

Personal Thermal Protection Suits

27 Stowages close to the vessel's side shall be avoided. If impracticable they shall be fitted with a vertical bar outboard to prevent the containers rolling overboard should the container be opened on a damaged vessel with heel.

Regulation 10 General Emergency Alarm System

Functional Objective

1 A General Emergency Alarm System shall enable the notification of all embarked persons in a timely manner that an emergency situation exists.

Performance Requirements

2 The general emergency alarm shall:

2.1 Be clearly noticeable by all embarked persons;

2.2 Be easily distinguishable and recognisable;

2.3 Be continuously available;

2.4 Be protected from hazards such as fire, vibration, electrical interference, flooding;

2.5 Be provided such that any incident which may cause alarm failure shall be guarded against by system or equipment redundancy;

2.6 Be operable from strategic Escape, Evacuation and Rescue positions.

Solutions

3 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

4 Unless provided otherwise in this Code, the general emergency alarm shall comply with:

4.1 LSA Code Paragraph 7.2.1 "General emergency alarm system";

4.2 IMO Resolution A.830(19) "Code on alarms and indicators", 1995;

4.3 IMO MSC/Circ.808: "Recommendation on performance standards for public address systems on passenger ships, including cabling", Paragraph 3.

5 A demonstration shall be used to verify whether the general emergency alarm is easily distinguishable from other signals on board.

6 The general emergency alarm system shall be clearly audible across the upper deck and within every compartment with all doors and accesses closed unless, specifically stated otherwise by the Naval Administration. In compartments where audible alarm may, on occasions, not comply with audibility levels, an additional visual alarm system shall be installed which cannot be confused with other indications and should be consistent throughout the vessel. A trial shall demonstrate that the general emergency alarm is clearly audible and/or visible.

7 When the general emergency alarm system is integrated within another system, such as entertainment systems, the alarm system shall have automatic priority over any other system input, so that all alarms will be broadcast even if any loudspeaker in the spaces concerned has been switched off or its volume has been turned down.

8 A number of operating positions shall be available for the general emergency alarm system. As a minimum this shall include the bridge, operations room and the main damage control headquarters. The operating positions shall be such that at sea:

8.1 At least one operating position is continuously manned;

8.2 During periods of increased risk, at least two of these positions are continuously manned (e.g. RAS, constricted navigational situations).

9 The power supply to the general emergency alarm shall comply with the requirements of Regulation 14 Power Supply to Escape, Evacuation and Rescue Systems.

10 A FMEA shall be approved by the Naval Administration showing any incident that may cause alarm failure is guarded against by system or equipment redundancy.

11 Communication equipment located or used in areas where flammable gases may be present shall be certified intrinsically safe.

Regulation 11 Main Broadcast System

Functional Objective

1 A main broadcast system shall enable verbal communication to embarked persons of an emergency incident and the actions to be taken.

Performance Requirements

2 Refer to the requirements of Chapter VIII: Regulation 7 Main Broadcast System.

Regulation 12 On board Two-Way Communication

Functional Objective

1 On board two-way communication systems shall enable effective two-way communication between crew members to support Escape, Evacuation and Rescue activities.

Performance Requirements

2 Refer to the requirements of Chapter VIII: Regulation 6 Internal Communications and Regulation 8 Portable Communications.

Regulation 13 External Communication Equipment

Functional Objective

1 External communication equipment shall enable communication to other ships or to shore during emergencies.

Performance Requirements

2 Refer to the requirements of Chapter VIII, in particular Regulation 2 GMDSS Equipment and Regulation 9 Survival Craft Radio Equipment.

Regulation 14 Power Supply to Escape, Evacuation and Rescue Systems

Functional Objective

1 The power supply to Escape, Evacuation and Rescue systems shall provide all sufficient power necessary to conduct any (combination of) Escape, Evacuation and Rescue activities during an emergency.

Performance Requirements

2 Power supply to Escape, Evacuation and Rescue systems shall:

2.1 Have sufficient capacity to simultaneously operate any combination of Escape, Evacuation and Rescue equipment with any other essential consumers;

2.2 Operate for a period as necessary to complete all Escape, Evacuation and Rescue activities;

2.3 Be provided such that any incident which may cause power supply failure shall be guarded against by system or equipment redundancy, so that Escape, Evacuation and Rescue systems identified at Paragraph 4 below will be powered continuously;

2.4 Have minimised susceptibility to damage.

Solutions

3 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

4 The power supply to the following Escape, Evacuation and Rescue systems shall fulfil the requirements of Chapter IV Engineering Systems:

4.1 Main broadcast system;

4.2 General emergency alarm system;

4.3 Internal communication system;

4.4 Escape, Evacuation and Rescue lighting system;

4.5 Radio communication equipment, for which the reserve source of power is to be independent of the ships electrical system;

4.6 Electrically powered way finding systems;

4.7 Electrically powered operated doors;

4.8 Additional systems as deemed necessary by the Naval Administration.

5 Failure of any power supply to any of the above systems shall operate an audible and visual alarm.

Regulation 15 Lighting During Escape, Evacuation and Rescue Emergencies

Functional Objective

1 Lighting systems shall provide sufficient illumination to conduct any Escape, Evacuation and Rescue activity during an emergency.

Performance Requirements

2 Escape, Evacuation and Rescue lighting systems shall:

2.1 Provide sufficient illumination to any location essential for any Escape, Evacuation and Rescue activity;

2.2 Operate for a period as necessary to complete all Escape, Evacuation and Rescue activities;

2.3 Be provided such that any incident which may cause lighting failure shall be guarded against by system or equipment redundancy;

2.4 Have minimised susceptibility to damage.

Solutions

3 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

4 The following locations shall be served by emergency lighting:

4.1 All primary and secondary escape routes giving access to the muster stations (if provided) and evacuation stations;

4.2 All muster stations (if provided);

4.3 All launching stations, including survival craft, its launching appliances, and the area of water into which it is to be launched;

4.4 All evacuation stations, both at the station as at the survival craft in the water;

4.5 Machinery spaces and workshops so that embarked persons do not come into contact with moving machinery;

4.6 Exits from galleys and associated areas to define clearly the nearest escape route, avoiding hot equipment;

4.7 Additional locations as deemed necessary by the Naval Administration.

5 An extra means of illumination shall be provided in passageways and normally occupied compartments for a period of at least four hours for the event of a failure of all main and emergency lighting. The provision of lanterns that operate automatically from a self contained power source on failure of the main and emergency lighting systems is the minimum acceptable arrangement.

6 Escape, Evacuation and Rescue emergency lights shall be switched on automatically in the case of emergency or power failure, except for lights that may be seen from any location outside the vessel. It shall be possible to manually switch on such lights locally and from the bridge. The switches shall be clearly marked and readily recognized.

7 A FMEA shall be approved by the Naval Administration showing any incident that may cause emergency lighting failure is guarded against by system or equipment redundancy.

8 A lighting trial shall demonstrate, to the satisfaction of Naval Administration, that minimum illumination levels are met and that the position of fittings is satisfactory for each Escape, Evacuation and Rescue task that is to be undertaken in each individual compartment.

Regulation 16 Escape Routes and Escape Exits

Functional Objective

1 Escape routes and escape exits shall enable the movement of embarked persons from any compartment within the ship to the muster stations (if provided) and evacuation stations as quickly and as safely as reasonably practicable.

Performance Requirements

2 Escape routes and escape exits shall:

2.1 Be provided from any compartment within the vessel and shall lead to the muster stations (if provided) or evacuation stations.

2.2 Be as direct as reasonably practicable;

2.3 Be as flexible as reasonably practicable to provide for the possibility that certain escape routes may not be available as a result of fire, flooding or other damage;

2.4 Remain functional as long as reasonably practicable during fire, flooding, list and trim;

2.5 Be arranged such that they do not contribute to the spread of fire, flood, smoke or other toxic gases to any muster, evacuation or launching station;

2.6 Allow for safe and easy movement of embarked persons, taking into account:

2.6.1 the anticipated number, physical characteristics and distribution of embarked persons, including the possibility that some injured personnel may be transported by stretchers;

2.6.2 the size, location, function and risks of individual compartments on board;

2.6.3 the clothing and personal protective equipment that may be worn or carried (e.g. fire fighting outfits, Emergency Escape Breathing Devices, life-jackets or personal thermal protection suits).

Solutions

3 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

4 Unless expressly provided otherwise in this Regulation:

4.1 At least two means of escape shall be provided from all compartments or group of compartments to the muster stations (if provided) and evacuation stations, as widely separated as possible;

4.2 A corridor, lobby, or part of a corridor from which there is only one route of escape shall be prohibited.

4.3 At least one means of escape from each main vertical zone, watertight compartments or similarly restricted space or group of spaces shall provide vertical escape. The Naval Administration may under Chapter III Regulation 2 exceptionally allow passage through the main subdivision compartment below the submergence limit. In such cases at least one of the means of escape shall be independent of openings in watertight bulkheads forming the boundaries of main subdivision compartments;

4.4 Lifts are not to be considered as forming one of the means of escape.

4.5 Where enclosed spaces adjoin an open deck, openings from the enclosed space to the open deck shall, where practicable, be capable of being used as an emergency exit.

5 The Naval Administration may dispense with one of the means of escape for:

5.1 Compartments other than machinery and steering gear spaces with a travel distance lower than 7 m;

5.2 Machinery spaces with a travel distance lower than 5 m;

5.3 Steering gear spaces with a travel distance lower than 7 metres and with direct access to the open deck;

5.4 Dead-end passageways with a travel distance lower than 7 m;

5.5 Dead-end corridors used in service areas which are necessary for the practical utility of the vessel, such as oil fuel stations and athwartship supply corridors, shall be permitted, provided such dead-end corridors are separated from any accommodation area and are entered only occasionally. Also, a part of a corridor that has a depth not exceeding its width is considered a recess or local extension and is permitted.

6 When a single means of escape is accepted, the following applies:

6.1 The single means of escape shall comply with the requirements of a primary escape route;

6.2 The single means of escape shall be independent of openings in watertight bulkheads forming the boundaries of main subdivision compartments;

6.3 Fire detection systems complying with the requirements of Chapter VI Fire Safety shall be provided to give early warning of a fire emergency.

7 Within each main vertical fire zone (according to Chapter VI Fire Safety) where more than 50 persons are present at any time, enclosed stairways shall be provided as a primary escape route. These enclosed stairways shall:

7.1 Be free of internal arrangements, equipment or stores which may contain fire risks.

7.2 Only be entered from areas with a low fire risk or by small passageways or airlocks which separate the enclosed stairway from high fire risk areas (e.g. galleys, laundries or machinery spaces). These passageways or airlocks shall have a minimum deck area of 4.5 m^2, a width of no less than 900 mm.

8 For all escape routes, the following applies:

8.1 Escape routes shall be demonstrated to be sufficiently effective by an Escape and Evacuation Analysis and an Escape and Evacuation Demonstration (see Regulation 3 Escape and Evacuation Analysis and Demonstration).

8.2 Escapes route shall have fire integrity according to Chapter VI Fire Safety.

8.3 Fixtures and fittings along escape routes shall comply with Regulation 17 Fixtures and Fittings on Escape Routes.

8.4 Consideration shall be given to ease of escape under adverse conditions, i.e. in a darkened smoke filled atmosphere, under the anticipated list or trim for damaged conditions, or the presence of stretcher bound embarked persons etc.

8.5 Unless specifically stated otherwise by the Naval Administration, all items and equipment along escape routes shall be secured in place to prevent shifting if the ship rolls or lists. Floor coverings shall also be secured in place.

8.6 Primary escape routes ending in deck areas where vehicles or stores are manoeuvred or stored (e.g. hangars, vehicle decks, flight decks, stores) shall, as far as practicable, be protected from obstruction. When protection cannot be provided, the secondary escape route shall avoid direct access to this. Parking arrangements for vehicles on board shall maintain escape routes clear at all times.

8.7 There shall be no protrusions or obstructions in escape routes which could cause injury or ensnare clothing, life-jackets or personal thermal protection suits. Machinery, piping, operating rods, brackets, trolley tracks, and other items that restrict passage or are a source of danger to embarked persons shall be kept clear of escape routes. Where such installations cannot be avoided, guards or protective padding shall be provided.

8.8 Wherever possible stiffeners, including swedges, shall be fitted on the reverse side of bulkheads forming main passageways. Where this is impossible, then the declared design clear widths shall be maintained. Also, where it is essential to site items of equipment along escape routes, the declared design clear widths shall be maintained in way of this equipment.

8.9 There shall not be any doors, hatches or similar along any escape route that require keys, codes or similar security to unlock them when moving in the direction of escape.

9 Additionally, for internal escape routes, the following applies:

9.1 Emergency Escape Breathing Devices shall be provided to protect embarked persons from smoke and hazardous vapours during escape, as required by Regulation 20 Emergency Escape Breathing Devices.

10 Additionally, for external escape routes, the following applies:

10.1 Protection shall be offered from green water;

10.2 Slip free surface shall be provided along the entire external escape route.

11 Additionally, for primary escape routes, the following applies:

11.1 The primary escape route shall be readily accessible and shall allow for the passage of stretchers. Primary escape routes shall provide a continuous fire shelter from the level of its origin to the evacuation station. The internal and external primary escape routes shall comply with the requirements of Chapter VI Fire Safety.

11.2 Primary escape routes via high risk compartments (e.g. machinery spaces, High Voltage compartments, hangars, vehicle decks), shall, as far as practicable, be avoided. When such escape routes are accepted, a secondary escape route shall be provided which does not lead through that compartment.

11.3 It shall not be necessary to cross from one side of the vessel to the other to follow a primary escape route.

11.4 The primary escape route from cabins and mess decks shall be as direct as possible, with a minimum number of changes in direction.

11.5 The minimum clear width of stairways, ladders and passageways of primary escape routes shall not be less than 700 mm and shall not be inferior to those determined by the calculation method provided within the FSS Code Paragraphs 2.1.2 and 2.3 or as proved necessary by Escape and Evacuation Analysis (Regulation 3 Escape and Evacuation Analysis and Demonstration).

Note: Passageway width should be sufficient to enable stretcher movement.

11.6 A minimum clear height of 2000 mm shall be provided along primary escape routes.

11.7 Hazards such as hatches sited at or adjacent to the foot of a stairway, ladder or door shall be avoided on primary escape routes.

11.8 For vessels with spaces that are not normally subdivided in any way and extend to either a substantial length or the entire length of the vessel, the lowest 0.5 metres of bulkheads and other partitions forming vertical divisions along primary escape routes shall be able to sustain a load of 750 N/m^2 to allow them to be used as walking surfaces from the side of the escape route with the vessel at large angles of heel.

12 Additionally, for secondary escape routes, the following applies:

12.1 The secondary escape route shall, as far as practicable, provide an escape performance equivalent to the primary.

12.2 The secondary escape route shall, wherever practicable, lead to a different compartment or passageway from the primary escape route. Where possible this compartment shall also be independent of ventilation serving the primary escape route.

13 For local means of escape, the following applies:

13.1 Compartments normally occupied shall not require keys, codes or similar security to unlock them from inside the room (e.g. secure compartments, stores).

13.2 For machinery spaces which contain internal combustion machinery used for main propulsion, internal combustion machinery used for purposes other than main propulsion where such machinery has in the aggregate a total power output of not less than 375 kW, any oil-fired boiler or oil fuel unit or units with similar fire risks, the two means of escape shall be arranged by:

13.2.1 Two sets of steel (or equivalent fire resistant material) ladders as widely separated as possible leading to doors in the upper part of the space similarly separated and from which a primary or secondary escape route can be accessed. One of these ladders shall be an enclosed escape route that satisfies Chapter VI Fire Safety, from the lower part of the space it serves. Self-closing fire doors of the same fire integrity standards shall be fitted in the enclosure. The ladder shall be fixed in such a way that heat is not transferred into the enclosure through non-insulated fixing points. The enclosure shall have minimum internal dimensions of at least 800 mm x 800 mm, and shall have emergency lighting provisions; or

13.2.2 One steel (or equivalent fire resistant material) ladder leading to an approved fire door in the upper part of the space and, additionally, in the lower part of the space and in a position well separated from the ladder referred to, an approved fire door capable of being operated from each side. The steel (or equivalent fire resistant material) ladder and the approved fire door shall provide access to a primary or secondary escape route.

13.3 Floorplate passageways shall be fitted in machinery compartments to provide platforms and walkways as required so that persons working in these compartments can readily escape. The area of platforms shall be the minimum practicable for the intended purpose and to provide the greatest unimpeded escape.

14 Ships shall be provided with means of embarkation on and disembarkation from ships for use in port and in port related operations, such as gangways and accommodation ladders, in accordance with paragraph 15, unless the Naval Administration deems that compliance with a particular provision is unreasonable or impractical.

Note:

Circumstances where compliance may be deemed unreasonable or impractical may include where the ship:

1. has small freeboards and is provided with boarding ramps; or
2. is engaged in voyages between designated ports where appropriate shore accommodation/embarkation ladders (platforms) are provided.

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15 The means of embarkation and disembarkation required in paragraph 14 shall be constructed and installed based on the guidelines developed by the IMO or an alternative standard acceptable to the Naval Administration.

16 For all ships the means of embarkation and disembarkation shall be inspected and maintained in suitable condition for their intended purpose, taking into account any restrictions related to safe loading. All wires used to support the means of embarkation and disembarkation shall be inspected periodically with special regard for areas passing through sheaves, and renewed when necessary due to deterioration or at intervals of not more than 5 years, whichever is the earlier.

Regulation 17 Fixtures and Fittings on Escape Routes

Functional Objective

1 Fixtures and fittings on escape routes shall facilitate the movement of embarked persons from any space within the ship to the evacuation station as quickly and as safely as reasonably practicable.

Performance Requirements

2 Fixtures and fittings shall:

2.1 Allow for safe and easy movement of embarked persons, taking into account:

2.1.1 the anticipated number, physical characteristics and distribution of embarked persons;

2.1.2 the size, location and function of individual compartments on board;

2.1.3 the clothing and personal protective equipment that may be worn or carried (e.g. fire fighting outfits, Emergency Escape Breathing Devices, life-jackets or personal thermal protection suits).

2.2 Offer a level of protection against fire hazards;

2.3 Be arranged such that they do not contribute to the spread of fire, flood, smoke or other toxic gases to the muster, evacuation or launching stations;

2.4 Be operable in case of normal operations and in case of anticipated level of list or trim for damaged conditions;

2.5 Be operational in case of electrical power failure;

2.6 Be readily identified.

Solutions

3 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

4 All fixtures and fittings on escape routes and of escape exits shall be of steel frame construction, or have equivalent fire resistance to the satisfaction of the Naval Administration.

5 Hatches, doors, stairways, ladders, scuttles and panels shall:

5.1 Be clearly and permanently marked for identification and operation;

5.2 Be capable of being opened rapidly by one person in the direction of escape, whereby the means of operation is obvious, in daylight and in darkness. This shall be demonstrated by an Escape and Evacuation Demonstration (see Regulation 3 Escape and Evacuation Analysis and Demonstration);

5.3 Unless specifically stated otherwise in this Code, open in-way of the direction of escape.

6 Doors and hatches shall be capable of being readily operated from inside and outside the craft.

<u>Handrails and handholds on escape routes</u>

7 Along the primary escape route, both internal and external, handrails or other handholds shall be provided whenever necessary to assist embarked persons to the evacuation station. These handholds shall be suitable when the vessel has developed the anticipated angles of list or trim for damaged conditions. Handrails shall be provided as follows:

7.1 On one side on escape routes with a clear width under 1800 mm and on both sides on escape routes with a clear width of 1800 mm and over.

7.2 For vessels with spaces that are not normally subdivided in any way and extend to either a substantial length or the entire length of the vessel, handrails shall be provided on both sides of longitudinal corridors more than 1.8 metres in width and transverse corridors more than 1 metre in width. Handrails and other handholds shall be of such strength as to withstand a distributed horizontal load of 750 N/m applied in the direction of the centre of the corridor or space, and a distributed vertical load of 750 N/m applied in the downward direction. The two loads need not be applied simultaneously.

<u>Escape doors</u>

8 Doors in primary and secondary escape routes shall, in general, open in-way of the direction of escape, except where the door of a compartment would open into a major escape route, thus impeding the flow of other embarked persons. Doors in vertical emergency escape trunks may open out of the trunk in order to permit the trunk to be used both for escape and for access.

9 Securing arrangements shall be provided to retain doors in the open position. These shall be sufficiently robust to ensure that the door remains secure against heavy sea motions of rolling and pitching and transmitted shock forces.

10 Escape doors with weight in excess of 50 kg shall be fitted with a mechanical means of operation sufficient to ensure that they can be opened or closed against an adverse trim or heel.

11 Non-watertight doors to living and working compartments shall be fitted with kick-out panels.

Escape stairways and ladders

12 The following stairways and ladders shall be fitted for escape purposes and shall serve all hatches and scuttles which are part of primary or secondary escape routes:

12.1 Stairs (including stair ladders) – on primary and secondary escape routes;

12.2 Ladders – on primary and secondary escape routes for crew spaces that are entered only occasionally;

12.3 Flexible emergency ladders – on secondary escape routes only, for crew spaces that are entered only occasionally. The arrangements and location shall be approved by the Naval Administration.

13 As far as practicable, escape stairways and ladders shall be arranged fore and aft and sited clear of through passageways.

14 Escape stairways and ladders shall not exceed 3.5 metres in vertical rise without the provision of a landing. Landings shall also be provided at the top and bottom of each stairway or ladder on the primary escape routes. The area of these spaces shall not be less than 2 m^2, and shall increase by 1 m^2 for every 10 persons anticipated to use that stairway or ladder in excess of 20 persons, but need not exceed 16 m^2.

15 The angle of inclination of stairways should be, in general, 45°, but not greater than 50°, and in machinery spaces and small spaces not more than 60°.

Escape hatches

16 Hatches shall be operable from above and below by one person. This may require spring counterbalance units or escape manholes to be incorporated into larger hatches.

17 Hatches shall be of sufficient size to allow for the passage of persons wearing personal protective equipment.

18 All hatches shall be provided with securing arrangements to retain hatches in the open position. These shall be sufficiently robust to ensure that the hatch remains secure against heavy sea motions of rolling and pitching and transmitted shock forces. Where hatches are adjacent to bulkheads, the cover shall hinge against the bulkhead. The hatch shall be hinged such that the clip can be released or shut without reaching across the opening. The arrangements for securing the hatch in the open position shall be in such a position that it is clearly visible to persons using the hatch.

19 Where practical, hatch covers shall be hinged on the forward or after side.

20 Flush type hatches shall not be installed in decks of wet spaces. Raised hatches or manholes shall be installed only where they do not impose a tripping hazard.

Escape panels or scuttles

21 Where a secondary means of escape is required but cannot otherwise be provided by a door or hatch, an escape panel or scuttle shall be installed.

22 Escape panels shall have a minimum clear opening area of 550 mm x 550 mm and escape scuttles a minimum diameter of 610 mm. Furthermore, they shall allow easy passage of persons wearing personal protective equipment.

23 Escape scuttles shall not be installed in decks at locations which would impede escape in the passageway along that deck.

Regulation 18 Way Finding System

Functional Objective

1 A way-finding system shall allow embarked persons to safely and effectively locate muster stations (if provided) and evacuation stations.

Performance Requirements

2 Way finding systems shall:

2.1 Enable embarked persons to locate escape routes, escape exits, muster stations (if provided) and evacuation stations;

2.2 Be unambiguous and readily found;

2.3 Be operational in case of unavailability of electrical power;

2.4 Be provided taking into account:

2.4.1 the anticipated distribution of embarked persons;

2.4.2 the anticipated familiarity of embarked persons with the vessel.

2.5 Lead from normally occupied compartments to the muster stations (if provided) and evacuation stations.

3 The arrangements of way finding systems shall as far as reasonably practicable take into account hazards such as fire, smoke and flood water.

Solutions

4 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

5 Unless expressly provided otherwise in this Code, way finding systems shall comply with Paragraphs 4 to 8 (excluding 4.5) of IMO Resolution A.752(18) “Guidelines for the evaluation, testing and application of low-location lighting on passenger ships”. Alternatively, the Naval Administration may adopt relevant paragraphs of ISO 15370:2001 “Ships and marine technology – Low-location lighting on passenger ships – Arrangement”.

6 IMO Resolution A.760(18) “Symbols related to lifesaving appliances and arrangements” as amended by IMO Resolution MSC.82(70) may be a guidance document for the signage on board.

7 Escape plans indicating escape routes, muster stations (if provided) and evacuation stations shall be placed according to the requirements of Regulation 8 Provision of Operational Information.

8 Internal and external escape routes and exits shall be clearly and permanently marked. The marking shall enable embarked persons to readily identify the routes of escape and escape exits from normally occupied compartments via the muster station (if provided) until the evacuation station is reached. Markings shall be provided at all points of the escape route, including angles, intersections and exits.

9 All way-finding markings on internal escape routes are to be by photo-luminescent strip indicators placed not more than 300 mm above the deck in order to remain visible in the event of smoke at all points of the escape route including angles, intersections and exits.

10 Additional arrows shall be positioned on internal escape routes:

10.1 At a nominal height of 1500 mm above the deck in order to remain visible in the event of flooding;

10.2 In the centre of passageways adjacent to bulkhead mounted markings in order to remain visible in the event of smoke.

11 Markings shall be placed such that they cannot be obscured by doors or hatches in the open position.

12 For escape routes, which are normally supplied by red light, the effectiveness of the photo-luminescent system shall be demonstrated to the satisfaction of the Naval Administration. If the Photo Luminescent system is not proven to be effective, Photo Luminescent Low Location Lighting shall be enhanced by Electrically Powered Low Location Lighting or Electrically Powered Directional Sound.

13 Where adhesives are used for the Photo Luminescent Low Location Lighting signage and markings, the adhesion shall be suitable for envisaged conditions (e.g. presence of heating in galleys, water within heads and bathrooms) and shall be approved by the Naval Administration.

14 When Electrically Powered Low Location Lighting or Electrically Powered Directional Sound is installed to enhance Photo Luminescent Low Location Lighting, it shall:

14.1 Be provided with an Escape, Evacuation and Rescue power supply as stated in Regulation 14 Power Supply to Escape, Evacuation and Rescue Systems.

14.2 Be capable of being manually activated by a single action from a continuously manned central control station. Additionally it may start automatically in the presence of smoke.

15 Additionally, Electrically Powered Directional Sound shall be approved by the Naval Administration based on compliance with IMO MSC/Circ.1167 ‘Functional Requirements and Performance Standards for the Assessment of Evacuation Guidance Systems’ and IMO MSC/Circ.1168 ‘Interim Guidelines for the Testing, Approval and Maintenance of Evacuation Guidance Systems used as an Alternative to Low-Location Lighting Systems’.

16 The Naval Administration shall ensure that such lighting or photo-luminescent equipment has been evaluated, tested and applied in accordance with the FSS Code.

17 The functionality of each escape way-finding system shall be demonstrated by practical tests to the satisfaction of the Naval Administration.

Regulation 19 Muster Station

Functional Objective

1 Muster stations shall allow assembly of embarked persons in a position of relative safety.

Performance Requirements

2 Muster stations shall:

2.1 Be of sufficient size for the number of persons assigned to it and the anticipated actions undertaken prior to moving to the evacuation station;

2.2 Be readily accessed from normally occupied compartments and provide ease of escape to evacuation stations as far as practicable;

2.3 Reflect the number and anticipated distribution of embarked persons;

2.4 Have redundancy if any primary muster station is unavailable owing to the emergency;

2.5 Provide protection against hazard for persons within (e.g. fire, green water).

Solutions

3 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

4 For vessels carrying a total of more than 50 persons without an assigned task related to safeguarding the vessel's essential safety functions, such as embarked forces or special personnel, muster stations shall be provided. An alternative muster station shall be nominated in event of the main muster station becoming unavailable.

5 The muster station may coincide with the evacuation station, provided there is sufficient room, and the assembly activities can safely take place concurrently with evacuation activities. Otherwise, muster stations shall be arranged, in the vicinity of, and permit ready escape for the assembled persons to the evacuation stations.

6 Each muster station shall have sufficient clear deck space to accommodate all persons assigned to muster at that station, but at least 0.35 m^2 per person.

7 Muster stations shall be positioned to reduce risk from fire, smoke and hazardous vapour and shall have fire integrity characteristics according to Chapter VI Fire Safety.

8 Additionally muster stations shall be operational in case of flooding, taking into account anticipated list or trim for damaged conditions. The muster station shall be positioned above the waterline and contain provision for draining down of water.

9 Muster stations shall be readily and safely accessed from normally occupied compartments and provide ease of escape to evacuation stations as far as practicable. These routes shall have similar characteristics as required for primary escape routes (see Regulation 16 Escape Routes and Escape Exits).

10 It shall be demonstrated, based on an Escape and Evacuation Analysis and an Escape and Evacuation Demonstration following the requirements of Regulation 3 Escape and Evacuation Analysis and Demonstration, that:

10.1 Assigned muster stations can be readily and swiftly accessed from normally occupied compartments, accommodation and work areas;

10.2 Assigned muster stations provide ready and swift escape to evacuation stations;

10.3 The muster stations are sufficiently illuminated by the Escape, Evacuation and Rescue lighting system to be able to marshal and count the persons assigned to the muster station and to don life-jackets;

10.4 The muster station is free from undue hazards, such as protrusions or obstructions which could cause injury or ensnare clothing or life-jackets.

11 The Naval Administration shall approve the following items, based on a risk assessment:

11.1 The muster station and the escape route to the evacuation station provides the maximum protection to the persons located within from:

11.1.1 External influences such as wash or green water;

11.1.2 Vessel's weapon and sensor systems;

11.1.3 Fire, smoke and hazardous vapours;

11.2 The muster station and the escape route to the evacuation station shall not contribute to the spread of fire, flood, smoke or other toxic gases to the evacuation stations;

11.3 The muster station shall be operational in case of flooding, taking into account the anticipated list or trim for damaged conditions;

11.4 The muster station shall be positioned above the waterline and contain provision for draining down of water.

Regulation 20 Emergency Escape Breathing Devices

Functional Objective

1 Emergency escape breathing devices shall provide embarked persons breathing and visual protection against a hazardous atmosphere while escaping to an area of relative safety.

Performance Requirements

2 Emergency escape breathing devices shall:

2.1 Provide breathing and visual protection against smoke and hazardous gases for any crew member;

2.2 Provide protection for the time necessary to escape to a safe haven;

2.3 Be clearly identifiable;

2.4 Be readily available;

2.5 Be provided and located considering:

2.5.1 The number and distribution of embarked persons;

2.5.2 Hazardous compartments;

2.5.3 Escape routes.

2.6 Be easy to don, without assistance;

2.7 Be easily apparent to operate;

2.8 Shall not hinder the person's movement during escape.

Solutions

3 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

4 Unless expressly provided otherwise in this Code, Emergency Escape Breathing Devices shall comply with the FSS Code.

5 The maximum time to escape from any compartment to an area of relative safety shall be verified by an Escape and Evacuation Analysis and an Escape and Evacuation Demonstration (see Regulation 3 Escape and Evacuation Analysis and Demonstration). If it is not reasonable to assume that this time is within 10 minutes, the minimum service duration of the Emergency Escape Breathing Device as stipulated by the FSS Code shall be increased accordingly.

6 The vessel shall carry at least a number of Emergency Escape Breathing Devices equivalent to 150% of the total number of crew members. Additional provision of Emergency Escape Breathing Devices for other embarked persons shall be to the satisfaction of the Naval Administration.

7 The distribution of Emergency Escape Breathing Devices on board shall be approved by the Naval Administration. As a minimum, Emergency Escape Breathing Devices shall be provided along each primary escape route, adjacent to normally occupied compartments. Furthermore, the distribution shall reflect:

7.1 Anticipated distribution of embarked persons during sea watch, defence watch and action stations;

7.2 Risks of fire, smoke and hazardous gases throughout the vessel;

7.3 Risk of entrapment (e.g. main machinery spaces);

8 Emergency Escape Breathing Devices shall be situated ready for use at easily visible and accessible places. Emergency Escape Breathing Devices shall be reached quickly and easily at any time in the event of fire, darkness or smoke filled environment (e.g. closer to the deck than the deckhead).

9 The number and location of the Emergency Escape Breathing Devices shall be indicated in the fire control plan required by Chapter VI Fire Safety.

Regulation 21 Stretchers

Functional Objective

1 Stretchers shall enable embarked persons to transport incapacitated persons during the escape and evacuation process.

Performance Requirements

2 Stretchers shall:

2.1 Enable crew members to transporting any embarked person throughout the vessel, without that person's assistance.

2.2 Be provided and located considering:

2.2.1 The number, distribution and anthropometrical characteristics of embarked persons;

2.2.2 Hazardous compartments;

2.2.3 Escape routes.

Solutions

3 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

4 Naval vessels shall carry at least a number of stretchers equivalent to 5% of the total number of embarked persons.

5 The chosen stretchers shall reflect the physical constraints on board. Consideration should be given to ensuring that the stretchers can be used within the confined spaces of the vessel.

6 The chosen stretchers shall allow the wounded person to be lifted vertically with the stretcher either vertical or horizontal.

Regulation 22 Launching and Embarkation Arrangements

Functional Objective

1 Launching and embarkation arrangements shall:

1.1 enable the transfer of survival craft or rescue boats from stowed positions to the sea surface;

1.2 enable persons to embark survival or rescue craft.

Performance Requirements

2 Launching and embarkation arrangements shall:

2.1 Enable evacuation as safely and swiftly as reasonably practicable;

2.2 Be always capable of safe and efficient operation under normal operating conditions and under the anticipated list or trim for damaged conditions;

2.3 Be easily and unambiguously used;

2.4 Be designed and surveyed according to the intended duty and have a minimum susceptibility to damage;

2.5 Not impose insurmountable dangers to the embarked persons during normal operations, training, maintenance and emergency situations;

2.6 Reflect the physical characteristics of the embarked persons;

2.7 Be provided with consideration for the possibility that certain launching arrangements may not be available as a result of loss due to fire, explosion, flooding, or other hazards;

2.8 Be protected from damage by wash, heavy seas, icing and wind, the vessel's weapon and sensor systems, fire, explosion and hazardous gasses;

2.9 Be free from hazards, such as protrusions or obstructions which could cause injury or ensnare clothing, life-jackets or personal thermal protection suits;

3 Launching stations shall:

3.1 Not be located above the approved launching height of the survival craft, rescue craft or launching equipment;

3.2 Be positioned so that survival and rescue craft can be launched clear of all obstructions under normal and abnormal conditions.

4 Launching equipment shall:

4.1 Be able to function without power supply;

4.2 Where capable of launching lifeboats, also be capable of their recovery.

5 Embarkation stations shall:

5.1 Be of sufficient size to accommodate the maximum number of persons anticipated to embark from each station.

6 Embarkation equipment shall:

6.1 Provide a safe means of transfer of persons into a survival craft;

6.2 Be aimed at dry shod embarkation;

6.3 Be suitable for the hull shape at the embarkation station and the height of the embarkation station above the waterline.

Solutions

7 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the Performance Requirements.

8 Launching and embarkation arrangements shall:

8.1 Be readily and safely accessed from normally occupied compartments and provide ease of escape to embarkation stations as far as practicable, which shall be verified by an Escape and Evacuation Analysis and an Escape and Evacuation Demonstration (Regulation 3 Escape and Evacuation Analysis and Demonstration). These routes shall have similar characteristics as required for primary escape routes (Regulation 16 Escape Routes and Escape Exits);

8.2 Be always capable of safe and efficient operation in conditions of trim of up to 10^{o} and list of up to 20^{o} either way or the worst trim and heel conditions if greater and in all anticipated environmental conditions.

8.3 Not interfere with the prompt preparation, handling and launching of any survival craft at any other station;

8.4 Avoid, where possible, overboard discharges so as to prevent flooding of survival and rescue craft;

8.5 Where there is a danger of survival and rescue craft being damaged by the vessel's stabiliser wings, means shall be available, powered by an emergency source of energy, to bring the stabiliser wings in board; indicators operated by an emergency source of energy shall be available on the navigating bridge to show the position of the stabiliser wings.

8.6 Be positioned to provide clearance from the propeller and overhanging positions of the hull to enable launching down the straight side of the ship with the exception of free-fall boats;

8.7 Be positioned to avoid ship sides openings, projections or discharge points between the embarkation station and the waterline in the lightest seagoing condition;

8.8 Be positioned away from magazines, in particular ready use magazines on the upper deck;

8.9 Have sufficient clear deck space to ensure free passage of persons to it;

8.10 Be so arranged as to enable stretcher cases to be placed in survival craft;

8.11 As minimum have at least one launching station and embarkation station on each side of the vessel and they shall be equally distributed as far as practicable;

8.12 Be provided with handholds, anti-skid treatment of the deck and adequate space which is clear of cleats, bollards and similar fittings;

8.13 For davit launched survival craft, be designed for boarding and launching from a position immediately adjacent to the stowed position or from a position which, in compliance with Regulation 9 Escape, Evacuation and Rescue Equipment Stowages, the survival craft is transferred prior to launching;

8.14 For rescue craft, allow for safe and efficient handling of a stretcher. Foul weather recovery strops shall be provided if heavy fall blocks constitute a danger.

9 The launching and/or embarkation stations shall:

9.1 Have fire integrity characteristics according to Chapter VI Fire Safety.

10 Launching stations shall:

10.1 Be positioned to enable the survival or rescue craft to be launched and lowered to sea level (and recovered where necessary) in full view of its operator at all times.

10.2 Be positioned as close as possible to the muster station (if provided), embarkation station and the stowage position of its survival or rescue craft;

10.3 Be positioned such that the survival or rescue craft can be safely launched in a simple manner and remain secured to the vessel during the embarkation procedure;

10.4 Be positioned abaft the collision bulkhead, in a sheltered position, and if located forward, special consideration shall be given to the strength of the launching equipment;

10.5 Be as near the water surface as is safe and practicable;

10.6 Be arranged to prevent any discharge of fluids onto survival craft during abandonment.

11 Embarkation stations shall:

11.1 For vessels with lifeboats, be such that the lifeboats can be boarded prior to launching.

12 Launching equipment shall:

12.1 Comply with the LSA Code Paragraph 6.1 “Launching and Embarkation appliances”.

12.2 Be able to deliver survival craft from the stowed position to the sea surface and enable boarding from the embarkation station where required.

12.3 Only one type of release mechanism shall be used for similar craft carried on board the vessel.

12.4 For rescue craft:

12.4.1 enable launching the rescue craft, where necessary utilizing painters, with the vessel making headway at speeds up to 5 knots in calm weather;

12.4.2 enable the rescue craft to be boarded and launched directly from the stowed position with the number of persons assigned to crew the rescue craft on board;

12.4.3 ensure that neither the launching nor the recovery time of the rescue craft shall be more than 5 minutes in moderate sea conditions when loaded with its full complement of persons and equipment. If the rescue craft is also a survival craft, this recovery time shall be possible when loaded with its survival craft equipment and the approved rescue craft complement of at least six persons;

12.5 Where falls are used, be long enough for the survival craft to reach the water with the vessel in its lightest seagoing condition, taking into account the anticipated list and trim for damaged conditions.

12.6 Where falls are used, the height of the davit head with the craft in evacuation position, shall, as far as practicable, not exceed 15 metres to the waterline when the vessel is in its lightest seagoing condition.

12.7 Be provided for survival and rescue craft which have a mass of more than 185 kg and for liferafts which cannot be launched directly from the stowed position under the anticipated trim and heel in damaged conditions.

12.8 Where partially enclosed lifeboats are fitted, be provided with a davit span fitted with not less than two lifelines of sufficient length to reach the water with the vessel in its lightest seagoing condition, under unfavourable conditions of list and trim for damaged conditions.

13 Embarkation equipment shall:

13.1 Unless expressly provided otherwise in this Code, boarding equipment shall comply with LSA Code Paragraph 6.1.6 “Embarkation ladders” and Paragraph 6.2 “Marine evacuation systems”.

13.2 As a minimum, the vessel shall carry a climbing net and an embarkation ladder on each side of single length from the deck to the waterline in the lightest seagoing condition under the anticipated list or trim for damaged conditions. The climbing net and embarkation ladder shall be ready for deployment. Along the length of the vessel there shall be a sufficient number of securing points available for attachment of climbing nets and embarkation ladders. These securing points need not be dedicated for use of the climbing nets or embarkation ladders, and may be existing structure serving another purpose.

13.3 When boarding is conducted after launching, means shall be provided for bringing survival craft against the vessel’s side and holding them alongside so that persons can safely embark.

13.4 Additional boarding systems (climbing nets, embarkation ladders or MES) shall be provided for vessels on which evacuation will take place from a height greater than 6 metres. These boarding systems shall be available on both sides of the vessel and be sufficient in number to ensure the maximum times for evacuation as prescribed in Regulation 2 Approval Procedures are not exceeded. In addition they shall be suitable for the hull shape of the location where they are fitted.

Note: The maximum jump height into water is 6 metres, beyond which additional boarding systems are required. The Naval Administration may specify an alternative maximum jump height. Lifejackets used in excess of 4.5 metres should be tested and demonstrated suitable to the required height. The LSA Code specifies a jump height of 4.5 metres for tests of survival craft designed for this purpose (see Regulation 24).

Regulation 23 Not Used

Regulation 24 Survival Craft

Functional Objective

1 Survival craft shall provide a place of relative safety away from the damaged ship following evacuation.

Performance Requirements

2 Survival craft shall:

2.1 Be provided taking into account the number of embarked persons;

2.2 Be able to manoeuvre away from the damaged vessel;

2.3 Protect embarked persons from risks of the damaged vessel;

2.4 Protect embarked persons against the natural environment;

2.5 Provide provisions and habitability during the anticipated rescue time;

2.6 Be designed for minimum motion sickness;

2.7 Allow the survival craft to be readily located under different environmental conditions (e.g. weather, sea state and darkness);

2.8 Be easily boarded from the water.

Solutions

3 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the Performance Requirements.

4 Unless expressly provided otherwise in this Code:

4.1 Survival craft shall comply with LSA Code, Chapter 4 "Survival craft".

4.2 Marshalling craft shall comply with LSA Code, Chapter 5 "Rescue boats", except 5.1.1.6 and 5.1.1.7. Where LSA Code, Chapter 5 the term "rescue boat" is used, it should be read to mean "marshalling craft" for the purpose of this Code.

4.3 Liferafts shall be automatically self-righting or canopied reversible liferafts in accordance with IMO MSC/Circ.809 "Recommendation for Canopied Reversible Liferafts, Automatically Self-righting Liferafts and Fast Rescue Boats, including testing, on Ro-Ro passenger ships".

4.4 A marine evacuation system (MES) complying with LSA Code, Section 6.2 "Marine Evacuation Systems" may be substituted for the equivalent capacity of liferafts and launching equipment as required by this regulation and Regulation 22 Launching and Embarkation Arrangements.

Note: The LSA Code specifies a jump height of 4.5 metres for tests of survival craft. The Naval Administration may require tests with an increased jump height. The maximum jump height into water is 6 metres (see Regulation 22).

5 Equipment to be brought into survival crafts, such as VHF radios and transponders, shall be stored in positions where they can be rapidly placed in any one of the survival crafts. Equipment shall be transported in containers or bags of a watertight and floating type.

6 Naval vessels shall comply with the following requirements:

6.1 Survival craft shall be carried to accommodate not less than 125% of the total number of persons the vessel is certified to carry, subject to a minimum of two such survival craft being carried;

6.2 Additional survival craft shall be carried such in that at least 110% capacity shall remain available in the event that all the survival craft on either side of the vessel's centreline within the longitudinal extent of damage (defined in the Concept of Operations Statement) are considered lost or rendered unserviceable.

Note: Where a longitudinal extent of damage is defined in the Concept of Operations Statement, each damage case is to be examined to determine that the remaining survival craft capacity is at least 110%, assuming that all survival craft on both sides of the ship are lost in the damage section.

6.3 Vessels where the horizontal distance from the extreme end of the stem or stern of the vessel to the nearest end of the closest survival craft is more than 100 metres shall additionally carry a liferaft stowed as far forward or aft, or one as far forward and another as far aft, as is reasonable and practicable. Such liferaft or liferafts may be securely fastened so as to permit manual release and need not be of the type which can be launched from an approved launching device;

6.4 A rescue craft or marshalling craft may be included in the survival craft capacity, providing it complies with the requirements of survival craft.

Note: Naval Administration to define the number of survival craft.

7 So far as practicable, survival craft shall be distributed in such a manner that there is an equal capacity on both sides of the vessel.

8 Survival craft stowages shall have fire integrity characteristics according to Chapter VI Fire Safety. Survival craft stowages shall be readily and safely accessed from normally occupied compartments. These routes shall have similar characteristics as required for primary escape routes (see Regulation 17 Fixtures and Fittings on Escape Routes).

9 Survival craft stowages shall be located as close to evacuation stations as possible.

10 Means shall be available to prevent any discharge of water into survival craft during evacuation.

11 The length of the securing lines and the arrangements of the bowsing lines shall be such so as to maintain the survival craft suitably positioned for evacuation. The securing arrangements for all securing and bowsing lines shall be of sufficient strength to hold the survival craft in position during the evacuation process.

12 For ships equipped with survival craft which are not self-propelled, the following applies:

12.1 The vessel shall carry sufficient marshalling craft to ensure that, in providing for abandonment by the total number of persons the vessel is certified to carry:

12.1.1 Not more than nine survival craft need be marshalled by each marshalling craft; or

12.1.2 If the Naval Administration is satisfied that the marshalling craft are capable of towing a pair of such survival craft simultaneously, not more than twelve survival craft need be marshalled by each marshalling craft; or

12.1.3 If it is demonstrated that the complete evacuation process from launching and boarding until all survival craft are cleared from the damaged vessel, are within the requirements of Regulation 2 Approval Procedures.

12.2 When more than one marshalling craft is fitted, at least one craft shall be fitted on each side of the ship.

12.3 Marshalling craft shall have sufficient mobility and manoeuvrability in a seaway to marshal survival craft and tow the largest survival craft carried on the vessel when loaded with its full complement of persons and equipment or as equivalent at a speed of at least two knots.

Note: A rescue craft can be used as a marshalling craft. Where a marshalling craft, not approved as a rescue craft, is fitted, at least one rescue craft is required in accordance with Regulation 27, paragraphs 4 - 9.

13 All lifeboats on board ships which carry fuel having a flashpoint not exceeding 60°C in accordance with Chapter VI, Regulation 14 shall be fire-protected lifeboats complying with the requirements of Paragraph 4.9 of the LSA Code.

Regulation 25 Life-Jackets

Functional Objective

1 Life-jackets shall provide effective flotation assistance for persons over board.

Performance Requirements

2 A life-jacket shall:

2.1 Turn unconscious drowning persons face-up thereby lifting the mouth above the water and protect the face from waves and sea-spray;

2.2 Be provided to accommodate the full range of physical characteristics of embarked persons;

2.3 Be sufficiently provided relating to the number of embarked persons;

2.4 Be compatible with the personal thermal protection suits or other PPE that embarked persons may be wearing during evacuation;

2.5 Allow the person over board to be readily located under different environmental conditions (e.g. weather, sea state and at all times of day).

Solutions

3 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the Performance Requirements.

4 Unless expressly approved by the Naval Administration, life-jackets shall comply with LSA Code Paragraph 2.2 "Lifejackets".

5 Life-jackets shall incorporate a screen to provide protection from waves and sea-spray to the person overboard.

6 The life-jackets shall not impede entry into the survival craft or interfere with occupant safety or operation of the survival craft. Where a MES is provided, compatibility shall be demonstrated.

7 For special purposes, alternative colours and retro-reflective material arrangements on the life-jackets may be approved by the Naval Administration. The inflated part shall, however, always comply with the colour and retro-reflective material requirements stated in the LSA Code.

8 If a boarding system is not carried for evacuation into life rafts, life-jackets shall be constructed to enable the wearer to jump from the evacuation station into the sea, without injury and without dislodging or damaging the life-jacket.

9 A life-jacket shall be issued individually to every embarked person. Additional life-jackets shall be carried for 10% of the number of embarked persons and stowed in at least two separated, conspicuous, readily accessible places as near as practicable to the evacuation stations.

10 Alternatively, life-jackets shall be stowed in at least two separated, conspicuous, readily accessible clusters as near as practicable to the evacuation stations. The number of life-jackets stored per cluster shall be at least 110% of the total number of persons assigned to the survival craft served by that evacuation station. Clustered life-jackets shall be stowed so that their distribution and donning does not impede any other escape or evacuation activity.

Note: The Naval Administration may require additional lifejackets at each cluster for redundancy.

11 Additionally, a sufficient number of life-jackets shall be carried for persons on watch. The number of the life-jackets carried for this reason shall equal the number of people ordinarily on watch and shall be stowed on the bridge, in the engine control room and at any other manned watch station.

12 The Naval Administration shall approve the number and type of life-jackets:

12.1 For use in amphibious operations and in conjunction with stretchers when transferring patients at sea. When persons are carrying heavy equipment attached to their person, the requirements for the life-jackets may be enhanced by the Naval Administration;

12.2 For embarked persons who are at greater risk of falling over board during normal operations, such as rescue craft crew, replenishment at sea teams, flight crew.

Regulation 26 Personal Thermal Protection Suits

Functional Objective

1 Personal thermal protection suits shall help prevent hypothermia and/or cold shock during Evacuation and Rescue activities.

Performance Requirements

2 Personal thermal protection suits shall:

2.1 Be designed to provide protection from cold shock and hypothermia;

2.2 Maintain life support for the envisaged rescue time;

2.3 Accommodate the full range of physical characteristics of embarked persons;

2.4 Be unpacked and donned easily, swiftly and without assistance;

2.5 Not hinder the person wearing it to conduct evacuation and rescue activities;

2.6 Remain functional during the evacuation and rescue process;

2.7 Not hinder the person wearing it to don a life-jacket, if not combined in the thermal protection suit.

2.8 Not hinder the person wearing it to swim a short distance through the water and board a survival craft.

Solutions

3 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the Performance Requirements.

4 Unless expressly provided otherwise in this Code, personal thermal protection suits shall comply with the LSA Code Paragraphs 2.3 “Immersion suits” and 2.4 “Anti-exposure suits”. Additionally, if a boarding system is not carried for evacuation of the naval vessel, personal thermal protection suits shall be constructed with water proof materials such that following a jump from the evacuation station into the seawater there is no undue ingress of water into the suit.

5 The sizes of the personal thermal protection suits shall accommodate the full range of physical characteristics of the embarked persons.

6 The number and location of immersion suits on board shall be similar to the requirements of life-jackets, unless:

6.1 Entry into the water to board the survival craft is not probable and sufficient protection from the elements is offered by the survival craft, e.g. for survival craft which are boarded prior to launching such as totally enclosed lifeboats, free-fall lifeboats or davit-launched liferafts and for liferafts which are served by an MES or equivalent. However, for liferafts, as a minimum thermal protective aid shall be provided complying with the requirements of LSA Code Paragraphs 2.5. The number and location of these thermal protective aids shall be similar to the requirements of life-jackets.

6.2 The vessel is constantly engaged on voyages in warm climates where, in the opinion of the Naval Administration, immersion suits are unnecessary. Refer to IMO MSC/Circ.1046 “Guidelines for Assessment of Thermal Protection”.

7 If a ship has any watch or work stations located remotely from the places where the personal thermal protection suits are normally stowed, additional immersion suits shall be provided at these locations for the number of persons normally on watch or working at those locations at any time.

8 Additionally, anti-exposure suits shall be provided for every person assigned to crew the rescue craft or assigned to the MES party.

9 Personal thermal protection suit stowages shall be adjacent to muster stations (if provided) or survival craft to permit easy distribution of the suits. Personal thermal protection suits shall be so placed as to be readily accessible and their position shall be plainly indicated.

Regulation 27 Rescue Arrangements

Functional Objective

1 Rescue arrangements shall enable persons to be rescued from the sea, rescue units or survival craft.

Performance Requirements

2 Rescue arrangements shall:

2.1 Permit effective and rapid rescue of persons over board;

2.2 Minimise the risk levels imposed on the rescue crew;

2.3 Be provided taking into account the physical characteristics of embarked persons;

2.4 Permit the mass rescue of persons from another vessel.

Solutions

3 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society’s rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the Performance Requirements.

<u>Rescue Craft Arrangements</u>

4 Unless expressly provided otherwise in this Code, rescue craft shall comply with:

4.1 IMO Resolution A.656(16) “Guidelines for Fast Rescue Boats”; or

4.2 LSA Code Chapter 5 “Rescue boats”; or where applicable

4.3 IMO MSC/Circ.809 “Recommendation for canopied reversible liferafts, automatically self-righting liferafts and fast rescue boats, including testing, on ro-ro passenger ships.”

5 Generally, naval vessels shall carry at least one rescue craft, unless:

5.1 The Naval Administration is satisfied that an adequate standard of safety is attained;

5.2 The naval vessel is sufficiently manoeuvrable, arranged, and equipped to allow the embarked persons to recover a person over board;

5.3 Recovery of a person overboard can be observed from the operating station;

5.4 The vessel does not regularly engage in operations that restrict its manoeuvrability.

6 All rescue craft shall be capable of being launched, where necessary utilising painters, with the ship making headway at speeds up to 5 knots in calm weather.

7 A lifeboat or marshalling craft may be accepted as a rescue craft provided it also complies with the requirements of a rescue boat.

8 A rescue craft shall permit taking an unconscious embarked person without capsizing.

9 The rescue craft shall allow for safe and efficient handling of a stretcher case.

<u>Swimmer of the Watch</u>

10 A rescue station from which the Swimmer of the Watch will operate in the recovery of persons over board shall be provided on each side of the vessel, in a position visible from the bridge or bridge wings. With the following exceptions:

10.1 The vessel is sufficiently manoeuvrable, arranged, and equipped to allow the embarked persons to recover a person over board;

10.2 A vessel with a freeboard greater than 12 metres.

11 Two recovery methods shall be provided at each rescue station, namely:

11.1 One-man lift, in which the wounded person and the swimmer are hoisted on board in turn, using the helicopter strop;

11.2 Two-man lift, (Ashanti rig), which uses a double harness to hoist the wounded person and the swimmer simultaneously.

12 The two-man lift may only be employed in vessels where the gantry/davit arrangements have been tested to a minimum safe working load of 270 kg. NOTE all rigging equipment shall be tested and certificates raised.

13 Stowage for the Swimmer of the Watch equipment shall be provided as follows:

13.1 The Swimmer of the Watch recovery line shall be on a drum, covered and protected from the elements but capable of rapid removal;

13.2 The harness for the Swimmer of the Watch shall be contained in a suitable weatherproofed quick to open bag;

13.3 The helicopter strop shall be stowed such that it is protected from the elements, and readily available.

Mass rescue

14 Each vessel shall be provided with a system for mass rescue, which may coincide with boarding systems, such as:

14.1 A climbing net from which persons can easily embark the naval vessel; or

14.2 A MES, provided the slide is equipped with hand-lines or ladders to aid in climbing up the slide; or

14.3 A device capable of rapidly recovering rescue or survival craft and transferring survivors to the ship.

Line-throwing appliance

15 One line-throwing appliance shall be carried to assist with the recovery of persons over board. The line-throwing appliance shall comply with the requirements of LSA Code Paragraph 7.1 “Line-throwing appliances”.

Lifebuoys

16 The minimum number of lifebuoys carried by a naval vessel shall be 2 for every 20 metres of vessel length or part thereof, with a minimum of 8. Lifebuoys shall comply with the requirements of LSA Code Paragraph 2.1.1 “Lifebuoy specification”.

17 Self-igniting lights for lifebuoys on vessels carrying cargos with high fire risks, such as replenishment vessels, shall be of an electric battery type.

18 The positioning and securing arrangements of the self-activating light and smoke signals shall be such that they cannot be released or activated solely by the accelerations produced by collisions or groundings.

19 Lifebuoys shall be so distributed as to be readily available on both sides of the ship and as far as practicable on all open decks extending to the vessel’s side; at least one shall be placed in the vicinity of the stern.

20 All lifebuoys shall be mounted in such a position that they can be released rapidly from their stowage to fall unobstructed into the sea, or easily cast into the sea to give a seamark by day or night. They shall not be permanently secured in any way.

21 At least one lifebuoy on each side of the vessel shall be fitted with buoyant lines of length not less than twice the height at which it is stowed above the waterline in the lightest seagoing condition, or 30 metres, whichever is the greater and comply with the requirements of LSA Code Paragraph 2.1.4 “Buoyant lifelines”.

22 Not less than half of the total number of lifebuoys shall be provided with lifebuoy self-igniting lights complying with the requirements of LSA Code Paragraphs 2.1.2 (Lifebuoy self-igniting lights) with a minimum of 6; not less than two of these shall also be provided with lifebuoy self-activating smoke signals complying with the requirements of LSA Code 2.1.3 (Lifebuoy self-activating smoke signals) and be capable of quick release from the navigation bridge; lifebuoys with lights and those with lights and smoke signals shall be equally distributed on both sides of the vessel and shall not be the lifebuoys provided with lifelines.

23 Each lifebuoy shall be marked in block capitals of the Roman alphabet with the name of the ship.

24 If a remote control release system is provided, it must be capable of manual override in case of power failure and without resorting to the use of any tools or equipment to effect release of lifebuoy.

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CHAPTER VIII COMMUNICATIONS

Regulation 0 Goal

1 The communications equipment shall be designed, installed and maintained so that the ship, while at sea, is capable of:

1.1 transmitting ship-to-shore distress alerts by at least two separate and independent means, each using a different radiocommunication service;

1.2 transmitting ship-to-air distress alerts;

1.3 receiving shore-to-ship distress alerts;

1.4 transmitting and receiving ship-to-ship distress alerts;

1.5 transmitting and receiving search and rescue coordinating communications;

1.6 transmitting and receiving on-scene communications;

1.7 transmitting and receiving signals for locating ships, aircraft or units in distress;

1.8 transmitting and receiving maritime safety information;

1.9 transmitting and receiving general radiocommunications to and from shore-based radio systems or networks;

1.10 transmitting and receiving bridge-bridge communications from the position where the ship is normally navigated; and

1.11 transmitting and receiving internal communications.

2 The communications equipment shall:

2.1 provide high reliability and minimise the risk of mal-operation in all Foreseeable Operating Conditions, accidents and emergencies; and

2.2 maintain essential safety functions after a minimum of one single operational error and/or system/equipment fault.

Regulation 1 General

Functional Objective

1 The purpose of this Regulation is to outline the principles and framework of Chapter VIII Communications Systems and their applications.

Definitions

Note: Definitions which are applicable to all Chapters are located in Chapter I, Regulation 2.

Bridge-to-bridge communications	Safety communications between ships from the position from which the ships are normally navigated.
Continuous watch	The radio watch concerned shall not be interrupted other than for brief intervals when the ship's receiving capability is impaired or blocked by its own communications or when the facilities are under periodical maintenance or checks.
Digital selective calling (DSC)	A technique using digital codes which enables a radio station to establish contact with, and transfer information to, another station or group of stations, and complying with the relevant recommendations of the Radiocommunications Sector of the International Telecommunications Union (ITU-R)
Direct-printing telegraphy	Automated telegraphy techniques which comply with the relevant recommendations of the ITU-R
General radiocommunications	Operational and public correspondence traffic, other than distress, urgency and safety messages, conducted by radio.
Inmarsat	The Organization established by the Convention on the International Maritime Satellite Organization adopted on 3 September 1976.
International NAVTEX service	The co-ordinated broadcast and automatic reception on 518 kHz of maritime safety information by means of narrow-band direct-printing telegraphy using the English language.
Locating	The finding of ships, aircraft, units or persons in distress.
Maritime safety information	Navigational and meteorological warnings, meteorological forecasts and other urgent safety related messages broadcast to ships.
Polar orbiting satellite service	A service which is based on polar orbiting satellites which receive and relay distress alerts from satellite EPIRBs and which provides their position.
Radio Regulations	The Radio Regulations annexed to, or regarded as being annexed to, the most recent International Telecommunication Convention which is in force at any time.
Sea area A1	An area within the radiotelephone coverage of at least one VHF coast station in which continuous DSC alerting is available, as may be defined by a Contracting Government.
Sea area A2	An area, excluding sea area A1, within the radiotelephone coverage of at least one MF coast station in which continuous DSC alerting is available, as may be defined by a Contracting Government.
Sea area A3	An area, excluding sea areas A1 and A2, within the coverage of an Inmarsat geostationary satellite in which continuous alerting is available.
Sea area A4	An area outside sea area A1, A2 and A3.
Global Maritime Distress and Safety System (GMDSS) identities	Maritime mobile services identity, the ship's call sign, Inmarsat identities and serial number identity which may be transmitted by the ship's equipment and used to identify the ship.

2 All other terms and abbreviations which are used in this chapter and which are defined in the Radio Regulations and in the International Convention on Maritime Search and Rescue (SAR), 1979, shall have the meanings as defined in those Regulations and the SAR Convention.

International Maritime Organization (IMO) Documents

Abbreviation	Title	Resolution No. (if applicable)	Amendments incorporated into or reviewed and applicable to ANEP-77	Amendments under review for ANEP-77
LSA Code	International Life-Saving Appliance (LSA) Code	MSC.48(66)	Amended by MSC.218(82)	Amended by MSC.207(81) MSC.320(89)
SAR	International Convention on Maritime Search and Rescue (SAR), 1979	-	MSC.70(69) MSC.155(78)	
SOLAS	International Convention for the Safety of Life at Sea, Consolidated Edition, 2009	-	MSC.201(81) MSC.204(81) MSC.216(82) Anx 3 MSC.256(84) MSC.257(84) MSC.258(84) MSC.269(85) MSC.282(86) MSC.283(86) MSC.290(87) MSC.291(87) MSC.308(88) MSC.309(88) MSC.317(89)	MSC.325(90)
STCW (Ref at Annex A)	International Convention on Standards of Training Certification and Watchkeeping for Seafarers		Amendments from 2007 onwards: No Amendments	

Purpose

3 The ability to be deployed to any area of interest to the Navy defined in the Concept of Operations Statement shall be maintained and the communications fit and on-board personnel shall provide:

3.1 the capability to send and transmit all information as required by the Global Maritime Distress and safety System (GMDSS).

3.2 on-board safety communications including internal communications, main broadcast, portable and survival craft equipment;

3.3 qualified personnel certified to operate and, if required, maintain the GMDSS equipment to ITU Radio Regulations.

Note: The requirements of Chapter VI, Regulation 10 which relate to communications equipment shall be met.

General Performance Requirements

4 The Concept of Operations Statement document is the Owner's vision of how the communications systems of the ship are to be operated and maintained throughout the life of the ship and is to be shared by the Naval Administration and, where appointed, it's Recognised Organisation.

Solutions

5 Verification that the ship complies with this chapter shall be by the Naval Administration. Provision of evidence to support verification shall be by the owner. All decisions that affect compliance with the requirements of this chapter shall be recorded at all stages from Concept to Disposal and these records be maintained throughout the life of the ship.

Regulation 2 GMDSS Equipment

Functional Objective

1 GMDSS communications equipment shall be fitted onboard.

Performance Requirements

2 The GMDSS equipment to be fitted shall be determined by the naval ship's sea area of operation with reference to the Concept of Operations Statement.

3 Every naval ship subject to this Chapter shall be provided with:

3.1 a VHF radio installation capable of transmitting and receiving:

3.1.1 DSC on the frequency 156.525 MHz (channel 70). It shall be possible to initiate the transmission of distress alerts on channel 70 from the position from which the naval vessel is normally navigated; and

3.1.2 general radiocommunications using radiotelephony on the frequencies 156.300 MHz (channel 6), 156.650 MHz (channel 13) and 156.800 MHz (channel 16);

3.2 a radio installation capable of maintaining a continuous DSC watch on VHF channel 70 which may be separate from, or combined with, that required by paragraph 3.1.1;

3.3 a search and rescue locating device capable of operating either in the 9 GHz band or on frequencies dedicated for AIS, which shall be so stowed that it can be easily utilised;

3.4 a receiver capable of receiving international NAVTEX service broadcasts if the naval ship is engaged on voyages in any area in which an international NAVTEX service is provided;

3.5 a radio facility for reception of maritime safety information by the Inmarsat enhanced group calling system if the naval ship is engaged on voyages in any area of Inmarsat coverage but in which an international NAVTEX service is not provided. However, the Naval Administration may permit naval ships engaged exclusively on voyages in areas where a HF direct-printing telegraphy maritime safety information service is provided and fitted with equipment capable of receiving such service, to be exempted from the requirement to carry an Inmarsat EGC receiver.

3.6 a satellite emergency position-indicating radio beacon (satellite EPIRB) which shall be:

3.6.1 capable of transmitting a distress alert through the polar orbiting satellite service operating in the 406 MHz band;

3.6.2 installed in an easily accessible position;

3.6.3 ready to be manually released and capable of being carried by one person into a survival craft;

3.6.4 capable of floating free if the ship sinks and of being automatically activated when afloat; and

3.6.5 capable of being activated manually.

Note: The satellite EPIRB shall be located such as to give the float-free function (paragraph 3.6.4) priority. If it is not possible to comply with the paragraphs 3.6.2, 3.6.3 and 3.6.5 from the chosen position, an additional satellite EPIRB (need not to be of a float-free type) may be required, preferably located on the bridge.

Sea Area A1

4 In addition to meeting the requirements of Regulation 2, paragraph 3, every naval ship engaged on voyages exclusively in sea area A1 shall be provided with a radio installation capable of initiating the transmission of ship-to-shore distress alerts from the position from which the ship is normally navigated, operating either:

4.1 on VHF using DSC; or

4.2 through the polar orbiting satellite service on 406 MHz; this requirement may be fulfilled by the satellite EPIRB required by Regulation 2 paragraph 3.6, either by installing the satellite EPIRB close to, or by remote activation from, the position from which the ship is normally navigated; or

4.3 if the naval ship is engaged on voyages within coverage of MF coast stations equipped with DSC, on MF using DSC; or

4.4 on HF using DSC; or

4.5 through the Inmarsat geostationary satellite service.

Sea Areas A1 and A2

5 In addition to meeting the requirements of Regulation 2, paragraph 3, every naval ship engaged on voyages beyond sea area A1, but remaining within sea area A2, shall be provided with:

5.1 an MF radio installation capable of transmitting and receiving, for distress and safety purposes, on the frequencies 2187.5 kHz using DSC and 2182 kHz using radiotelephony; and

5.2 a radio installation capable of maintaining a continuous DSC watch on the frequency 2187.5 kHz which may be separate from, or combined with, that required by paragraph 5.1; and

5.3 means of initiating the transmission of ship-to-shore distress alerts by a radio service other than MF operating either through the polar orbiting satellite service on 406 MHz; this requirement may be fulfilled by the satellite EPIRB, required by Regulation 2 paragraph 3.6, either by installing the satellite EPIRB close to, or by remote activation from, the position from which the ship is normally navigated; or on HF using DSC or through the Inmarsat satellite service using a ship earth station.

6 It shall be possible to initiate transmission of distress alerts by the radio installations specified in paragraphs 5.1 and 5.3 from the position from which the ship is normally navigated.

7 The naval ship shall, in addition, be capable of transmitting and receiving general radiocommunications using radiotelephony or direct-printing telegraphy by either:

7.1 a radio installation operating on working frequencies in the bands between 1,605 kHz and 4,000 kHz or between 4,000 kHz and 27,500 kHz. This requirement may be fulfilled by the addition of this capability in the equipment required by paragraph 5.1; or

7.2 an Inmarsat earth station.

Sea Areas A1, A2 and A3

8 In addition to meeting the requirements of Regulation 2, paragraph 3, every ship engaged on voyages beyond sea areas A1 and A2, but remaining within sea area A3, shall, if it does not comply with the requirements of paragraph 9, be provided with:

8.1 an Inmarsat ship earth station capable of:

8.1.1 transmitting and receiving distress and safety communications using direct-printing telegraphy;

8.1.2 initiating and receiving distress priority calls;

8.1.3 maintaining watch for shore-to-ship distress alerts, including those directed to specifically defined geographical areas; and

8.1.4 transmitting and receiving general radiocommunications, using either radiotelephony or direct-printing telegraphy.

8.2 an MF radio installation capable of transmitting and receiving, for distress and safety purposes, on the frequencies 2187.5 kHz using DSC and 2182 kHz using radiotelephony; and

8.3 a radio installation capable of maintaining a continuous DSC watch on the frequency 2187.5 kHz which may be separate from, or combined with, that required by paragraph 8.2; and

8.4 means of initiating the transmission of ship-to-shore distress alerts by a radio service other than MF operating either through the polar orbiting satellite service on 406 MHz; this requirement may be fulfilled by the satellite EPIRB, required by Regulation 2 paragraph 3.6, either by installing the satellite EPIRB close to, or by remote activation from, the position from which the ship is normally navigated; or on HF using DSC or through the Inmarsat satellite service using a ship earth station.

9 In addition to meeting the requirements of Regulation 2, paragraph 3, every naval ship engaged on voyages beyond sea areas A1 and A2, but remaining within sea area A3, shall, if it does not comply with the requirements of paragraph 8, be provided with:

9.1 an MF/HF radio installation capable of transmitting and receiving, for distress and safety purposes, on all distress and safety frequencies in the bands between 1,605 kHz and 4,000 kHz and between 4,000 kHz and 27,500 kHz using DSC, radiotelephony and narrow band direct printing:

9.2 equipment capable of maintaining DSC watch on 2,187.5 kHz, 8,414.5 kHz and on at least one of the distress and safety DSC frequencies 4,207.5 kHz, 6,312 kHz, 12,577 kHz or 16,804.5 kHz; at any time, it shall be possible to select any of these DSC distress and safety frequencies. This equipment may be separate from, or combined with, the equipment required by paragraph 9.1; and

9.3 means of initiating the transmission of ship-to-shore distress alerts by a radio service other than MF operating either through the polar orbiting satellite service on 406 MHz; this requirement may be fulfilled by the satellite EPIRB, required by Regulation 2 paragraph 3.6, either by installing the satellite EPIRB close to, or by remote activation from, the position from which the ship is normally navigated; or through the Inmarsat satellite service using a ship earth station.

9.4 in addition, naval ships shall be capable of transmitting and receiving general radiocommunications using radiotelephony or direct-printing telegraphy by an MF/HF radio installation operating on working frequencies in the bands between 1,605 kHz and 4,000 kHz and between 4,000 kHz and 27,500 kHz. This requirement may be fulfilled by the addition of this capability in the equipment required by paragraph 9.1.

10 It shall be possible to initiate transmission of distress alerts by the radio installations specified in paragraphs 8 and 9 from the position from which the ship is normally navigated.

Sea Areas A1, A2, A3 and A4

11 In addition to meeting the requirements of Regulation 2, paragraph 3, naval ships engaged on voyages in all sea areas shall be provided with the radio installations and equipment required by Regulation 2, paragraph 9, except that the Inmarsat earth station required by Regulation 2, paragraph 9.3 shall not be accepted as an alternative to that required by Regulation 2, paragraph 9.1, which shall always be provided. In addition, naval ships engaged on voyages in all sea areas shall comply with the requirements of Regulation 2, paragraph 10.

Note: This means that Sea Area A4 naval ships must always be fitted with a MF/HF installation, as Inmarsat does not cover Sea Area A4

Solutions

12 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

13 GMDSS equipment shall comply with the following standards:

13.1 International Electrotechnical Commission (IEC) IEC 60945:2002 Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results.

13.2 International Electrotechnical Commission (IEC) IEC 61097 series Global Maritime Distress and Safety System, (latest versions):

13.2.1 Part 1: Radar transponder - Marine search and rescue (SART) - Operational and performance requirements, methods of testing and required test results

13.2.2 Part 2: COSPAS-SARSAT EPIRB - Satellite emergency position indicating radio beacon operating on 406 MHz - Operational and performance requirements, methods of testing and required test results

13.2.3 Part 3: Digital selective calling (DSC) equipment - Operational and performance requirements, methods of testing and required testing results

13.2.4 Part 4: INMARSAT-C ship earth station and INMARSAT enhanced group call (EGC) equipment - Operational and performance requirements, methods of testing and required test results

13.2.5 Part 6: Narrowband direct-printing telegraph equipment for the reception of navigational and meteorological warnings and urgent information to ships (NAVTEX)

13.2.6 Part 7: Shipborne VHF radiotelephone transmitter and receiver - Operational and performance requirements, methods of testing and required test results

13.2.7 Part 8: Shipborne watchkeeping receivers for the reception of digital selective calling (DSC) in the maritime MF, MF/HF and VHF bands - Operational and performance requirements, methods of testing and required test results

13.2.8 Part 9: Shipborne transmitters and receivers for use in the MF and HF bands suitable for telephony, digital selective calling (DSC) and narrow band direct printing (NBDP) - Operational and performance requirements, methods of testing and required test results

13.2.9 Part 13: Inmarsat F77 ship earth station equipment - Operational and performance requirements, methods of testing and required test results

13.2.10 Part 14: AIS search and rescue transmitter (AIS-SART) - Operational and performance requirements, methods of testing and required test results.

14 Marine survivor locating systems shall comply with Radio Technical Commission for Maritime (RTCM) Standard 11901.0 Maritime Survivor Locating Devices.

Regulation 3 Ensuring Availability of GMDSS Equipment

Functional Objective

1 GMDSS equipment shall be continuously available at sea.

Performance Requirements

2 The GMDSS radio equipment required by this chapter shall be maintained to provide the availability of the functional requirements specified in Regulation 1 General and to meet the recommended performance standards of such equipment.

3 On naval ships engaged on voyages in sea areas A1 and A2, the availability shall be ensured by using such methods as duplication of equipment, shore-based maintenance or at-sea electronic maintenance capability, or a combination of these, as may be approved by the Naval Authority.

4 On naval ships engaged on voyages in sea areas A3 and A4, the availability shall be ensured by using a combination of at least two methods such as duplication of equipment, shore-based maintenance or at-sea electronic maintenance capability, as may be approved by the Naval Administration, taking into account the recommendations of the IMO.

Solutions

5 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

6 If availability is ensured by using a combination of methods which includes duplication of equipment, in addition to the equipment required by Regulation 2, the following radio installations should be available on board naval ships engaged on voyages in:

6.1 Sea area A3 – A VHF radio installation complying with the requirements of Regulation 2, paragraph 3.1 and either an MF/HF installation complying with the requirements of Regulation 2, paragraphs 9.1 and 9.2 or an Inmarsat ship earth station complying with Regulation 2, paragraph 8.1.

Note – In practice A3 ships must fit two complete VHF systems and either 2 complete Inmarsat ship earth stations, or an Inmarsat ship earth station and a MF/HF installation. The MF/HF installation may be combined with an existing MF installation fitted under Regulation 2.

6.2 Sea areas A3 and A4 - A VHF radio installation complying with the requirements of Regulation 2, paragraph 3.1 and an MF/HF installation complying with the requirements of Regulation 2, paragraphs 9.1 and 9.2. Naval ships operating only occasionally in A4 may fit an additional Inmarsat ship earth station in lieu of a second MF/HF installation

6.3 The additional radio installations specified in paragraphs 6.1 and 6.2 should each be connected to a separate antenna and be installed and ready for immediate operation.

7 If availability is ensured by using a combination of methods which includes shore-based maintenance, an arrangement acceptable to the Naval Administration should be established to ensure adequate support of the naval ship for the maintenance and repair of its radio installation. For example an agreement with a company providing GMDSS maintenance services known to cover the operating area of the ship.

8 If availability is ensured by using a combination of methods which includes at sea electronic maintenance capability, adequate technical documentation, tools, test equipment and spare parts must be carried on board in order to enable the maintainer to perform tests and localise and repair faults in the radio equipment.

8.1 The person(s) designated as the GMDSS equipment maintainer should either hold a GMDSS 1st or 2nd Class Radio-Electronic Certificate or qualifications recognised as equivalent by the Naval Administration.

Note: In practice, the option of at sea electronic maintenance is rarely used by GMDSS ships, as equipment is generally very reliable, repair of equipment requires specialised equipment and few, if any, training institutions offer courses for the 1st and 2nd Class Radio Electronic Certificates. GMDSS A1/2 ships use duplication or shore based maintenance, and the great majority of GMDSS A3/4 ships use duplication and shore based maintenance.

Regulation 4 GMDSS Sources of Energy

Functional Objective

1 GMDSS equipment shall be provided with main, emergency and reserve sources of energy.

Performance Requirements

2 There shall be available at all times, while the naval ship is at sea, a supply of electrical energy sufficient to operate the radio installations and to charge any batteries used as part of a reserve source or sources of energy for the radio installations.

3 A reserve source or sources of energy shall be provided on every naval ship, to supply GMDSS radio installations, for the purpose of conducting distress and safety radiocommunications, in the event of failure of the ship's main and emergency sources of electrical power. The reserve source or sources of energy shall be capable of simultaneously operating the main and duplicated GMDSS equipment for a period of at least:

3.1 1 hour on naval ships provided with an emergency source of electrical power, if such source of power complies fully with all relevant provisions of Chapter IV, Regulation 9, including the supply of such power to the radio installations; and

3.2 6 hours on naval ships not provided with an emergency source of electrical power complying fully with all relevant provisions of Chapter IV, Regulation 9, including the supply of such power to the radio installations.

4 The reserve source or sources of energy shall be independent of the propelling power of the ship and the ship's electrical system.

5 The reserve source or sources of energy may be used to supply the electrical lighting required by Regulation 14.

6 If an uninterrupted input of information from the ship's navigational or other equipment to a radio installation required by this chapter, including the navigation receiver referred to in Regulation 5, is needed to ensure its proper performance, it shall be powered from the main, emergency and reserve sources of energy.

Solutions

7 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

8 The reserve source is only to be used for the GMDSS equipment, the navigation receiver referred to in paragraph 6 and the emergency radio lighting referred to in Regulation 14.

9 Where a reserve source of energy consists of a rechargeable accumulator battery or batteries:

9.1 a means of automatically charging such batteries shall be provided which shall be capable of recharging them to minimum capacity requirements within 10 hours; and

9.2 the capacity of the battery or batteries shall be checked, using an appropriate method, at intervals not exceeding 12 months, when the ship is not at sea.

Note: The battery capacity is normally checked at the annual survey of the GMDSS equipment.

9.3 The siting and installation of accumulator batteries which provide a reserve source of energy shall be such as to ensure:

9.3.1 the highest degree of service;

9.3.2 a reasonable lifetime, agreed by the Naval Administration;

9.3.3 reasonable safety;

9.3.4 that battery temperatures remain within the manufacturer's specifications whether under charge or idle; and

9.3.5 that when fully charged, the batteries will provide at least the minimum required hours of operation under all weather conditions.

Note: GMDSS batteries are normally mounted at the same level or higher than the GMDSS equipment, in a vented insulated locker or container.

9.4 For more information on GMDSS reserve supplies, see IMO COMSAR Circular 16, dated March 4, 1998.

Regulation 5 Position Updates

Functional Objective

1 Electronic position information shall be available to the GMDSS equipment.

Performance Requirements

2 All GMDSS equipment carried on board a naval ship to which this Chapter applies which is capable of automatically including the ship's position in the distress alert shall be automatically provided with this information from an internal or external navigation receiver, if either is installed.

Solutions

3 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

4 Electronic navigation receivers used for position input to GMDSS equipment shall comply with IEC 61108-1:2003 - Maritime navigation and radio communication equipment and systems – Global navigation satellite systems (GNSS) – Part 1: Global positioning system (GPS) – Receiver equipment – Performance standards, methods of testing and required test results (2003-07).

Regulation 6 Internal Communications

Functional Objective

1 Internal communications equipment shall be provided to:

1.1 enable safe operation of the ship;

1.2 alert persons onboard of emergency or hazardous situations; and

1.3 facilitate appropriate emergency response and recovery.

Performance Requirements

2 The main internal communications system shall provide effective two-way verbal communication between crew members.

3 A back-up internal communications system shall also be provided in the event that the main system is unavailable. The back-up system shall:

3.1 be effective and continuously available;

3.2 be protected from hazards such as fire, vibration, electrical interference, flooding;

3.3 be independent of the ships power supply;

3.4 be operable from positions defined by the Naval Administration.

Solutions

4 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

5 The main internal communications system shall:

5.1 be operable from all positions used for Escape, Evacuation and Rescue, damage control and command and control;

5.2 be operable from positions used for operational activities related to the ship's role;

5.3 be operable from locations identified in Chapter IV Engineering Systems to support machinery control and RAS operations;

5.4 be operable from other locations defined by the Naval Administration.

6 An emergency means comprised of either fixed or portable equipment or both shall be provided for two-way communications between strategic positions for Escape, Evacuation and Rescue.

7 Additionally, on ships fitted with a MES, two-way communication shall be provided between the MES embarkation point and the platform or survival craft.

8 The power supply to the internal communication system shall comply with the requirements of Chapter IV. Alternatively a redundant system not requiring a power supply shall be provided such as sound powered telephones or battery powered portable equipment.

Note: For portable communications, see Regulation 8

9 System redundancy shall be demonstrated through functional testing of the installed systems.

10 Cables for internal communication systems shall be routed clear of galleys, machinery spaces and their casings and other high fire risk areas, except for supplying equipment in those spaces.

11 Communication equipment located or used in areas where flammable gases may be present shall be certified intrinsically safe.

12 Performance Requirements at paragraphs 2 and 3.1 above shall be verified by a risk assessment and/or a demonstration.

Regulation 7 Main Broadcast System

Functional Objective

1 A main broadcast system shall enable verbal communication to Persons Onboard of an emergency incident and the actions to be taken.

Performance Requirements

2 The main broadcast system shall:

2.1 allow one-way verbal communication to Persons Onboard;

2.2 be clearly noticeable by all embarked persons;

2.3 be easily distinguishable and recognisable;

2.4 be continuously available;

2.5 be protected from hazards such as fire, vibration, electrical interference or flooding;

2.6 be provided such that any incident which may cause alarm failure shall be guarded against by system or equipment redundancy;

2.7 be operable from strategic Escape, Evacuation and Rescue positions and locations used for command and control.

Solutions

3 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

4 Unless provided otherwise in this Code, the main broadcast system shall comply with:

4.1 LSA Code Paragraph 7.2.2 "Public address system";

4.2 IMO Resolution A.1021(26) "Code on alerts and indicators", 2009;

Note: Where possible, the main broadcast system should also comply with IMO MSC/Circ.808: "Recommendation on performance standards for public address systems on passenger ships, including cabling".

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5 Where in any referenced IMO documents the term "public address system" is used, it should be read to mean "main broadcast system" for the purpose of this Naval Ship Code.

6 The main broadcast system shall be clearly distinguishable across the upper deck and within the ship with all doors and accesses closed, unless stated otherwise by the Naval Administration. A trial shall demonstrate that the main broadcast system is clearly audible and/or visible.

7 When the main broadcast system is integrated with systems other than the general alarm system, the broadcast system shall have automatic priority over any other system input, so that all announcements will be broadcast even if any loudspeaker in the spaces concerned has been switched off, its volume turned down or the main broadcast system is used for other purposes.

8 A number of operating positions shall be available for the main broadcast system. As a minimum this shall include the bridge, operations room and the damage control headquarters. At least one operating position is to be continuously manned when at sea. During periods of increased risk, at least two of these positions are to be continuously manned (e.g. RAS, constricted navigational situations).

9 The power supply to the main broadcast system shall comply with the requirements of Chapter VII Regulation 14 Power Supply to Escape, Evacuation and Rescue Systems.

10 Functional testing of the installed system shall demonstrate that any incident that may cause main broadcast system failure is guarded against by system or equipment redundancy.

11 Loudspeaker installations shall comply with the requirements of Section 7.2 of the LSA Code.

12 Communication equipment located or used in areas where flammable gases may be present shall be certified intrinsically safe.

Regulation 8 Portable Radiocommunications

Functional Objective

1 Portable Radiocommunications systems shall enable effective two-way communication between crew members.

Performance Requirements

2 Portable Radiocommunications systems shall:

2.1 Allow clear and distinguishable two-way verbal communication;

2.2 Be suitably rated for the environment under which it will operate;

2.3 Have complete system redundancy.

Solutions

3 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

4 Portable radiocommunications shall be provided to enable Escape, Evacuation and Rescue evolutions in accordance with Regulation 6.

5 Portable radiocommunications shall be operable from all positions used for Escape, Evacuation and Rescue, damage control and command and control. The equipment may also be required by shore parties and boat parties as defined in the Concept of Operations Statement.

6 Complete system redundancy shall be demonstrated through functional testing.

7 Communication equipment located or used in areas where flammable gases may be present shall be certified intrinsically safe.

8 Performance Requirements at paragraph 2 above shall be verified by demonstration.

Regulation 9 Survival Craft Radio Equipment

Functional Objective

1 External communication equipment used in survival craft shall enable communication to other ships or to shore during emergencies.

Performance Requirements

2 External communication equipment to be used in survival craft shall:

2.1 be easy to operate including by those wearing fire fighting or other individual protective equipment;

2.2 incorporate redundancy;

2.3 be located at strategic Escape, Evacuation and Rescue positions as agreed with the Naval Administration;

2.4 be installed in such a way as to avoid harmful electromagnetic interference arising from, or being given to other equipment on board; and

2.5 not cause injuries to persons using the equipment.

Solutions

3 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

4 Unless expressly provided otherwise in this Code, survival craft radio equipment shall comply with

4.1 International Electrotechnical Commission (IEC) IEC 61097 series Global Maritime Distress and Safety System, (latest versions):

4.1.1 Part 1: Radar transponder - Marine search and rescue (SART) - Operational and performance requirements, methods of testing and required test results.

4.1.2 Part 2: COSPAS-SARSAT EPIRB - Satellite emergency position indicating radio beacon operating on 406 MHz - Operational and performance requirements, methods of testing and required test results

4.1.3 Part 12: Survival craft portable two-way VHF radiotelephone apparatus - Operational and performance requirements, methods of testing and required test results

4.1.4 Part 14: AIS search and rescue transmitter (AIS-SART) - Operational and performance requirements, methods of testing and required test results.

4.2 LSA Code, Chapter 3 “Visual Signals”;

4.3 SOLAS Chapter IV “Radio communications”.

5 At least three waterproof portable two-way VHF radiotelephone apparatus shall be provided on every naval ship over 500 GRT. Ships below 500 GRT shall carry two. The location shall be approved by the Naval Administration.

6 At least one search and rescue transponder (SART) shall be carried on each side of a naval ship over 500 GRT. Ships below 500 GRT shall carry one. SARTs shall be stowed in such locations that they can be rapidly placed in any one of the survival craft.

7 Not less than 12 rocket parachute distress flares shall be carried and be stowed directly available on or near the navigation bridge. Flares shall comply with the LSA Code Chapter 3.1 “Rocket parachute flares”.

8 All ships shall be provided with a portable daylight signalling lamp which is available at all times and which is not dependent on the ship's main source of electrical power.

9 Communication equipment located or used in areas where flammable gases may be present shall be certified intrinsically safe.

Regulation 10 Sea-Air Radiocommunications

Functional Objective

1 A sea-to-air two-way radiocommunications system shall enable communication with overflying aircraft during emergencies.

Performance Requirements

2 Every naval ship shall be provided with means for two-way on-scene radiocommunications for search and rescue purposes using civil aeronautical VHF frequencies.

Solutions

3 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

4 The equipment shall provide operation on the aeronautical frequencies of 121.5 MHz and 123.1 MHz from the position from which the ship is normally navigated. Additional civil aeronautical VHF frequencies may be provided if required.

5 Equipment shall comply with the following performance standard:

5.1 ETSI EN 301 688 V1.1.1 Electromagnetic compatibility and Radio spectrum Matters (ERM) Technical characteristics and methods of measurement for fixed and portable VHF equipment operating on 121,5 MHz and 123,1 MHz.

Regulation 11 Radio Personnel

Functional Objective

1 Radio operators shall be qualified to operate GMDSS equipment.

Performance Requirements

2 The communications qualifications shall include:

2.1 GMDSS certificates specified in ITU Radio Regulations;

2.2 Military qualifications as required by the operational installation.

Solutions

3 The operator qualification is to be approved by the Naval Administration as being compliant with the above Performance Requirements.

Regulation 12 Radio Watches

Functional Objective

1 GMDSS equipment shall be monitored at sea as determined by operational requirements.

Performance Requirements

2 Every naval ship shall, while at sea, maintain a continuous radio watch:

2.1 on VHF DSC channel 70;

2.2 on the distress and safety DSC frequency 2,187.5 kHz, if the ship is fitted with an MF radio installation;

2.3 on the distress and safety DSC frequencies 2,187.5 kHz and 8,414.5 kHz and also on at least one of the distress and safety DSC frequencies 4,207.5 kHz, 6,312 kHz, 12,577 kHz or 16,804.5 kHz, appropriate to the time of day and the geographical position of the ship, if the ship is fitted with an MF/HF radio installation. This watch may be kept by means of a scanning receiver; and

2.4 for satellite shore-to-ship distress alerts, if the ship is fitted with a GMDSS ship earth station system.

3 While at sea, and when practicable, a continuous listening watch should be maintained on VHF channel 16. This watch shall be kept at the position from which the ship is normally navigated.

4 Every naval ship, while at sea, shall maintain a radio watch for broadcasts of maritime safety information on the appropriate frequency or frequencies on which such information is broadcast for the area in which the ship is navigating.

Solutions

5 The operating procedures are to be approved by the Naval Administration as being compliant with the above Performance Requirements.

Regulation 13 Radio Records

Functional Objective

1 Radio records shall be maintained.

Performance Requirements

2 Radio records shall be maintained by transcript, magnetic media or any other method as agreed by the Naval Administration.

3 A record shall be kept, to the satisfaction of the Naval Administration and as required by the Radio Regulations, of all incidents connected with the radio communication service which appear to be of importance to safety of life at sea.

4 The relevant distress, emergency or safety records shall be released to the relevant Investigation Authority if operational conditions and circumstances allow.

Solutions

5 The operating procedures are to be approved by the Naval Administration as being compliant with the above Performance Requirements.

Regulation 14 Installation, Maintenance, Testing and Repairs

Functional Objective

1 The location and ship installation of GMDSS equipment shall enable it’s operation, maintenance, testing and repair.

Performance Requirements

2 Every GMDSS radio installation shall;

2.1 be so located that no harmful interference of mechanical, electrical or other origin affects its proper use, and so as to ensure electromagnetic compatibility and avoidance of harmful interaction with other equipment and systems;

2.2 be so located as to ensure the greatest possible degree of safety and operational availability;

2.3 be protected against harmful effects of water, extremes of temperature and other adverse environmental conditions;

2.4 be provided with reliable, permanently arranged electrical lighting, independent of the main and emergency sources of electrical power, for the adequate illumination of the radio controls for operating the radio installation; and

2.5 be clearly marked with the call sign, the ship station identity and other codes as applicable for the use of the radio installation.

3 Control of the VHF radiotelephone channels, required for navigational safety, shall be immediately available on the navigation bridge convenient to the conning position and, where necessary, facilities should be available to permit radiocommunications from the wings of the navigation bridge. Portable VHF equipment may be used to meet the latter requirement.

4 Where applicable, equipment shall be so constructed and installed that it is readily accessible for inspection and on-board maintenance purposes.

4.1 Adequate information shall be provided to enable the equipment to be properly operated and maintained, taking into account the recommendations of the IMO.

4.2 Adequate tools and spares shall be provided to enable the equipment to be maintained;

4.3 Satellite EPIRBs shall be annually tested for all aspects of operational efficiency, with special emphasis on checking the emission on operational frequencies, coding and registration. The test may be conducted on board the ship or at an approved testing station, and subject to maintenance at intervals not exceeding five years, to be performed at an approved shore-based maintenance facility;

4.4 Radio communication equipment shall be so designed that the main units can be replaced readily, without elaborate recalibration or readjustment; and

4.5 change over switches shall be tested in accordance with SOLAS Regulations as approved by the Naval Administration.

5 Where required by the Naval Administration, GMDSS equipment shall be provided with facilities to inhibit transmission for EMCON/RADHAZ purposes.

Solutions

6 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

7 The maintenance information and maintenance procedures are to be approved by the Naval Administration as being compliant with the above Performance Requirements.

Regulation 15 Operational Audit and Compliance Validation

Functional Objective

1 GMDSS equipment shall be surveyed at regular intervals.

Performance Requirements

2 The GMDSS equipment shall be surveyed annually in accordance with the requirements of Chapter I, Part B.

Note: Annual survey of GMDSS equipment is required for full SOLAS compliance. The Naval Administration may require alternative arrangements for the periodicity of surveys.

Solutions

3 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

4 Surveys shall be conducted in accordance with Annex 1 to IMO Resolution A.997(25), as amended by IMO Resolution A.1020(26). – *Survey Guidelines under The Harmonised System of Survey and Certification*.

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CHAPTER IX NAVIGATION

Regulation 0 Goal

1 The navigation related spaces, systems and equipment shall be designed, constructed, installed and maintained so that the ship, while at sea, may:

1.1 be capable of independent navigation;

1.2 be aware of all navigation hazards, fixed or mobile;

1.3 minimise risk of grounding, collision and negative environmental impact;

1.4 measure and interpret environmental data;

1.5 assist other ships, aircraft, units or persons in distress.

2 The navigation spaces, workstations, systems and equipment shall:

2.1 provide high reliability and minimise the risk of mal-operation in all Foreseeable Operating Conditions, accidents and emergencies;

2.2 maintain uninterrupted essential safety functions after a minimum of one single operational error and/or system/equipment fault.

3 The navigation systems and equipment providing essential safety functions shall not be dependent upon the ship's combat functions being available.

Regulation 1 General

Functional Objective

1 The purpose of this Regulation is to outline the principles and framework of Chapter IX Navigation and its application.

Definitions

Note: Definitions which are applicable to all Chapters are located in Chapter I, Regulation 2.

Bridge	an area from which the navigation and control of the ship is exercised, including the wheelhouse, Bridge Wings and, possibly, the Bridge roof.
BAM	Bridge Alert Management
BES	Bridge Equipment and Systems
Bridge Resource Management	the process of co-ordinating and directing all the available assets of the Bridge and its staff for the safe and efficient conduct of navigation
Bridge Wings	parts of the Bridge on both sides of the ship's wheelhouse which extend to the ship's side.

Conning Position	a place on the Bridge with a commanding view and which is used by navigators when commanding, manoeuvring and controlling a ship. Certain ships may have additional conning positions (including an emergency conning position) according to its size or purpose
Environmental Data	data relating to the environment in which the ship is or expects to operate including, but not limited to, meteorological, oceanographic, electromagnetic signal propagation
Field of vision	an angular size of a scene that can be observed from a position on the ship's Bridge.
Geo	Of, or relating to the Earth
Geospatial	Pertaining to the location and characteristics of natural or constructed features and boundaries on, above or below the Earth's surface; especially referring to data that is geographic and spatial in nature.
Main Steering Position	a workstation at which the helmsman steers the ship manually in normal conditions.
Navigator	a person who, for the time being, has responsibility for the conduct of safe navigation and conning (manoeuvring) the ship.
Navigation	the process of planning, recording and controlling the movement of a vessel from berth to berth, including operations and evolutions undertaken during the voyage.
Navigation related space	a platform, deck, compartment, control room or other part of the ship which may be used for, or contributes to, the conduct of safe navigation.
Operator	an individual utilising, programming, manipulating or deriving information from a system or equipment.
Spatial	Of, or relating to space.
WAIS	Warship Automatic Identification System
WECDIS	Warship Electronic Chart Display and Information System
Wheelhouse	an enclosed area of the Bridge.
Workstation	a position at which one or several tasks constituting a particular activity are carried out.

2 All other terms and abbreviations which are used in this chapter and which are defined in the Regulations for the Prevention of Collision at Sea (COLREGs), 1972 shall have the meanings as defined in those Regulations.

International Maritime Organization (IMO) Documents

Abbreviation	**Title**	**Resolution No. (if applicable)**	**Amendments incorporated into or reviewed and applicable to ANEP-77**	**Amendments under review for ANEP-77**
COLREGS	International Regulations for Preventing Collisions at Sea, 1972	-	Amendments from 2007 onwards: A.1004(25)	
HSC Code (2000 HSC Code)	International Code of Safety for High-Speed Craft, 2000	MSC.97(73)	MSC.222(82) MSC.260(84) MSC.271(85)	MSC.326(90)

SOLAS	International Convention for the Safety of Life at Sea, Consolidated Edition, 2009	-	MSC.201(81) MSC.204(81) MSC.216(82) Anx 3 MSC.256(84) MSC.257(84) MSC.258(84) MSC.269(85) MSC.282(86) MSC.283(86) MSC.290(87) MSC.291(87) MSC.308(88) MSC.309(88) MSC.317(89)	MSC.325(90)
STCW	International Convention on Standards of Training Certification and Watchkeeping for Seafarers		Amendments from 2007 onwards: No Amendments	

Purpose

3 The ability to be deployed to any area of interest to the Navy defined in the Concept of Operations Statement shall be maintained and the navigation equipment and sensors fit and on-board personnel shall provide:

3.1 the capability to conduct safe navigation as required by SOLAS, the COLREGS and, where applicable, the HSC Code. This capability must be entirely independent from the military combat systems functionality;

Note: The requirements of Chapter IV and Chapter VI, Regulation 10 which relate to navigation equipment and systems shall be met.

3.2 on-board safety communications including internal communications, main broadcast, Bridge Navigation Watch Alarm System (if fitted) and portable communications equipment;

3.3 qualified personnel certified to operate and, if required, maintain the NAVTEX equipment to ITU Radio Regulations.

General Performance Requirements

4 The vessel's Concept of Operations Statement document defines how the navigation systems of the ship are to be operated and maintained throughout the life of the ship and is to be shared by the Naval Administration and, where appointed, its Recognised Organisation.

Solutions

5 Verification that the ship complies with this chapter shall be by the Naval Administration. Provision of evidence to support verification shall be by the owner. All decisions that affect compliance with the requirements of this chapter shall be recorded at all stages from concept to disposal and these records be maintained throughout the life of the ship.

Regulation 2 Working Environment in Navigation Related Spaces

Functional Objective

1 The design of compartments, their equipment and supporting services, related to the navigation of the ship, shall provide a working environment which facilitates the sustained maintenance of an effective lookout and conduct of safe navigation.

Performance Requirements

2 The bridge shall be provided with a Heating, Ventilation and Air Conditioning (HVAC) system, or equivalent, that maintains the ventilation, temperature and humidity of the navigation Bridge and associated compartments within a comfortable range.

Note: The HVAC system shall also comply with Chapter IV Regulation 23 of the Code.

2.1 Control of the HVAC as it affects the Bridge shall be available on the Bridge.

3 The Bridge, associated compartments, and systems installed on the Bridge, shall be provided with lighting and illumination systems that enable Bridge personnel to perform all Bridge tasks, including maintenance and chartwork, by day and night.

3.1 Lighting systems required outside of the Bridge shall be designed such that they do not impair safe navigation. Alternatively where a lighting system is required which could have such an impact, facilities are to be provided to ensure that their use does not impair safe navigation.

4 Noise levels within the enclosed bridge during good weather are to be sufficiently low as to enable operators carrying out navigation duties to concentrate for long periods of time and comfortably hold conversations with Bridge personnel for the sustained conduct of safe navigation.

5 The effects of direct and indirect glare are to be reduced to a minimum.

6 Where multiple consoles or workstations are to be installed in the navigation Bridge they shall be of a common design.

7 The arrangement of workstations remote from the Bridge, but having the same functionality as those used by Bridge operators, shall be the same to prevent mal-operation.

8 A system shall be installed is to monitor bridge activity and detect operator disability which could lead to marine accidents.

9 The wheelhouse passageways, entrances and areas around workstations, windows and doors are to be so arranged as to enable personnel to move or stand safely in bad weather.

10 Personnel safety equipment stored on the Bridge shall be readily accessible.

11 Facilities to promote the efficiency and alertness of the Bridge operators are to be provided on the Bridge or adjacent to the Bridge on the Bridge deck.

Solutions

12 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

13 The Bridge and associated compartments shall be provided with HVAC that complies ISO 8468: 2007, Ships and marine technology – Ships bridge layout and associated equipment – Requirements and guidelines.

14 The ship shall be provided with lighting arrangements in the navigation Bridge and associated compartments that comply with ISO 8468: 2007, Ships and marine technology – Ships bridge layout and associated equipment – Requirements and guidelines.

15 The design and fitting out of the navigation Bridge shall be such that noise levels comply with the requirements of ISO 8468: 2007, Ships and marine technology – Ships bridge layout and associated equipment – Requirements and guidelines.

16 In accordance with ISO 8468: 2007, Ships and marine technology – Ships bridge layout and associated equipment – Requirements and guidelines, utilization of dark coloured, non-reflective or matt surfaces shall be made for bulkheads, deckheads, consoles, chart tables and other major fittings in order to reduce indirect glare so that the information presented on visual display units and instruments shall not be obscured in any lighting conditions.

17 The design of workstations or consoles shall be common throughout the ship so as to avoid confusion and mal-operation.

18 The ship shall be provided with a Navigation Watch Alarm System that complies with the latest version of IEC 62616 - Bridge navigational watch alarm system (BNWAS):

Note: The system shall also comply with Chapter VIII Regulation 7 Paragraph 11 of this Code

19 The navigation Bridge and associated compartments shall be provided with non-slip deck surfaces free of trip hazards, and handrails, hand grabs or other means in accordance with ISO 8468: 2007, Ships and marine technology – Ships bridge layout and associated equipment – Requirements and guidelines.

20 All doors shall be operable with one hand and shall have 'holdbacks' in the open position. External doors shall not be self-closing.

21 The Bridge design shall include appropriate stowages for prescribed personnel safety equipment.

Note: They shall also comply with Chapter VII Regulation 9 of the Code.

22 Design of the Bridge deck shall include toilet facilities, and the means of making warm or cold drinks, on the Bridge or immediately adjacent to it in accordance with ISO 8468: 2007, Ships and marine technology – Ships bridge layout and associated equipment – Requirements and guidelines.

Regulation 3 Bridge Design and Arrangement

Functional Objective

1 The design and arrangement of a ship's navigation Bridge, related control positions and spaces, navigational systems and equipment shall ensure that the operators are enabled to perform expeditious, continuous and effective information processing and decision making for maintaining a proper lookout and the conduct of safe navigation without fatigue.

Performance Requirements

2 The design of the ship's Bridge, navigational systems and equipment, and the arrangement of those systems and equipment within the Bridge shall:

2.1 facilitate the tasks to be performed by the Bridge team and pilot in making full appraisal of the situation and in navigating the ship safely under all operational conditions;

2.2 promote effective and safe Bridge Resource Management;

2.3 enable the Bridge team and pilot to have convenient and continuous access to essential information which is presented in a clear, unambiguous manner, using standard symbols and coding systems for controls and displays;

2.4 indicate the operational status of automated functions and integrated components, systems and/or sub-systems;

2.5 allow for expeditious, continuous and effective information processing and decision making by the Bridge team and pilot;

2.6 prevent, or minimise, excessive or unnecessary work and any conditions or distractions on the Bridge which may cause fatigue or interfere with the vigilance of the Bridge team and the pilot (especially light pollution which compromises the ocular dark adaptation of the Bridge team or is incompatible with the use of Night Vision devices);

2.7 minimise the risk of human error and detect such error, if it occurs, through monitoring and alarm systems, in time for the Bridge team and pilot to take appropriate action.

3 The ship's navigation Bridge should (and in vessels over 55 metres in length, shall) provide a 360 degree view of the horizon to a standing operator with a maximum of one change of position within the enclosed area.

Note: External doors shall not impede this visibility requirement.

4 A means of viewing the ship's side at the waterline shall be provided on the Bridge.

5 There shall be a method of observing the launch positions (davits) of boats from the Bridge and Bridge wing by day and night.

6 There shall be a method of observing the flight deck by day and night.

7 Where a rescue station from which the Swimmer of the Watch will operate is provided in accordance with Chapter VII, Regulation 27, Paragraph 10, this position shall be visible from the Bridge or Bridge wings.

8 Windows shall meet the following requirements:

8.1 there should be provision of 'look up' windows, inclined from the vertical plane, top in, at an angle of not less than 10 deg and not more than 40 deg, around the covered wheelhouse, especially in Destroyer and Frigate sized vessels and smaller vessels;

8.2 there shall be a clear view through at least two of the navigation Bridge front windows and depending on the Bridge configuration, an additional number of clear view windows shall be provided at all times, regardless of weather conditions.

9 Ships of unconventional design which, in the opinion of the Naval Administration, cannot comply fully with this Code shall be provided with a level of visibility that is as near as practicable to that prescribed in this Code.

10 Electrical and electronic equipment, including portable electrical and electronic equipment, provided for use on, or near, the Bridge shall:

10.1 have been tested for electromagnetic compatibility;

10.2 be so installed or operated that electromagnetic interference does not affect the proper function of navigational systems and equipment;

10.3 in the case of passive electronic equipment, be provided with an exemption statement in place of evidence of electromagnetic compatibility (e.g. cables, purely resistive loads and batteries).

11 The ship's navigation bridge shall be arranged such that access to it and the bridge wings, movement around and escape from it is unobstructed and hazard free.

Note: Access shall also comply with Chapter VII Regulation 16 of this Code.

12 Workstations for navigation are to be arranged to facilitate the conduct of safe navigation, manoeuvring and other functions allocated to the Bridge from any normal working position.

13 It shall be possible to control the steering and propulsion from the navigation Bridge in accordance with the requirements of Regulation 5.

14 At least one of the screens for presentation of WECDIS or radar shall be mounted near the conning position in 'portrait' orientation in order to optimise the functionality of the WECDIS Anti-Grounding Cone (AGC) and promote 'head up' working.

15 Where a chair is installed at a workstation, operations shall be capable of being conducted in both the standing and seated positions by operators of any size.

16 Bridge seating shall meet the shock and vibration criteria required of seats provided in the Operations, and other Control Rooms.

17 Sufficient provision for the temporary, secure stowage and immediate access to equipment such as AGR bags, Action overalls, Anti-flash, etc. shall be made.

18 The navigation Bridge and its external extensions shall be arranged such that an operator has immediate access to the vessel's internal communications network.

Note: Access shall also comply with Chapter VIII Regulation 6 of this Code.

19 The navigation Bridge and its external extensions shall be arranged such that an operator has immediate access to the vessel's external communications network.

Note: Access shall also comply with Chapter VIII Regulation 2 of this Code.

20 At least two independent methods shall be provided for communicating orders from the navigation Bridge to the position in the machinery space or control room from which the speed and direction of thrust of the propellers are normally controlled; one of these shall be an engine-room telegraph which provides visual indication of the orders and responses both in the machinery spaces and on the navigation Bridge. Appropriate means of communication shall be provided from the navigation Bridge to any other position from which the speed or direction of the thrust of the propellers may be controlled.

Note: Communications shall also comply with Chapter IV Regulations 5 and 13 of this Code

21 At least two independent methods of communication shall be provided between the navigation Bridge and the steering gear compartment. Appropriate means of communication shall be provided from the navigation Bridge to any other position from which the steering gear may be controlled.

Note: Communications shall also comply with Chapter IV Regulations 5 and 13 of this Code

22 Alarms associated with navigation equipment are to be both audible and visual and are to be centralised for efficient identification and management. Repeater displays may be fitted on the Bridge wings and at other appropriate positions on the Bridge where necessary. At least the following alarms are to be provided:

22.1 Closest Point of Approach;

22.2 Shallow Depth;

22.3 Waypoint approaching (where automatic track follow is provided);

22.4 Off-course;

22.5 Off-track (where automatic track following is provided);

22.6 Steering alarms;

22.7 Navigation light failure;

22.8 Gyro failure;

22.9 Watch safety system failure (where provided);

22.10 Power supply failure.

Note: Alarm systems shall also comply with Regulation 2 and Chapter IV Regulation 14 of this Code.

23 In addition to any displays presented as part of an integrated navigation or control system the following indicators are to be provided directly from the relevant machinery or equipment installation:

23.1 for controllable pitch propellers, the propeller pitch applied;

23.2 Speed and direction of shaft rotation;

23.3 where lateral or directionally controllable thrusters are installed, the proportion of full thrust being generated;

23.4 where, lateral or directionally controllable thrusters are installed, the direction of thrust;

23.5 for each rudder, the rudder angle demanded and achieved;

23.6 rate of turn;

23.7 heading;

23.8 the status of electrical motors of electric and electrohydraulic steering gear.

24 An emergency source of power capable of supporting for up to 36 hours navigation equipment and systems shall be available to the navigation Bridge and extensions.

Note: Power supplies shall also comply with Chapter VIII Regulation 4 and Chapter IV Regulation 9 of this Code

25 Local uninterruptable power supplies capable of supporting for up to 30 minutes navigation and safety equipment and systems susceptible to discontinuities in power supply shall be provided.

26 Provision shall be made for temporary stowage in the Bridge of not less than 12 hand launched, red para-illuminant flares.

27 The navigation Bridge and extensions and other navigation related spaces shall be protected against the ingress of solids, liquids and gases. The Naval Administration may also require these spaces to be protected against Chemical, Biological, Radiological and Nuclear (CBRN) hazards.

Note: Ingress protection shall also comply with Chapter II, Chapter III Regulations 2 and 8 and Chapter IV Regulation 23 of this Code.

28 Equipment and systems provided for the safety of navigation shall be protected against the of ingress of solids, liquids and gases appropriate to their location. The Naval Administration may also require these equipments and systems to be protected against CBRN hazards.

Solutions

29 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

30 The Bridge and Bridge wings shall be designed so as to comply with ISO 8468: 2007, Ships and marine technology – Ships bridge layout and associated equipment – Requirements and guidelines, the latest version of IEC 62616 - Bridge navigational watch alarm system (BNWAS), ISO 22555: 2007 – Ships and marine technology – Propeller pitch indicators, ISO 22554: 2007 – Ships and marine technology – Propeller shaft revolution indicators – Electric type and electronic type, ISO 20673: 2007 – Ships and marine technology – Electric rudder angle indicators, ISO 20672: 2007 – Ships and marine technology – Rate of turn indicators, latest version of IEC 60945, Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results and latest version of IEC 61162 Maritime navigation and radiocommunication equipment and systems – Digital interfaces series, SN.1/Circ.288 (Bridge Equipment and Systems) and MSC.302(87) (Bridge Alert Management) paying particular attention to:

30.1 The design shall include space for the temporary stowage of portable equipment, instruments, foul weather clothing, hooks, cupboards, seat backs, etc;

30.2 There shall be a clear passage from bridge wing to bridge wing that is at least 1200 mm wide that is clear of the main conning workstation;

30.3 There shall be a direct access to the front of the Bridge from the main conning position of not less than 800 mm width;

30.4 Irrespective of other performance criteria, all navigation related equipment installed shall be Type Approved against the appropriate International Standard and shown also to comply when part of an integrated system;

30.5 Where the Bridge has open Bridge wings, access to the Bridge from the upper deck shall be possible via both wings;

30.6 The provision of a centralized alarm management panel adjacent to the Officer Of the Watch's (OOW's) or primary conning position.

31 There shall be direct line of view of boat launch positions from the Bridge and Bridge wing. Where direct line of view is not possible a near field surveillance camera system shall be installed.

32 There shall be direct line of view of the flight deck from the Bridge and Bridge wing. Where direct line of view is not possible a near field surveillance camera system shall be installed.

33 Where the design includes an Integrated Navigational Bridge System (INBS) it shall be built in accordance with IEC 61209: 1999 Maritime navigation and radiocommunication equipment and systems – Integrated bridge systems (IBS) – Operational and performance requirements, methods of testing and required test results.

34 Means of communicating between the navigation Bridge, its outstations and positions from which control of steering and machinery can be exercised shall be considered as part of the whole ship internal communications matrix.

35 Utilisation of the same type of seating, and the method of securing it, as used in the Operations Room and other Control Rooms.

36 The vessel's power generation and distribution system shall be so designed that there are at least two sources of supply from the primary system to all equipment and that there is also an emergency source, independent of the primary system. Equipment susceptible to fluctuation or discontinuity in supply shall be provided with a dedicated UPS.

37 An open basket type stowage, or equivalent, with sufficient capacity for a box of flares in their primary packaging shall be provided.

38 The Bridge structure and its equipment shall be constructed in compliance with the Ingress Protection Code appropriate to their location.

Regulation 4 Navigation Safety - Geospatial, Temporal & Environmental Awareness

Functional Objective

1 The ship shall be provided with sufficient sensors and systems to continuously and accurately determine, display and record its present time, position, orientation and movement in relation to the Earth and the rate of change of the parameters measured to ensure safe, independent navigation.

2 The ship shall be provided with appropriate sensors and processing equipment to adequately measure, analyse, assess, display and record its physical environment for the conduct of safe navigation.

Performance Requirements

3 The ship shall have one, or more, precise time generator(s), or other means, suitable for maintaining and displaying platform time continuously throughout the intended voyage, which automatically synchronises ship's time with UTC and may be interfaced with the GNSS or terrestrial navigation receivers installed.

4 The ship, shall have the means to transmit heading information for input to, at least, a display at the main steering position, the navigational radar, an electronic plotting aid, or equivalent, the WECDIS, (W)AIS equipment and a recording facility. The heading shall be correctable to True at all times.

5 The ship shall be able to determine, at all times, its heading and display the reading at the main, secondary and emergency steering positions. The equipment shall be capable of correcting headings to True at all times.

6 The ship shall be provided with one, or more, speed and distance measuring equipment (SDME), or other means, to be able to determine, display and record its speed and distance travelled through the water in both the fore and aft and athwartships axes and transmit speed information for input to, at least, the navigational radar, an electronic plotting aid, or equivalent, and the WECDIS, (W)AIS and recording equipment.

7 The ship shall have at least one echo sounder, or other device, for measuring, displaying and recording the available depth of water. Vessels operating in Polar waters shall have two. The equipment shall be capable of transmitting depth information to the ship's WECDIS and Voyage Data Recorder (VDR).

8 The ship shall have a method of measuring, displaying and recording its rate of turn and transmit rate of turn information for input to, at least, the navigational radar, automatic radar plotting aid, or equivalent, and the (W)AIS and VDR equipment.

9 The ship shall have one, or more, receivers for one, or more, global navigation satellite systems (GNSS), suitable for use at all times throughout the intended voyage, including the capability to utilise 'differential' data, which automatically establishes and updates the ship's position and transmits positional information for input to, at least, the navigational radar, an electronic plotting aid, or equivalent, and the WECDIS, (W)AIS, appropriate GMDSS transmitters and VDR equipment. The equipment may be combined with the receiver(s) for civil terrestrial radionavigation installed.

Note: The receiver(s) shall also comply with Chapter VIII Regulation 5 Paragraph 2 of this Code.

Note: The Naval Administration shall determine whether the connection is left to stand, is capable of being interrupted as dictated by naval operations, or is permanently disabled upon the justification that, in case of distress, ship's position will be passed by military means.

10 Where required by the Concept of Operations Statement, ships shall have two, or more, inertial navigation systems, suitable for use at all times throughout the intended voyage, including the capability to navigate at Latitudes higher than 75 degrees, which automatically establishes and updates the ship's position and transmits positional information for input to, at least, the navigational radar, an automatic radar plotting aid, or equivalent, and the WECDIS, (W)AIS and VDR equipment.

11 The ship shall have one, or more, receivers for one, or more, terrestrial navigation systems, suitable for use during the intended voyage, including the capability to utilise 'differential' data, which automatically establishes and updates the ship's position and transmits positional information for input to, at least, the navigational radar, an electronic plotting aid, or equivalent, and the WECDIS, (W)AIS, appropriate GMDSS transmitters and VDR equipment. The equipment may be combined with the receiver(s) for civil GNSS installed.

Note: The receiver(s) shall also comply with Chapter VIII Regulation 5 Paragraph 2 of this Code.

12 The ship shall have one, or more, receivers for one, or more, global navigation satellite systems suitable for use at all times throughout the intended voyage, including the capability to utilise 'limited access signals' (such as PPS GPS), which automatically establishes and updates the ship's position and transmits positional information for input to, at least, the navigational radar, an electronic plotting aid, or equivalent, and the WECDIS, (W)AIS and VDR equipment.

13 The ship shall have one, or more, gyro-compass bearing repeaters, or other means, to take bearings over an arc of the horizon of 360 degrees from within the enclosed wheelhouse, using the gyro-compass or other means. The repeater shall be directly connected to the WECDIS. The equipment shall be capable of correcting bearings to True at all times.

14 The ship shall, in addition to the Transmitting Heading Device (THD), or other means, have a gyro-compass, or other means, to determine and display its heading by shipborne non-magnetic means, clearly readable by the helmsman at each steering position. These means shall also transmit heading information for input to the navigational radar, WECDIS, WAIS, automatic radar plotting aid and recording equipment. The gyro, or equivalent, shall be capable of operation at high latitudes (above 75 degrees).

15 The ship shall be fitted with a warship electronic chart display and information system (WECDIS) to facilitate the planning, execution and recording of an intended voyage so as to take account of relevant ship's routing systems, ensure sufficient searoom for safe passage, anticipate all known navigational hazards and adverse weather conditions, take into account the marine environmental protection measures that apply, and avoid, as far as possible, actions and activities which could cause damage to the environment.

Note: The Naval Administration shall define the extent of the 'warship' functionalities as captured in STANAG 4564.

Note: If a single WECDIS is fitted a back-up system is required; either a further independent WECDIS or paper charts.

16 The WECDIS equipment provided shall be capable of use for navigation at high latitude (above 75 degrees). The ship shall be provided with adequate and up to date nautical publications, or other means, necessary for the planning and execution of the intended voyage. Access to the publications shall not be denied in the event of complete WECDIS failure.

17 The ship shall have a ship's Log-book, or other means, to retain onboard a record of navigational activities and incidents which are of importance to safety of navigation and which must contain sufficient detail to restore a complete record of the voyage. When such information is not contained in the ship's log-book it shall be maintained in another form approved by the Naval Administration.

18 Ships shall have an Operator Guidance System, or other means, to measure, display, record and analyse, in real time, the vessel's behaviour in the prevailing conditions of wind and sea so as to better determine its stability and identify combinations of course and speed which will preserve stability and enable the safe conduct of evolutions constrained by motion limitations.

19 The ship shall have a device for measuring, displaying and recording the angle of heel. The equipment may be part of the Operator Guidance System, if fitted.

20 The ship shall have a device for measuring, displaying and recording the angle of pitch. The equipment may be part of the Operator Guidance System, if fitted.

21 The ship shall have means to collect, examine, disseminate and exchange high resolution meteorological and ice data, including imagery, at sea. The ship shall have a facsimile receiver, or other means, to receive, in both text and graphic form, meteorological information and forecasts and, when appropriate, Ice Patrol products, some of which should be capable of being displayed on WECDIS. The ship shall have sufficient, tested, meteorological instruments (such as a barometer, a barograph, a psychrometer, a hygrometer, thermometers, an anemometer and suitable apparatus for measuring sea temperature) to take, record, and transmit meteorological observations at the main standard times for surface synoptic observations.

22 The ship shall be provided with a receiver capable of receiving international NAVTEX service broadcasts automatically if the naval ship is engaged on voyages in any area in which an international NAVTEX service is provided. The NAVTEX receiver shall be capable of exchanging data directly with the WECDIS such that message content will be automatically displayed at a chart presentation. The receiver may be part of the vessel's GMDSS installation.

Note: The receiver(s) shall also comply with Chapter VIII Regulation 2 Paragraph 3.4 of this Code

23 The ship shall be provided with adequate and up to date nautical charts and publications, or other means, necessary for the planning and execution of the intended voyage so as to take account of relevant ship's routing systems, ensure sufficient searoom for safe passage, anticipate all known navigational hazards and adverse weather conditions, take into account the marine environmental protection measures that apply, and avoid, as far as possible, actions and activities which could cause damage to the environment, whilst navigating to a safe haven in the event of complete loss of WECDIS. If an appropriate folio of paper nautical charts is provided the navigation Bridge shall be provided with a suitable table and storage for chartwork.

Solutions

24 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

25 All equipment provided for sensing, measuring, processing and recording shall be compliant with the latest version of IEC 60945, Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results and the latest version of IEC 61162 Maritime navigation and radiocommunication equipment and systems – Digital interfaces series.

26 The ship shall be provided with one, or more, precise time and frequency generating equipment to a specification agreed with the Naval Administration.

27 The ship, if not fitted with a gyro compass, shall be provided with one, or more, transmitting heading device compliant with ISO 22090:2002, Ships and marine technology – Transmitting heading devices (THDs) series and ISO 11606 – Ships and marine technology – Marine electromagnetic compasses.

28 The ship shall be provided with a properly adjusted standard magnetic compass independent of any primary power supply, or other means approved by the Naval Administration, compliant with ISO 1069: 1973, Magnetic compasses and binnacles for sea navigation - Vocabulary or ISO 25862: 2009 – Ships and marine technology – Marine magnetic compasses, binnacles and azimuth reading devices as appropriate.

29 The ship shall be provided with Speed and Distance Measuring Equipment compliant with the latest version of IEC 61023, Maritime navigation and radiocommunication equipment and systems - Marine speed and distance measuring equipment (SDME) - Performance requirements, methods of testing and required test results.

30 The ship shall be provided with Echo Sounders compliant with ISO 9875: 2000, Ships and marine technology – Marine echo-sounding equipment.

31 The ship shall be provided with a Rate of Turn indicator compliant with ISO 20672: 2007, Ships and marine technology – Rate of turn indicators.

32 The ship shall be provided with GNSS receivers compliant with the latest version of IEC 61108 Maritime navigation and radiocommunication equipment and systems - Global navigation satellite systems (GNSS) series. Receivers intended to utilise ‘limited access’ signals shall also comply with additional Defence standards as agreed with the Naval Administration.

33 The ship shall be provided with terrestrial radionavigation receivers compliant with the latest version of IEC 61075, Loran-C receivers for ships - Minimum performance standards - Methods of testing and required test results.

34 The ship shall be provided with one, or more, inertial navigation systems to a specification agreed with the Naval Administration.

35 The ship shall be provided with gyro repeaters compliant with ISO 449: 2000, Ships and Marine Technology – Magnetic compasses, binnacles and azimuth reading devices – Class A, ISO 613: 2001, Ships and Marine Technology – Magnetic compasses, binnacles and azimuth reading devices – Class B, ISO 25862: 2009, Ships and Marine Technology – Marine Magnetic compasses, binnacles and azimuth reading devices.

36 The ship shall be provided with gyro compasses compliant with ISO 8728: 1999, Ships and marine technology – Marine gyro-compasses or ISO 16328: 2001, Ships and Marine Technology – gyro-compasses for high speed craft as appropriate.

37 The ship shall be provided with a warship electronic chart display and information system compliant with the latest version of IEC 61174, Maritime navigation and radiocommunication equipment and systems - Electronic chart display and information system (ECDIS) - Operational and performance requirements, methods of testing and required test results , ISO 22472; 2006, Ships and marine technology – Guidelines for the operation and installation of voyage data recorders and such additional Defence standards as agreed with the Naval Administration.

38 The ship shall be provided with a means of automatically recording navigation related information compliant with the latest version of IEC 61996, Maritime navigation and radiocommunication equipment and systems - Shipborne voyage data recorder (VDR) - Part 1: Voyage data recorder (VDR) - Performance requirements, methods of testing and required test results and ISO 22472; 2006, Ships and marine technology – Guidelines for the operation and installation of voyage data recorders if a programmable system.

39 The ship shall be provided with an Operator Guidance System to a specification agreed with the Naval Administration. A programmable system shall also be compliant with ISO 22472; 2006, Ships and marine technology – Guidelines for the operation and installation of voyage data recorders.

40 The ship shall be provided with analogue roll and pitch indicators readily visible at the conning position.

41 The ship shall be provided with a meteorological data facsimile receiver or equivalent compliant with the Recommendations of the CCITT committee of the ITU and/or a meteorological data suite as agreed with the Naval Administration.

42 The ship shall be provided with suitable certified measuring instruments.

43 The ship shall be provided with a NAVTEX receiver complaint with the latest version of IEC 61097-6, Global maritime distress and safety system (GMDSS) - Part 6: Narrowband direct-printing telegraph equipment for the reception of navigational and meteorological warnings and urgent information to ships (NAVTEX) The latest version of ETSI 300 065-1; 2009, Electromagnetic compatibility and Radio spectrum Matters (ERM);Narrow-band direct-printing telegraph equipment for receiving meteorological or navigational information (NAVTEX);Part 1: Technical characteristics and methods of measurement and ETSI 301 843-4: 2004, Electromagnetic compatibility and Radio spectrum Matters (ERM);ElectroMagnetic Compatibility (EMC) standard for marine radio equipment and services; Part 4: Specific conditions for Narrow-Band Direct-Printing (NBDP) NAVTEX receivers.

44 The ship shall be provided with nautical publications and charts issued by a recognised Hydrographic Office to augment or complement the WECDIS. Where a Chart Table is fitted it shall comply with the dimensions in ISO 8468: 2007, Ships and marine technology – Ships bridge layout and associated equipment – Requirements and guidelines.

Regulation 5 Operation & Control Systems

Functional Objective

1 A ship shall be provided with appropriate means to control propulsion and manoeuvring, navigation and other systems from the Bridge for the conduct of safe navigation, collision avoidance and operational evolutions.

Performance Requirements

2 An engine-room telegraph (or equivalent) shall be provided between the navigation Bridge and the machinery space.

3 The vessel shall be provided with a means of operating the steering system by hand on the navigation Bridge. The steering system shall be capable of being brought into operation from a position on the navigation Bridge. The system shall be so arranged as to permit, at least, the testing routines laid down in SOLAS Chapter V Regulation 26.

Note: The steering system shall also comply with Chapter IV of this Code.

4 The vessel shall be provided with a sufficient control system, or other means, to enable safe manoeuvring of the vessel from the navigation Bridge or Bridge wings. In particular the control system shall include a means of ordering a reversal of thrust so as to bring the ship to rest within a reasonable distance.

5 The vessel shall be provided with a heading or track control system, or other means, to automatically control and keep to a heading and/or track.

6 A Pilot Information Card shall be prepared for the vessel and displayed on the navigation Bridge of the vessel.

7 When its role demands, the vessel is to be provided with an appropriate, discrete propulsion and manoeuvring control system (Dynamic Positioning system) or equivalent, integrated with the navigation system. The installation of such a system shall not prevent the conventional operation of propulsion and manoeuvring systems when required.

8 A system for controlling and monitoring the vessel's navigation and additional signal light arrangements shall be provided. The system shall enable individual lamps to be activated, dimmed, and (where multi-colour lanterns are installed) colour selected. Provision shall be made for the operation of discrete sets of lights. The system shall be capable of automatically changing over lanterns where the selected one has failed. It shall also enable the OOW to control lights from any Bridge workstation. It shall be possible to control the navigation lights from a position other than the navigation Bridge. The system shall include a 'master control panel'. Operation of the master control panel shall not be dependent upon operation of any other bridge system.

9 The vessel shall be provided with at least one adequate searchlight controllable from the navigation Bridge. The vessel shall be provided with a portable daylight signalling lamp, to communicate by light during night and day, maintained ready for use on the navigation Bridge.

10 Provision shall be made for the OOW to have overriding control of all lighting on the upper deck (working lights, screen lighting, red lighting).

11 A system for controlling and monitoring the vessel's sound signalling arrangements shall be provided. The system shall include means for the automatic sounding of prescribed sound signals and enable the manual operation of the combined whistle arrangement or individual whistles. One of the control positions is to be located adjacent to the helmsman's workstation and the primary conning position.

12 Facilities to operate the Emergency Alarm Signal from the navigation Bridge shall be provided.

Note: The system shall also comply with Chapter VII Regulation 10 of this Code

13 Facilities to operate the Public Address System from the navigation Bridge (including the Bridge wings and roof) shall be provided.

Note: The system shall also comply with Chapter VII Regulations 10 and 11 and Chapter VIII Regulation 7 of this Code

14 A fixed or portable emergency means of two-way communication between emergency control stations, muster and embarkation stations and strategic positions on board (see Chapter VII) shall be provided from the navigation Bridge.

Note: The system shall also comply with Chapter VII Regulation 12 and Chapter VIII Regulations 6 and 8 of this Code

15 A means of communicating between the navigation Bridge and the machinery control position shall be provided. Facilities to operate the Machinery Broadcast (or equivalent) from the navigation Bridge shall be provided. A means of communicating between the navigation Bridge and the steering gear compartments and the emergency steering positions shall be provided. Facilities to operate the Conning Broadcast (or equivalent) from the navigation Bridge shall be provided.

Note: The system shall also comply with Chapter VIII Regulation 6 of this Code

16 The vessel shall be provided with means for controlling IMM VHF radiotelephone channels at the conning position and from the Bridge wings.

Note: The system shall also comply with Chapter VIII Regulation 2 of this Code

17 The vessel may be provided with a 'distress panel', or other means, on the navigation Bridge, which, when operated, initiates a distress alert using all radiocommunications installations fitted in the vessel.

Note: The system shall also comply with Chapter VIII Regulation 2 of this Code

18 The vessel may be provided with a ship security system, or other means, controllable from the navigation Bridge and at least one other location.

Note: The system shall also comply with Chapter VIII of this Code

19 A list of the operational limitations applicable to the vessel shall be prepared and be readily available to the Commanding Officer onboard.

20 The vessel may, if capable of operating rotary wing aircraft from a purpose installed Flight Deck, be fitted with a means of exchanging visual signals between the navigation Bridge, Flight Deck and helicopter controller's position for conducting aviation operations.

21 The vessel may be fitted with a means of exchanging visual signals between the navigation Bridge, seaboat/rescue craft and other craft davit positions for conducting small craft operations.

22 The vessel may be fitted with a means of exchanging visual signals between the navigation Bridge and the cable or manoevring deck for controlling anchoring.

Solutions

23 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

24 The steering gear operating and control system shall be compliant with the principles laid down in IMO Resolution MSC 137(76).

25 There shall be a manoeuvring control system compliant with the principles laid down in IMO Resolution MSC 137(76).

26 The vessel shall be provided with a heading or track control system compliant with one of the latest version of IEC 62065, Maritime navigation and radiocommunication equipment and systems – Track control systems – Operational and performance, ISO 16329: 2003, Ships and marine technology – Heading control systems for high speed craft or ISO 11674: 2006, Ships and marine technology – Heading control systems as appropriate to the ship type.

27 A 'Pilot Information Card' shall be prepared for the vessel, suitable for permanent display on the navigation Bridge, adjacent to the conning and pilot's positions compliant with the requirements of IMO Resolution A.601(15).

28 A vessel intended to conduct Dynamic Positioning (DP) operations shall be provided with a DP control system compliant with a standard agreed by the Naval Administration.

29 The vessel shall be provided with a control panel for the monitoring and control of the navigation light arrangements, readily available to the OOW and independent of any other control system and compliant with an agreed Classification Society's rules and any additional requirements of the Naval Administration.

30 The vessel shall be provided with at least one searchlight and at least one daylight signalling lamp, or a lamp or lamps which combine both functions and are compliant with ISO 17884: 2004, Ships and marine technology – Searchlights for high speed craft.

31 The vessel shall be provided with at least one portable daylight signalling lamp operable from the navigation Bridge, which shall comply with a performance standard agreed with the Naval Administration.

32 The vessel shall be provided with a control panel for the monitoring and control of those Upper Deck lights (working lights, screen lighting, red lighting) which may interfere with the maintenance of lookout or the conduct of safe navigation, readily available to the OOW and independent of any other control system and compliant with an agreed Classification Society's rules and any additional requirements of the Naval Administration.

33 The vessel shall be provided with a control system for sound signalling arrangements compliant with the rules of a classification Society as agreed with the Naval Authority.

34 The vessel's Emergency Alarm System and operating functions shall be installed so as to be compliant with Chapter VII of this Code.

35 Control of a Public Address system compliant with the requirements of Chapter VII and VIII of this Code installed in the ship shall be provided from the navigation Bridge.

36 Access to and control of the emergency communications system provided in compliance with Chapter VIII of this Code shall be available in the navigation Bridge.

37 Provision shall be made for control from the Bridge of the means of communication between the navigation Bridge and machinery control positions installed in compliance with Chapter VIII of this Code.

38 Means to control the IMM VHF radio installation provided in accordance with Chapter VIII Regulation 2 of this Code, as approved by the Naval Administration, shall be provided near the conning position in the navigation Bridge and on the Bridge wings.

39 The vessel shall be provided with a GMDSS suite, to be fitted in accordance with Chapter VIII Regulation 2 of this Code, as approved by the Naval Administration.

40 If required by the Naval Administration a ship security system compliant with Chapter VIII of this Code shall be installed.

41 A consolidated list of operational limits applicable to the vessel, its propulsion and steering gear arrangements, anchors and cable and any other data which will assist the Commanding Officer to prevent collision or environmental damage.

42 The vessel may, if capable of operating rotary wing aircraft from a purpose installed Flight Deck, be fitted with a 'Stop/Go' Light system between the navigation Bridge, Flight Deck and helicopter controller's position for conducting aviation operations compliant with a standard or standards agreed with the Naval Administration.

43 The vessel may be fitted with a 'Stop/Go' Light system between the navigation Bridge, seaboat/rescue craft and other craft davit positions for conducting small craft operations compliant with a standard or standards agreed with the Naval Administration.

44 The vessel may be fitted with a 'Stop/Go' light system for controlling anchoring compliant with a standard or standards agreed with the Naval Administration.

Regulation 6 Resilience and Continuous Availability

Functional Objective

1 The ship shall be provided with sufficient equipment to assure that there is resilience and continuous availability in navigation related systems and equipment.

Performance Requirements

2 The vessel's spaces, systems and equipment essential to the maintenance of a proper lookout and the conduct of safe navigation shall be so arranged as to ensure high reliability and minimise the risk of mal-operation.

Note: The measures to ensure continuous availability shall be appropriate to the size, operational role, area of operations and maximum speed of the vessel.

3 Machinery, equipment and systems essential to safe navigation shall be so arranged that, as far as is reasonable and practical, they will continue to function correctly and/or be easy to restore in the event of a minimum of a single operational error and/or system/equipment fault.

4 Equipment necessary for the safety of navigation shall be capable of being accessed for the purpose of routine maintenance to keep it in efficient working order.

5 There shall be reversionary methods of controlling propulsion and manoeuvring systems from the navigation Bridge and alternative remote and local emergency control positions.

Note: The system shall also comply with Chapter IV Regulation 13 of this Code

6 The angular position of the rudder shall be indicated on the navigation Bridge when reversionary modes of control are in use.

Note: The system shall also comply with Chapter IV Regulation 13 of this Code

7 The direction of rotation of shafts and/or thrust of the propulsion system shall be indicated on the navigation Bridge when reversionary modes of control are in use.

Note: The system shall also comply with Chapter IV Regulation 13 of this Code

8 The navigation light arrangement is to be so designed that it is capable of being powered for up to 36 hours independently of the vessel's primary power supplies.

Note: The system shall also comply with Chapter IV Regulation 9 of this Code

9 Portable signalling lamps provided in accordance with Chapter IX Regulation 5 of this Code are to be capable of using an energy source of electrical power not solely dependent upon the vessel's power supply.

Note: The system shall also comply with Chapter IV Regulation 9 of this Code

10 The vessel shall be able to utilise available terrestrial radionavigation services during emergency operation.

Note: The system shall also comply with Chapter IV Regulation 9 of this Code

11 The vessel shall be provided with a means of determining and distributing time independent of GNSS positioning systems and the ship's primary power supply.

Note: The system shall also comply with Chapter IV Regulation 9 of this Code

12 The vessel shall be provided with a means of determining heading and displaying it at the main, secondary and emergency steering positions independent of the primary power supply. The vessel shall be provided with a means for correcting heading and bearings to True at all times.

Note: The system shall also comply with Regulation 4 of this Chapter

13 There shall be an independent back-up WECDIS.

14 If fitted, the Sound Reception System shall be so arranged that it is capable of operating for up to 36 hours independently of the vessel's primary power supply.

15 The internal communications facilities required in an emergency shall be so designed that they are capable of being powered for up to 36 hours independently of the vessel's primary power supply. There shall be a means of communicating between the navigation Bridge, the machinery space and the steering gear compartment that is independent of the primary power supply.

Note: The system shall also comply with Chapter IV Regulation 9 and Chapter VIII Regulation 6 of this Code

16 When installed under Regulation 5 of this Chapter, a BNWAS shall be capable of being powered for up to 36 hours independently of the vessel's primary power supply.

Solutions

17 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

18 The provision of a compartment to be a navigation Bridge arranged in compliance with ISO 8468: 2007, Ships and marine technology – Ships bridge layout and associated equipment – Requirements and guidelines.

19 As agreed with the Naval Administration the provision of an external Emergency Conning position arranged with the minimum facilities to exercise control of the vessel's manoeuvring and maintain a proper lookout.

20 The provision of duplicate systems, power supplies , internal communications bearers and instrumentation, reversionary modes of control, alternative control locations and means of automatic reinstatement after loss and restoration of power supplies shall be compliant with the appropriate international standards.

Note: The electrical distribution system shall also comply with Chapter IV Regulation 9 and 10 of this Code

21 Use of intelligent control systems, safety interlocks, consideration of the human element in the design process.

22 The vessel shall be provided with an independent time (and, if necessary, frequency) generating system. The system shall have at least one alternative power source to the primary supply.

23 The vessel shall be provided with a properly adjusted standard magnetic compass, or other means, compliant with ISO 449: 2000, Ships and marine technology – Marine magnetic compasses, binnacles and azimuth reading devices – Class A or ISO 613: 2000, Ships and marine technology – Marine magnetic compasses, binnacles and azimuth reading devices – Class B, approved by the Naval Administration, independent of the primary power supply. The vessel shall be provided with a means for correcting heading and bearings to True at all times.

24 The navigation Bridge and related systems shall be provided with primary, alternative and emergency power supplies such that safety of navigation is capable of being maintained in a 'dead ship' condition.

25 Equipment and systems are to be routinely maintained and surveyed.

Regulation 7 Integrated Bridge

Functional Objective

1 If an Integrated Bridge System (IBS), Integrated Navigation System (INS), or both (INBS), is installed, the system shall be capable of presenting all relevant information necessary for the conduct of safe navigation, manoeuvring and collision avoidance to ensure that additional hazards are not introduced as a result of installing or operating the system.

Performance Requirements

2 The INBS shall be designed, constructed and able to be maintained so as to maintain a proper lookout, sustain safe conduct of navigation and manoeuvre as required.

Note: The system shall also comply with Regulation 1 paragraph 3 of this Chapter.

3 The INBS shall be so arranged that its performance is at least equivalent to the performance required of the individual components and sub-systems by IMO Resolutions and international standards.

4 The INBS shall be such as to permit operating crew members to perform their duties in a correct manner without unreasonable difficulty, fatigue or concentration, and to minimize the likelihood of injury to operating crew members in both normal and emergency conditions.

5 The INBS shall contain equipment which provides relevant information to enable the officer in charge and any assisting officer or other crew member or pilot to carry out navigational and safety functions safely and efficiently.

6 Instruments, equipment and controls shall be so installed that they remain functional, visible to the operator and operable in heavy seas or after subjection to vibration or shock and will not present a loose object hazard to the operators.

7 All instruments and equipment shall be installed so as to reduce to a minimum the risk of human error.

8 Instruments and equipment shall not be rationalized by sharing functions or by inter-switching.

9 The Bridge operators and/or pilot shall be provided with immediate and easily recognisable annunciation of fault conditions, including human error, in time to take appropriate action and to permit ‘alarm management’.

10 The operators shall be presented with consistent warning annunciation across all the vessel’s systems.

Note: The system shall also comply with Regulation 5 of this Chapter

11 A failure of one part of the system, or parts of other systems integrated with the INBS shall not affect the functionality of other parts except for those functions directly dependent upon the information from the defective part.

12 Programmable electronic systems shall be robust, resilient to at least one operator error and able to continue functioning in extremis.

Note: The system shall also comply with Chapter IV Regulation 15 of this Code

13 The navigation systems and equipment shall be able to function whether or not the ship’s combat functions are available.

Note: Failure of the INBS shall not interfere with the operation of the combat functions.

14 It shall be possible, by a ‘single operator action’ function, to remove all tactical data that may have been transmitted to the INBS by the Command System.

15 The ship shall be provided with appropriate communications equipment, including daylight signalling lamp(s), for the transmission and receipt of distress messages.

Note: The equipment shall also comply with Chapter VIII of this Code

16 The ship shall be provided with appropriate communications equipment, including daylight signalling lamp(s), for the transmission and receipt of lifesaving messages.

Note: The equipment shall also comply with Chapter VIII of this Code

17 Bridge and communications operators shall have instant access to the appropriate message formats and codes for messages relating to distress and lifesaving.

Solutions

18 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society’s rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

19 The INBS shall be designed, constructed and installed in accordance with the latest version of IEC 61209, Maritime navigation and radiocommunication equipment and systems –Integrated bridge systems (IBS) – Operational and performance requirements, methods of testing and required test results, the latest version of IEC 61924, Maritime navigation and radiocommunication equipment and systems – Integrated Navigation Systems, the HSC Paragraph 15.4.11 and the standards for operational performance of the individual components.

20 Instruments, equipment and controls shall be permanently mounted in consoles or other appropriate places, taking into account operation, maintenance and environmental conditions.

21 All instruments and equipment shall be logically grouped according to their functions and shall not be rationalized by sharing functions or by inter-switching.

22 Instruments and equipment shall be plainly visible and easily read in daylight and in darkness, with the minimum risk of confusion under all operating conditions in compliance with the latest version of IEC 62288, Maritime navigation and radiocommunication equipment and systems – Presentation of navigation-related information on shipborne navigational displays – General requirements, methods of testing and required test results and HSC Chapter 15.

23 The INBS shall include a monitoring and alarm system which employs warning annunciations consistent with the monitoring systems of other ship's equipment.

24 The utilisation of programmable electronic systems compliant with ISO 17894: 2005, Ships and marine technology – Computer applications – General principles for the development and use of programmable electronic systems in marine applications.

25 The navigation systems and equipment shall be so arranged that they are not dependent upon ship's combat systems being available.

26 The daylight signalling lamps installed as part of the INBS shall be compliant with ISO 25861: 2007, Ships and marine technology – Navigation – Daylight signalling lamps.

27 Use of intelligent control systems, safety interlocks, consideration of the human element in the design process.

28 The Ship shall be provided with copies of the International Code of Signals and the IAMSAR Manual, in whatever medium they are available, such that they are instantly accessible to the Bridge and communications personnel.

Regulation 8 Data Communication

Functional Objective

1 The ship shall be fitted with equipment and systems in order to receive, transmit, record and analyse data, in recognised formats, relevant to safe navigation.

Performance Requirements

2 The ship shall be fitted with a means for recording all navigation related data for a period of at least 12 hours such that the sensor presentations, internal and external voice communications, Bridge staff decision making process and the vessel's movements might be adequately re-constructed if necessary.

3 The vessel shall be provided with systems/equipment to support the regular reporting of its position and movement to the appropriate command. The position of a naval vessel is confidential, therefore a commercial Long Range Identification and Tracking (LRIT) system is not required for naval ships.

4 Irrespective of size, the ship shall be capable of the automatic transmission and reception of specified navigation and safety-related information to and from appropriately equipped ships, aircraft and shore stations The system shall:

4.1 monitor and track ships;

4.2 be so arranged that information exchanged shall be available to both the Bridge and the Operations Room.

Note: The equipment shall also comply with Chapter VIII of this Code

5 Irrespective of size, the vessel should be capable of the automatic transmission and reception of specified navigation and safety-related information to and from appropriately equipped ships, aircraft and shore stations and able to process that data as part of naval operations. The system shall:

5.1 be able to be controlled from the Operations Room or the Bridge and may be interfaced with, or an integral element of, the Combat System provided that independent operation is possible;

5.2 be capable of providing (at the Commanding Officer's discretion) to similarly fitted ships, aircraft and shore stations the ship's identity, position, course, speed, navigational status and other safety related information;

5.3 receive automatically such information from AIS fitted vessels;

5.4 monitor and track ships;

5.5 exchange data with shore-based facilities.

Note: The equipment shall also comply with Chapter VIII of this Code

6 The ship shall be able to receive automatically maritime safety information on 518 kHz by means of narrow-band direct-printing telegraphy.

7 The vessel shall be provided with sufficient communications facilities to be able to send and receive, by at least two separate and independent means, distress alerts, SAR co-ordination communications, maritime safety information, general radiocommunications and bridge-to-bridge communications.

Note: The equipment shall also comply with Chapter VIII of this Code

8 The vessel shall be provided with the necessary installations to be capable of participating in the exchange of maritime safety information with other ships and shore stations as established under the eNavigation programme.

Solutions

9 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

10 The ship shall be provided with a Voyage Data Recorder (VDR) compliant with the latest version of IEC 61996 – Maritime navigation and radiocommunication equipment and systems – Shipborne voyage data recorder (VDR).

11 The ship shall be provided with an automatic identification system or warship automatic identification system compliant with the latest version of IEC 61993 – Maritime navigation and radiocommunication equipment and systems – Automatic Identification systems (AIS) and other defence standards as agreed with the Naval Administration.

12 The ship shall be provided with eNavigation equipment compliant with international standards.

Regulation 9 Collision Avoidance

Functional Objective

1 The ship shall be provided with sensors, systems and equipment to enable the maintenance of a proper lookout in all circumstances and conditions and the early and accurate determination of the risk of collision.

2 The ship shall be provided with systems and equipment to signal its nature and general intentions so as to enable other shipping to make an early and accurate determination of the risk of collision.

3 The ship shall be provided with equipment and systems in order to manoeuvre as necessary for collision avoidance.

Performance Requirements

4 The ship shall be able to exhibit by day and in twilight periods, in all weathers, where they may best be seen, shapes in order to indicate its size, orientation, activity and limitations so as to facilitate the determination of risk of collision by other mariners.

5 The ship shall be able to exhibit, by day and night, in all weathers, where they may best be seen, lights, in order to indicate its size, orientation, activity and limitations so as to facilitate the determination of risk of collision by other mariners.

6 The ship shall be able to exhibit, by day and night, in all weathers, where they may best be seen, lights, for specific military purposes, which cannot be mistaken for those lights required by COLREGs.

7 The vessel's lights, required by paragraphs 5 and 6, may be capable of being continuously adjusted in intensity from the minimum required for a vessel of its size to zero. The Naval Administration may require the lights to be adjusted simultaneously.

8 It shall be possible to revert all navigation lights to full brilliance by a single operator action.

9 Vessels greater than 30 metres in length and if aviation capable, may be provided with red 'masthead obstruction' lights, visible all-round from a range of at least one nautical mile, placed at or near the highest point of each mast, or other similar structure.

10 The Naval Administration may require additional lights for the purpose of specific military signalling.

11 It shall be possible to exhibit any, or all, of the light signals above without the necessity for personnel to access the Upper Deck.

12 The lights installed for all navigation and signalling purposes shall be night vision device compatible.

13 The vessel shall be provided with such other signalling lights as are required by the Naval Administration. Any such lights installed shall not obscure those lights required by the COLREGs or be capable of being interpreted as a COLREG signal.

14 The vessel shall be provided with the capability of sounding, in all weathers, so that they may best be heard, those sound signals prescribed by the COLREGs for vessels of its size, nature, movement and limitations.

14.1 If fitted, a bell should be capable of automatically generating the signals required in COLREGs and of manual operation.

14.2 If fitted, a gong should be capable of automatically generating the signals required in COLREGs and of manual operation.

15 The vessel shall be provided with a whistle or whistles, or combined whistle system.

16 The officer in charge of the navigational watch shall be able to hear other sound signals and determine their direction from within the enclosed bridge.

17 The ship shall be provided with an image intensifier, or other means, installed on the navigation Bridge to supplement an operator's night vision to maintain a proper lookout.

18 The ship shall be able to determine the range and bearing of radar transponders and of other surface craft, obstructions, buoys, shorelines and navigational marks, to assist in navigation and in collision avoidance.

19 The ship shall be able to plot automatically the range and bearing of other targets to determine collision risk.

20 The ship shall have sufficient power for going astern to secure proper control of the ship in normal circumstances.

Note: The propulsion installation shall also comply with Chapter IV of this Code

21 It shall be possible for the vessel to reverse the direction of thrust of the propeller, or other means of propulsion, in sufficient time, and so to bring the ship to rest within a reasonable distance from maximum ahead speed.

22 The ship shall always have a means of steering available.

Note: The steering gear installation shall also comply with Chapter IV of this Code

23 The main steering gear and rudder stock shall:

23.1 be capable of steering the ship at maximum ahead speed;

23.2 not be damaged at maximum astern speed.

24 It shall be possible to control both the main and auxiliary steering gear from the navigation Bridge.

Solutions

25 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

26 the vessel shall be provided with shapes compliant with COLREGs Rules 24, 27, 28 and 30 and Annex I. In addition, a spare of each shape shall be carried.

Note: It is recommended that not less than 5 ball shapes, 3 diamond shapes and (if over 30m in length) 2 cylinder shapes are fitted.

27 The vessel shall be provided with appropriate stowages for the shapes adjacent to the means of exhibiting them. The style of the stowages to be agreed with the Naval Administration.

28 The ship shall be provided with sufficient white, red, green and yellow navigation lights compliant as closely as possible with COLREGs Rule 1(e) and Annex I for a vessel of its dimensions and purpose and IEC 14744, except that:

28.1 The lanterns provided shall be compatible with night vision devices in compliance with standards agreed with the Naval Administration;

28.2 The lanterns shall not be installed in a position where they contribute to light pollution of the navigation Bridge.

29 The ship shall be provided with additional, sufficient white, red, green and yellow lamps for the purpose of specific military signalling:

29.1 Ships which are the Guide or Supplying ship for Replenishment at Sea evolutions shall be provided with the following 'contour' lights:

29.1.1 along each side at the deck edge at least two red lights, at the break of the bow and the turn of the stern, and if deemed necessary additional ones in between, so arranged as to cast light onto the hull to assist spatial orientation for the Bridge staff of another vessel making an approach. The installations shall be such that the light source is not directly visible to an observer from another vessel and the intensity of the light is such that it shall not be seen at ranges of greater than one nautical mile;

29.1.2 an additional red light, of an intensity that it shall be visible at a range of one nautical mile, be mounted above the stern light;

29.1.3 an additional red light, of an intensity that it shall be visible at a range of 1nm, be mounted forward and higher than the light at Paragraph 10.2 so that, together, they will indicate the fore and aft line of the vessel to an observer approaching from astern.

29.2 It shall be possible to:

29.2.1 exhibit contour lights when all other lights are extinguished;

29.2.2 adjust the intensity of individual contour lights.

29.3 In ships that are capable of operating aircraft from their deck or whose design includes masts or other projections more than 15 metres above the main superstructure shall have one, or more, red 'obstruction' lights that:

29.3.1 are fitted at or near the extremities of those projections;

29.3.2 may be seen from all round;

29.3.3 are of such an intensity that they may be seen at a range of not less than one nautical mile;

29.3.4 shall be capable of being exhibited as a steady light, or flashing, or occulting.

30 The ship shall be provided with a comprehensive control system for the management of navigation and signalling light arrangements. If the control system is programmable it shall be compliant with ISO 17894: 2005, Ships and marine technology – Computer applications – General principles for the development and use of programmable electronic systems in marine applications. and Classification society rules as agreed by the Naval Administration.

31 The ship shall be provided with an arrangement of sound signalling apparatus compliant with COLREGs Annex III for a vessel of its size.

32 The ship shall be fitted with a Sound Reception System compliant with ISO 14859: 2012, Ships and marine technology – Sound reception systems. The Naval Administration may accept a justification for alternative arrangements to meet the requirement at paragraph 16.

33 The navigation Bridge shall be provided with a fixed or portable image intensifier to a standard agreed with the Naval Administration.

34 The ship shall be fitted with one, or more, 9 GHz marine radar compliant with the latest version of IEC 62388, Maritime navigation and radiocommunication equipment and systems – Shipborne radar – Performance requirements, methods of testing and required test results and IHO S.52: 2010, Specifications for chart content and display aspects of ECDIS, Appendix 2. If more than one radar is fitted each shall be functionally independent of the others.

35 The ship shall, be fitted with one, or more, 3 GHz marine radar compliant with the latest version of IEC 62388, Maritime navigation and radiocommunication equipment and systems – Shipborne radar – Performance requirements, methods of testing and required test results and IHO S./52: 2010, Specifications for chart content and display aspects of ECDIS, Appendix 2. If more than one radar is fitted each shall be functionally independent of the others. The Naval Administration may exempt smaller ships from this requirement.

36 The ship shall be provided with one, or more, automatic radar plotting aids (ARPA), or equivalent, compliant with the latest version of IEC 62388, Maritime navigation and radiocommunication equipment and systems – Shipborne radar – Performance requirements, methods of testing and required test results.

37 The ship shall be provided with a propulsion installation and machinery control system appropriate to its size and intended operations, compliant with the requirements of SOLAS II-1, having sufficient power for going astern to secure proper control of the ship in all normal circumstances and the ability to reverse the direction of thrust of the propeller in sufficient time, and so to bring the ship to rest within a reasonable distance from maximum ahead speed.

38 The ship shall be provided with a main and an auxiliary steering gear and associated control systems compliant with the requirements of SOLAS II-1, such that the failure of one of them will not render the other one inoperative.

39 The requirements at Chapter IV of this Code articulate the means of ensuring that a vessel's propulsion and steering installations are compliant with the requirements of SOLAS.

Regulation 10 Training of Personnel

Functional Objective

1 The personnel who operate a ship's Bridge, navigation systems and equipment shall be adequately trained, suitably qualified and experienced.

Performance Requirements

2 English shall be used on the bridge as the working language for bridge-to-bridge and bridge-to-shore communications as well as for communications on board between the pilot and bridge watchkeeping personnel, unless those directly involved in the communication speak a common language other than the English Language.

3 Personnel in command or in charge of a navigational watch are to have attained the appropriate STCW qualification (or the Naval equivalent) before undertaking their duties unsupervised.

4 Personnel in charge of the vessel during Dynamic Positioning operations are to have attained the appropriate DP qualification (or the Naval equivalent) before undertaking their duties unsupervised.

5 Personnel whose duties include the operation of a WECDIS equipment for purposes related to the safe navigation of the vessel, are to have undertaken the appropriate generic and equipment specific training before undertaking their duties unsupervised.

6 To ensure safety of life at sea, all ships shall be sufficiently and efficiently manned.

Solutions

7 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

8 The Naval Administration shall ensure that its professional development strategies and training courses ensure that a sufficient number of personnel with the necessary qualifications and experience to complement and safely operate its vessels are available.

9 The Naval Administration shall ensure that personnel likely to be employed on the navigation Bridge of its ships have sufficient language skills to use and comprehend English as the common language of the sea whether or not its national language is used internally to operate those vessels.

10 Where there are specific international requirements for training in the use of systems the Naval Administration shall utilise a recognised external training deliverer or take steps to establish formal acceptance that internal training is equivalent to the required standard. In particular the method adopted shall recognise that training in use of particular systems may well involve both a 'generic' principles element and equipment specific training.

11 The Naval Administration shall ensure that the process for establishing manning levels for a vessel takes account of the requirement for safe operation in normal circumstances and has the capacity to continue to operate safely when a vessel is in extremis or is, by force majeure, compelled to operate beyond the established Concept of Operations Statement.

Regulation 11 Pilot Transfer Arrangements

Functional Objective

1 Ships engaged on voyages in the course of which pilots may be employed shall be provided with pilot transfer arrangements for the safe transfer of pilots from either side of the vessel.

Performance Requirements

2 The pilot transfer station shall be located such that it provides safe and unobstructed access for any person embarking on or disembarking from the vessel.

3 Arrangements permitting pilot access to, or egress from the vessel should be either available on both sides of the ship, or be capable of being transferred for use on either side.

4 Effective means of communication, in accordance with Chapter VIII, are to be provided between the Navigation Bridge, pilot station and pilot vessel.

5 Adequate lighting shall be provided to illuminate the transfer arrangements overside and the position on deck where a person embarks or disembarks.

6 Crew engaged in the operation of mechanical equipment or rigging shall be adequately instructed in the safe procedure for their use.

7 All equipment used in the transfer operation should be maintained and tested in accordance with manufacturers' specifications or to a recognised standard.

Solutions

8 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

9 The requirements of SOLAS Chapter V, Regulation 23 and IMO Resolution A.1045(27) shall be met.

CHAPTER X DANGEROUS GOODS

Regulation 0 Goal

Note: Currently this Chapter applies to the carriage and use of Class 1 articles only (namely explosives).

1 The ship arrangements for the carriage and use of dangerous goods shall:

1.1 minimise the risk of an incident associated with the carriage of dangerous goods;

1.2 manage the risk to the people, property and the environment including essential safety functions arising from incidents associated with the carriage and use of dangerous goods to an acceptable level;

1.3 enable the safe movement, maintenance and preparation for use of dangerous goods.

Note: This Chapter seeks to control the risk of an incident arising from the carriage and use of dangerous goods and could be considered a component of an environmental protection policy.

Regulation 1 General

Functional Objective

1 The purpose of this Regulation is to outline the principles and framework of Chapter X that must be met if the role of the ship requires the carriage or use of dangerous goods.

Definitions

Note: Definitions which are applicable to all Chapters are located in Chapter I, Regulation 2.

Activation	The use of an item creating a danger to the ship, or personnel.
Carriage and Use / Carriage or Use	All activity associated with the, stowage, handling, movement, transport, transfer, preperation, and activiation of dangerous goods under normal and fault conditions. Note: Use is assumed to include any activity involving the dangerous goods for any purpose other than to transfer it.
Classification	Classification of dangerous goods as defined in the UN Recommendations on the Transport of Dangerous Goods – Model Regulations.
Compatibility	Compatibility is defined in the UN Recommendations on the Transport of Dangerous Goods – Model Regulations.
Dangerous Goods Incident	A Dangerous Good Incident includes: • any accident - an occurrence involving dangerous goods that results in, or contributes to: personal injury or death, material losses or damage to the environment. • any unintended event or action that affects the inherent safety of the dangerous good. • a near miss - any unintended event or action that could have affected the inherent safety of the dangerous good. • the theft or loss of a dangerous good. • the failure of a dangerous good or its system to function in it's intended manner.

Dangerous Goods Preparation Area	A part of the ship where dangerous goods are worked on and during such activity the safety risk is modified compared to the level of risk associated with stowage of the item.
Dangerous Goods Safety Management System DGSMS	This is the body of evidence that demonstrates that the risks associated with the dangerous goods are managed to an acceptable level.
Dangerous Goods Stowage Area	A designated part of the ship specifically designed, assessed operated for the stowage of dangerous goods.
Generic Naval Environment (GNE)	Defines the physical environmental ship conditions to which dangerous goods will be subjected. The scope of the GNE will cover all aspects relevant to the class of dangerous goods carried.
Handling	The manipulation of an item and the associated equipment to enable safe movement, transport or transfer.
Inherent Safety	The ability of an item to retain its safety under specified accidental or intended stimuli due to its design, safety features and materiel employed as an inseparable part of its system.
Movement:	To change the location or orientation of an item within a dedicated space.
Re-location	The act of changing the location of the item between spaces.
Preparation	The modification of an item that affects its inherent safety parameters.
Sensitiveness	The degree to which the Dangerous Good will respond to external stimuli outside of its design mode.
Ship Arrangements	The physical, positional and procedural processes for equipment, systems, structure and personnel whose design, and operation ensures the safe management of the safety risks associated with the carriage and use of dangerous goods.
Stowage	The act of storing an item such that its inherent safety parameters are preserved.
Transfer	The act of moving an item and the responsibility for its safety to or from the ship.

International Maritime Organization (IMO) Documents

Abbreviation	Title	Resolution No. (if applicable)	Amendments incorporated into or reviewed and applicable to ANEP-77	Amendments under review for ANEP-77
IMDG Code	Adoption of the International Maritime Dangerous Goods (IMDG) Code	MSC.122(75)	MSC.157(78) MSC.205(81) MSC.262(84) MSC.294(87 MSC.328(90)	
SOLAS	International Convention for the Safety of Life at Sea, Consolidated Edition, 2009	-	MSC.201(81) MSC.204(81) MSC.216(82) Anx 3 MSC.256(84) MSC.257(84) MSC.258(84) MSC.269(85) MSC.282(86) MSC.283(86) MSC.290(87) MSC.291(87) MSC.308(88) MSC.309(88) MSC.317(89)	MSC.325(90)

Scope

2 Chapter X Dangerous Goods is written in a goal based format which specifies high level objectives to achieve a minimum level of safety. It also provides some Solutions which form the foundation for the selection of standards and development of practices and procedures.

3 Ship arrangements associated with dangerous goods shall be in accordance with the requirements of SOLAS and IMDG Code. Where compliance, in whole or part, is not compatible with the Concept of Operations Statement the Owner shall comply with this Chapter by the implementation of:

3.1 equivalent arrangements for aspects within the scope of SOLAS or IMDG Code; and/or

3.2 additional arrangements for aspects outside the scope of SOLAS or IMDG Code.

4 The requirements of this Chapter apply directly to all spaces and systems in which dangerous goods are stowed, maintained, handled or used and to those adjacent spaces containing items that might produce an unacceptable risk of incident. The list of affected spaces and equipment shall be agreed with the Naval Administration.

5 Chapter X does not apply to dangerous goods which are a permanent component of a ship's system except for Class 1 items stored within their launching mechanisms.

6 Once equipment containing dangerous goods is removed from its host system it is subject to the Regulations of this Chapter.

7 Where a ship loads and unloads dangerous goods to vehicles (boats, craft, vehicles and aircraft) the ship arrangements shall manage the safety of the dangerous goods until the loaded vehicle no longer places the ship at risk.

Application

8 This Chapter shall apply from the point at which dangerous goods directly contact or place at risk the receiving vessel (e.g. landing on the deck or attachment to ship's lifting equipment) to the point at which they no longer put the vessel at risk (e.g. after consumption or transfer to another vessel or shore).

9 This Chapter applies to the carriage and use of dangerous goods during Foreseeable Operating Conditions. For extreme threat conditions, the Owner shall define the requirements in the Concept of Operations Statement and set the performance requirements for the safety of dangerous goods.

Note: Foreseeable Operating Conditions and extreme threat conditions are defined in Chapter I

10 Where the ship arrangements do not meet the requirements of the other chapters the implications for dangerous goods shall be identified and ship arrangements provided specific to the risk management of the dangerous goods.

General Performance Requirements

11 A Dangerous Goods Safety Management System specific to the dangerous goods, whose scope at a minimum addresses all the elements of this Chapter, shall be operated and independently assured. Design standards, acceptance criteria and verification of effective ship arrangements throughout the ship's life shall be derived from the Dangerous Goods Safety Management System.

12 Ship arrangements supporting the safe carriage and use of dangerous goods shall be clearly identified, operated and maintained commensurate with the importance of the risk they manage.

13 Dangerous goods shall be designated in accordance with the *UN Recommendations on the Transport of Dangerous Goods – Model Regulations*.

14 Dangerous goods shall not be embarked without appropriate documentation that identifies the dangerous goods' inherent safety and associated safety parameters.

15 Where, for extraordinary immediate operational reasons, the requirements of Chapter X are unable to be met, approval for the safe carriage, and use of dangerous goods and potentially dangerous goods shall meet the requirements of Chapter I Regulation 5.

Note: Potentially dangerous goods are items whose safety is not fully understood that may reasonably be suspected of being either a) hazardous in accordance with the *UN Recommendations on the Transport of Dangerous Goods – Model Regulations* or; b) may endanger embarked dangerous goods.

16 The standards, criteria and/or procedures for design, construction, test, operation, inspection, maintenance and repair of the ship arrangements shall be approved.

17 The ship, systems and equipment shall be approved in accordance with the agreed standards by the Naval Administration.

18 Ship arrangements for the safe carriage and use of dangerous goods shall be present and their functioning verified/tested prior to embarkation of dangerous goods.

19 Ship arrangements shall be demonstrated by analysis or test to maintain safety of dangerous goods during normal, failure and fault conditions that the ship may reasonably be expected to encounter.

20 Dangerous goods shall be independently assessed and demonstrated to be suitable for use within the ship arrangements.

Solutions

21 Verification that the ship complies with this chapter shall be by the Naval Administration. Provision of evidence to support verification shall be by the owner. All decisions that affect compliance with the requirements of this chapter shall be recorded at all stages from concept to disposal and these records maintained throughout the life of the ship.

22 The degree of risk control shall be commensurate with the hazards associated with the dangerous goods and be approved.

23 The level of inherent safety required of dangerous goods shall be approved.

24 The ship arrangements shall remain under periodic review against the risks posed by the carriage and use of dangerous goods to ensure safety standards are maintained.

25 Dangerous goods stowage areas, and other ship arrangements protecting the dangerous goods shall be identifiable by clear and informative labelling and signage.

26 Labelling shall be clearly visible and inform all relevant persons of the dangers associated with the dangerous goods stored and any restrictions or instructions they must comply with. This is to include personnel in the vicinity of the store area. Labelling shall also identify spaces and systems that are part of the dangerous goods safety management systems and inform the appropriate actions to be take by personnel.

27 Appropriate personal protection equipment shall be worn.

28 Design review, operational trials and material state inspections shall be undertaken for Naval Administration review and acceptance.

29 A maintenance plan for ship arrangements shall be approved.

30 Ship arrangements shall, where appropriate, provide for the recording of the environmental conditions to which dangerous goods have been exposed during Carriage and Use.

Regulation 2 Layout and Services

Functional Objective

1 Ship arrangements for the location within the ship, layout of spaces and the provision of supporting services shall maintain the inherent safety of the dangerous goods and manage incidents.

Performance Requirements

2 The design requirements and operation of the ship safety arrangements shall be determined through a systematic assessment of the safety risks associated with the dangerous goods carried derived from the Dangerous Goods Safety Management System including managing risks associated with external events and managing risks to external events from dangerous goods.

3 The size, shape and location of the dangerous goods stowage areas, maintenance facilities, embarkation and disembarkation routes and emergency procedures shall be designed taking into account the Concept of Operations Statement, the use of the dangerous goods, their sensitiveness and their compatibility.

4 Spaces adjacent to dangerous goods stores and ship equipment (for both normal and fault conditions) shall be designed to manage the hazards they present to the dangerous goods.

5 Ship arrangements for temporary holding areas for dangerous goods shall manage the risk from and to the dangerous goods commensurate with the time at risk.

6 The ergonomics of the spaces in which dangerous goods are stored, prepared, maintained or used shall provide for the safe carriage and use, maintenance and inspection of dangerous goods and the dangerous goods stowage areas.

7 Ship arrangements shall mitigate the risk of a reaction occurring between dangerous goods.

8 Systems or equipment passing through or resident in spaces in which dangerous goods are stored or used shall not present an unacceptable risk to the dangerous goods or vice versa during normal operation or fault conditions.

9 Dangerous goods stowage areas shall be designed to reduce the concentration of hazardous gases or vapours that might emanate from dangerous goods or other items.

10 Ship arrangements shall be such that an incident associated with dangerous goods does not degrade essential escape, evacuation and rescue systems below an acceptable level.

11 Incident control systems such as pressure relief systems and containment control shall not endanger the crew or third parties when operated.

12 Dangerous goods stowage areas shall provide emergency escape and evacuation arrangements for personnel. The scope of such arrangements shall be commensurate with the size of the vessel and the type of hazard presented by the dangerous goods.

13 The ship arrangements shall control the environment to be within the General Naval Environment (GNE) or additional requirements as required by the dangerous goods embarked.

14 Ship arrangements shall be demonstrated at build and through life to control the environment in accordance with the GNE or dangerous goods requirements whichever is the more onerous.

Solutions

15 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

16 The location of dangerous goods stores shall be determined by hazard identification and risk analysis against the foreseeable damage (and extreme threat damage where required) and taking into account the Concept of Operations Statement and the risks associated with the dangerous goods stored. For Class 1 items it is good practice to meet the following but should this not be possible, mitigation will be required to control the risks. The final arrangement shall be approved.

16.1 Avoid locating dangerous goods stores adjacent to compartments whose contents present a high risk to the dangerous goods, such as for Class 1 items:

16.1.1 Main Machinery Spaces including fuel pump rooms;

16.1.2 Galley;

16.1.3 Pressurised gas stores inc LOX;

16.1.4 Electrical Spaces;

16.1.5 Structural tanks or spaces containing flammable stores;

16.1.6 Heated tanks;

16.1.7 Other high fire risk spaces.

16.2 Additionally provide at least an A60 boundary between auxiliary machinery spaces, exhausts, workshops and hangar and vehicle stores;

16.3 Provide maximum separation between accommodation spaces and dangerous goods stowage areas;

16.4 Locate dangerous goods stores above the double bottom and between the collision bulkhead and aft peak bulkhead;

16.5 Locate dangerous goods stowage areas below the waterline.

17 Dangerous goods stowage areas shall not share drains or vents with compartments containing flammable liquids. Where this is not possible, ship arrangements shall prevent ingress of hazardous atmospheres or liquids into the dangerous goods store.

18 Consideration shall be given to the length and complexity of re-location and transfer routes.

19 Initiation systems (e.g. fuzes and detonators) required to be separated from dangerous goods when stored shall be isolated either in a separate compartment or suitable locker.

20 Dangerous goods stowage areas shall provide for segregation of incompatible dangerous goods.

21 Over-pressure relief systems are to be led directly to a safe location on the open deck. The boundary of the relief route shall withstand the over-pressure and the route chosen to avoid increases to pressure. The relief route shall not be obstructed and shall be marked accordingly.

22 Pressure relief systems are to remain captive when operated. They are to resist water and weather loads under normal operation. Pressure relief systems shall not be obstructed and shall be marked accordingly.

23 Where it is necessary to fumigate spaces containing dangerous goods, an assessment shall be made of the impact on the safety of the dangerous goods and where necessary they shall be disembarked prior to fumigation.

24 Ship arrangements shall allow regular inspection of dangerous goods and associated safety systems without the requirement to breach protective boundaries or increase the risk to the dangerous goods or personnel.

25 A system for the control of quantity and variety of items within a dangerous goods store shall be implemented.

Regulation 3 Structural Protection

Functional Objective

1 Ship arrangements shall provide appropriate structural integrity to support dangerous goods and their associated safety systems.

Performance Requirements

2 Ship structure associated with the carriage and use of dangerous goods shall be designed using a recognised and appropriate structural design code.

3 Structure which is a component of the ship's dangerous goods safety management system shall be designed, constructed and maintained to protect the ship from incidents occurring with dangerous goods.

Note: For foreseeable damage conditions structural requirements relating to fire incidents are in Chapter VI, regulation 2 and structural requirements relating to damage are in Chapter II, Regulation 3.

4 Ship structure shall withstand or be protected from loads (e.g. blast, heat, and shock) arising from the use of dangerous goods.

5 Ship structure shall support safety and consequence management systems.

6 Safety factors of structure associated with handling and operating equipment shall be appropriate for the hazard classification of the dangerous goods being used and the operation under consideration.

7 Temporary or portable ship structure, or fittings associated with the carriage and use of dangerous goods shall be designed, built, assembled and tested commensurate with the risk associated with the dangerous goods.

8 Structural fixing of items within dangerous goods stowage areas shall ensure items remain fixed in all foreseeable operating conditions and extreme conditions where required by the Naval Administration.

Solutions

9 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

10 Preservation systems shall be used to maintain functionality, structural integrity and safety between inspections.

11 Design review and certification supported by appropriate tests and inspection of the ship arrangements shall be undertaken.

12 Boundaries, penetrations and openings are to be designed to withstand the water pressure head associated with the requirements to flood the space in the event of an incident and the damage stability requirements defined in Chapter III.

Regulation 4 Fire Protection

Functional Objective

1 Ship arrangements shall manage to an acceptable level, the risk of fire incidents initiated by dangerous goods or that threaten dangerous goods.

Note: This regulation applies whenever and wherever dangerous goods are present and are additional to the requirements of Chapter VI – which should be read in conjunction with Chapter X.

Performance Requirements

2 The fire management policy for dangerous goods for the vessel, including prevention, detection, containment, control and extinguishing of fires, shall be defined in the Concept of Operations Statement and be approved.

Note: This will include a definition of the number and severity of fire incidents the ship shall be expected to manage and verified for operation in the extreme threat conditions as defined in Chapter I, Regulation 0

3 The fire detection, alarm and response system (e.g. fully automated or require manual activation) shall be appropriate to the ship Concept of Operations Statement.

4 Materials shall be selected to minimise the fire risk they present.

5 Drainage, flooding and fixed fire fighting systems for dangerous goods stowage areas shall be controllable from outside the space.

6 To prevent fire escalation, the fire protection system design, coverage, reaction times and rates of deployment shall be commensurate with the type of hazard presented by the dangerous goods.

7 Systems passing through dangerous goods stores shall be avoided where failure of the system presents a fire risk to the goods stored. Where this is not possible appropriate mitigation such as shielding or enhanced fire protection systems shall be provided.

Note: Systems refers to pipes, cables, vents etc.

8 Integrity and operational efficiency of fire protection systems for dangerous goods stores shall not be compromised by failure or maintenance of the ship systems or equipment that support the fire protection system.

9 Ventilation control shall ensure the effectiveness of the fire protection system provided for the protection of dangerous goods.

10 The operation of the fire protection system should be monitored at all times whilst dangerous goods are embarked and reported to the ship's staff when activated.

11 Reporting of the fire protection system shall be to a continually manned space.

12 Arrangements for dangerous goods stowage areas shall limit transfer of heat from fires, machinery systems or other equipment or systems outside of the stowage areas to within safe levels.

13 Ship arrangements shall provide the rapid and direct distribution of appropriate fire suppressant or cooling media.

14 Dangerous goods shall not be embarked until the fire protection system is operable and verified.

15 Control points for fire fighting systems shall be provided and separated to reduce the probability of loss of system control.

16 Positions where dangerous goods are temporarily stowed, prepared or maintained shall be provided with fire detection, prevention and suppressant systems commensurate with the time at risk and the magnitude of the risk presented by the dangerous goods.

17 Dangerous goods stored on exposed decks shall be provided with fire protection systems which maintain the dangerous goods in safe environmental conditions.

18 Ship arrangements shall facilitate the testing of fire systems to ensure their availability and reliability is maintained whilst the dangerous goods are present.

19 Ship arrangements for fire protection of dangerous goods shall consider failure modes and provide suitable mitigation measures.

Solutions

20 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

21 Fire detection shall incorporate at least two different types of detector (e.g. smoke, flame or heat) with either detector type triggering the system.

22 Sufficient manual fire system activation points shall be installed and positioned to facilitate the rapid raising of an alarm or activation of the fire extinguishing system.

23 The ship arrangements shall ensure the supply of services (e.g. electricity, water) to the dangerous goods fire safety management system and that equivalent alternative arrangements are available in the event of the loss of critical services.

24 Number and distribution of detectors shall be to an agreed standard.

25 Adjacent spaces that present a fire risk shall be equipped with fire detectors.

26 The fire protection system shall operate when the temperature in the dangerous goods stowage area reaches an appropriate threshold temperature.

27 Where dangerous goods stowages are split into zones the detectors shall be distributed evenly amongst the zones.

28 Detectors protecting the dangerous goods stowage area shall be configured to raise the alarm in a continually manned space linked into the dangerous goods fire protection arrangements.

29 Detectors shall operate individually – the system architecture shall not include combined detector loops.

30 Detectors shall be constructed to a recognised standard and certified safe. Heat detectors shall be of low thermal inertia and be capable of responding to an appropriate temperature/ time gradient.

31 Any single heat detector indicating the threshold temperature or above is to activate distinctive local and remote audible and visual alarms.

32 Boundaries of dangerous goods stowage areas and adjacent spaces shall provide a fire barrier as required by Chapter VI, Regulation 8.

33 Where water spray systems are installed they shall be arranged to provide 100% coverage of all dangerous goods stowage areas as defined as the larger of the deck or deckhead area.

34 Fully automatic systems shall be capable of manual operation.

35 The reaction time of fully automatic systems shall be appropriate to the carriage and use of dangerous goods and the consequences of an incident.

36 Fully automatic systems shall be designed to assure its operation and performance can be routinely tested without detriment to the safety of dangerous goods.

37 Remote control stations are to be separated by at least one deck or a main watertight bulkhead with independent power supply.

38 Water systems are to be fitted with flow and pressure sensors configured to operate distinctive audible and visual alarms at the appropriate manned monitoring position.

39 Flow rates for water systems shall be appropriate to the quantity and type of dangerous goods embarked and account for both fire suppressant and cooling of dangerous goods and stowage boundaries.

40 Water systems shall provide cooling for a time after the end of the fire incident.

41 First aid fire extinguishers shall be provided appropriate to the content of the dangerous goods store.

42 Where dangerous goods are stowed on the upper deck, ship arrangements shall provide a dedicated fire management system.

43 Ship arrangements are to control pressurisation as a result fire safety system activation.

Regulation 5 Electrical Fittings

Functional Objective

1 The ship arrangements shall protect dangerous goods from electrical conditions that could lead to an incident.

Performance Requirements

2 Electrical equipment shall be approved and certified safe for operation in dangerous good stowage areas or in the vicinity of dangerous goods or their associated safety systems.

3 The design of electrical items under normal, overload and fault conditions shall maintain the safety arrangements associated with the protection of dangerous goods.

4 Electrical items under normal, overload and fault conditions shall not create a source of ignition; wherever and whenever dangerous goods are present.

5 Ship arrangements shall maintain the electromagnetic conditions within safe limits wherever and whenever dangerous goods are present.

6 Electrical items under normal, overload and fault conditions shall maintain the safety arrangements associated with the protection of dangerous goods.

7 Arrangements for electrical items shall be such that their maintenance or repair shall not create an incident.

Note: Authorised electrical equipment is recognised by the Naval Administration to be safe for operation through meeting or exceeding applicable standards associated with the dangerous goods embarked.

Solutions

8 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

9 Ship arrangements shall prevent the use of non-authorised electrical equipment in areas where dangerous goods are present.

10 Construction of lighting systems shall be of a certified safe type appropriate to the type of dangerous goods.

11 Fixed and portable lighting shall be provided in dangerous goods stowage areas to support inspection and operation under normal and fault conditions. Portable lighting and light switches shall be readily accessible at the entrance to the space and appropriate for use in hazardous environments.

12 Portable electrical equipment shall be of the same certified safe type as fixed installed electrical equipment in dangerous goods stowage areas.

13 Failure of safety related electrical devices shall be detected rapidly and fail safe.

14 Emergency stop or safety related shut-down shall be fitted with a lock-out to prevent re-start without an intentional command.

15 Electrical items shall be protected from accident damage arising from operations in the dangerous goods stowage area.

16 Cabling shall be:

16.1 routed away from dangerous goods stowages as far as is practicable;

16.2 arranged to prevent lightning or other external RF event from discharging into the dangerous goods stowage area;

16.3 joint and termination free within the dangerous goods stowage area;

16.4 fitted with glands at the dangerous goods stowage area boundaries that control fire transition across the boundary;

16.5 capable of total isolation unless there is no termination or junction within the dangerous goods stowage area;

16.6 separated, screened, sheathed or protected where necessary to prevent contamination or false signals;

16.7 not attached directly to the dangerous goods stowage area boundary except for lighting and low power cables, e.g. alarms;

16.8 of a rating selected to avoid self heating;

16.9 protected against mechanical damage.

17 Where compliance with safety standards is achieved through the use of environmental isolation, containment shall be secure to prevent accidental opening.

18 Earth arrangements shall ensure earth links are as short as possible with minimal earth loops.

19 Safety related switching should not involve intermediate software control and be fitted with manual override.

20 Power outlets in dangerous goods stowage areas shall be of socket type only and designed to contain any arcing on make/break.

21 The temperature of electrical items (or any other item) shall not exceed levels likely to lead to the ignition of gases or vapours or risk elevation of the temperature of dangerous goods above safe levels.

22 Arrangements within dangerous goods stowage areas shall prevent the accidental creation of sparks.

23 Electro-static build-up or discharge, stray electric and leakage currents shall be assessed and managed to prevent corrosion, overheating, sparks or arcs.

24 Electrical items within the dangerous goods stowage area shall not create an unsafe electrical environment when the fire fighting system is activated.

25 The boundary arrangements for dangerous goods stowage areas shall prevent external RF conditions from creating an unsafe internal electrical environment.

26 Magnetic field (both static and transitory) shall be controlled through shielding or location to be within safe limits.

27 Electrical items shall be capable of isolation on all poles from outside the dangerous goods stowage area.

28 Where more than two light fittings are provided they shall be split into at least two independent systems fed from a different fuse.

29 Cables carrying greater than 440 volts shall not be permitted in a dangerous goods stowage area containing class 1 items or attached to its boundaries.

Regulation 6 Stowage and Handling

Functional Objective

1 Ship arrangements shall provide safe and secure stowage, handling, movement, re-location and transfer of dangerous goods.

Performance Requirements

2 Ship arrangements shall have secure restraint systems that maintain the integrity and safety of the dangerous goods.

3 All other items stored within dangerous goods stowage areas shall be assessed for compatibility with the dangerous goods and restrained such that they do not endanger the dangerous goods.

4 Where bulk or versatile stowage of dangerous goods is used, ship arrangements shall provide appropriate segregation, restraint and partitioning.

5 Dangerous goods stores on exposed decks shall be provided with protection from weather and solar radiation (heating and UV) and sited to control the risk from ship operations.

6 Stowage layouts shall be commensurate with the protection systems (e.g. adequate clearance to bulkheads and decks for boundary cooling from fire fighting systems).

7 The temperature of surfaces in the vicinity of dangerous goods shall be maintained at safe levels during normal and fault conditions.

8 Where dangerous goods safety is at risk from submergence in sea water, flood alarms shall be fitted and reported in a continually manned space, at sea and in harbour.

9 Ship arrangements shall incorporate embarked vehicles in which dangerous goods are stored for transfer.

10 The interface between safety arrangements for the ship and any system delivering dangerous goods to and from the ship shall be carefully managed and controlled.

11 Restraint systems and layout shall allow access to and removal of dangerous goods without detriment to the safety of other dangerous goods.

12 Movement, re-location or transfer shall be undertaken in accordance with a procedure to efficiently, with the minimum of delay or pausing in the process to limit the exposure of the ship to increased safety risk.

13 Primary and alternative re-location and transfer routes shall be defined and approved.

14 All handling equipment is to comply with approved standards and regulations for the areas in which they are to be used commensurate with the risks appropriate to the dangerous goods stored.

Solutions

15 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

16 Handling systems for dangerous goods shall ensure that at all times during lifting and movement the load is under positive control, is within its design limits for the environmental conditions and will not slide or topple.

17 The ship's stowage and handling arrangements shall include communication systems such that operators have full control of the dangerous goods at all times.

18 Loading, unloading, movement and stowage arrangements shall be tested and verified using inert substitutes to prove arrangements before dangerous goods are embarked.

19 Readiness of fire-fighting and environmental protection equipment and ship's crew shall be ensured prior and during the movement, relocation or transfer.

20 Power failure shall not compromise the safety of the dangerous goods.

21 Relocation routes shall be assessed, as a minimum, to verify that:

21.1 they are free from obstruction;

21.2 they afford protection to the dangerous goods;

21.3 alternative routes are available;

21.4 emergency arrangements are in place;

21.5 they maintain the environmental conditions in accordance with the safety requirements of the dangerous goods;

21.6 they prevent access by unauthorised personnel.

22 Handling systems shall be tested and certified for use with the dangerous goods taking account of sea states in which the handling system is expected to operate.

23 Dangerous goods containing white phosphorous shall be stowed in either floodable spaces capable of submerging the dangerous goods or jettisonable stowages.

Regulation 7 Security

Functional Objective

1 Ship arrangements shall prevent malicious or unintended interference with the dangerous goods or their safety management system.

Performance Requirements

2 The permission of the Commanding Officer or a delegated responsible representative is required for the embarkation of any dangerous goods.

3 Ship arrangements shall prevent access to dangerous goods or associated safety management systems by unauthorised persons and be approved.

Note: Authorised persons are those approved by the Owner to have access to dangerous goods and have been assessed as competent or are appropriately supervised.

Note: Access includes physical presence, control of procedures, or freedom to affect the safe carriage and use of dangerous goods. This may apply when dangerous goods are not present.

4 The location, condition and quantity of all dangerous goods shall be known, logged and monitored at all times by the Commanding Officer or a delegated responsible representative and a system in place for reporting discrepancies.

Solutions

5 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

6 Permission to embark should only be granted when a satisfactory inspection of the ships security arrangements for the carriage and use of dangerous goods has been conducted.

7 The ship's security arrangements shall be agreed by the Naval Administration and demonstrated through design review and physical testing as appropriate.

8 A dangerous goods security plan that complies with a recognised standard shall be implemented.

Regulation 8 Incident Reporting

Functional Objective

1 Incidents involving dangerous goods or associated safety systems shall be reported, investigated and, where appropriate, ship arrangements amended to maintain or improve safety levels.

Performance Requirements

2 A management system shall exist to ensure that dangerous goods incidents are recognised and reported.

3 The Naval Administration shall make adequate and proportional arrangements for the investigation or review of each dangerous goods incident.

4 Appropriate measures shall be taken such that the intended acceptable safety levels are maintained or improved following a dangerous goods incident.

Solutions

5 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

6 An incident reporting system should be operated such that clear procedures for the identification and reporting of incidents are in place and communicated in such a manner that all personnel directly or indirectly involved with the carriage and use of dangerous goods understand their responsibilities.

7 Incidents should be independently investigated or reviewed by suitably qualified and experienced personnel.

8 Incidents should be investigated or reviewed to identify patterns and trends and to determine the root cause/s of the incident.

9 Corrective and preventative actions should be taken in a timely manner to prevent any recurrence of an incident, or to improve safety levels.

10 Any lessons identified from incident investigations or reviews should be widely communicated.

11 A system for tracking, monitoring and evaluating the implementation of safety measures and recommendations arising from incident investigations should be in place.

Regulation 9 Training and Personnel Competence

Functional Objective

1 All persons directly or indirectly responsible for or affected by the safe carriage and use of dangerous goods shall be demonstrably competent to discharge their duties.

Performance Requirements

2 The Naval Administration shall define and certify the manning levels and required competence and responsibilities of all personnel involved in the carriage and use of dangerous goods.

3 Appropriate manning levels shall be maintained throughout to ensure the safe carriage and use of dangerous goods.

4 All personnel managing the safety of dangerous goods are suitably qualified, and experienced or supervised.

5 A formal process for assessing, validating and recording evidence of qualification, experience and training shall be in place

Solutions

6 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

7 All personnel associated with the safe carriage and use of dangerous goods shall be made aware of and understand their duties and responsibilities.

8 All personnel responsible for managing the safety of dangerous goods are in place prior to and throughout the carriage and use of dangerous goods.

9 All personnel associated with the safe carriage and use of dangerous goods should be provided with appropriate training and experience.

10 Procedures and information necessary for the trained personnel to undertake their duties shall be readily available and maintained up to date.

11 Where appropriate, personnel should be adequately supervised if there are any shortfalls in their training or experience

12 A personnel management system shall be implemented that:

12.1 ensures independent assurance of competence;

12.2 meets legal requirements;

12.3 communicates that safety of dangerous goods is critical;

12.4 is based on evidence; and

12.5 is proportionate to the risks involved.

Regulation 10 Use of Dangerous Goods

Functional Objective

1 Ship Arrangements shall control the safety risk associated with use of dangerous goods.

Performance Requirements

2 All planned activities involving the use of dangerous goods shall be identified with a safe system of work defined for each activity

3 The ship arrangements shall provide for the safe disassembly and assembly of packaging.

4 Ship arrangements shall manage the safe preparation of dangerous goods.

5 Ship arrangements shall manage the safe activation of dangerous goods.

6 Ship Arrangements shall manage the risk due to the carriage of dangerous goods by offboard systems operating to and from the ship.

7 Ship Arrangements shall manage the risk due to carriage and use of dangerous goods by embarked personnel.

8 Ship Arrangements shall manage the safety of tests, trials and experiments involving dangerous goods.

Solutions

9 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

10 Planned activities shall have an approved risk control regime or safety case in place ahead of the event taking place.

11 Emergency procedures and any other safety arrangements shall be verified before activation.

12 Personnel involved with the activation shall be aware of their safety responsibilities.

13 Safety protection measures shall be in place for personnel and material and equipment.

14 The interface between the ship and off board system shall be managed to provide a safe environment to manage the dangerous good.

15 A system shall be in place to identify and categorise all dangerous goods carried by embarked personnel.

16 Stowage plans shall be in place to manage the risk associated with dangerous goods carried by embarked personnel.

17 Additional arrangements may be necessary to assure the safety of dangerous goods involved in tests, trials and experiments.

18 Approved procedures shall be available for all activities involving removal of dangerous goods from their dedicated stowage that clearly identify the action and define a safe system of work.

19 Breakdown and make-up of transportation packaging shall:

19.1 Be undertaken by approved personnel;

19.2 Follow procedures approved for the ship and operation;

19.3 Occur only when the ship arrangements are functioning correctly;

19.4 Be scheduled to reduce risk to personnel as far as possible;

19.5 Be carried out efficiently to minimise time at risk;

19.6 Expose as few dangerous goods as possible to risk consistent with efficiency and scheduling;

19.7 Use an approved standard for packaging.

Regulation 11 Emergency Procedures

Functional Objective

1 Ship Arrangements shall control the consequences associated with dangerous goods, arising from foreseeable emergency situations.

Performance Requirements

2 Emergency planning shall be conducted to identify and prioritise all foreseeable emergency situations.

3 Arrangements to control the consequences of emergency situations shall be put in place.

4 Emergency arrangements shall be implemented effectively.

5 Appropriate measures shall be taken to return all dangerous goods to a safe condition following an emergency.

Solutions

6 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

7 A formal risk assessment methodology shall be used to identify foreseeable emergency situations.

8 Emergency arrangements to control or mitigate the consequences of an emergency situation shall consider:

8.1 the emergency organisation;

8.2 emergency procedures and plans;

8.3 supporting safety information;

8.4 training requirement;

8.5 the involvement of other emergency services;

8.6 testing (see paragraph 9 below).

9 The arrangements for emergencies shall also consider, and incorporate where appropriate, generic safety measures which take into account the risks associated with the carriage and use dangerous goods.

10 Specific operator procedures shall be prepared for all unintended but foreseeable events involving the use of the dangerous good.

11 The Emergency planning process and arrangements shall be constantly reviewed.

12 All ship arrangements designated as part of the emergency arrangements shall be available, maintained and tested to ensure availability.

13 The emergency plans and arrangements shall be tested and regularly exercised.

14 Emergency arrangements shall consider the recovery phase of an emergency

ANNEX A

Guide to the Naval Ship Code

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1 INTRODUCTION

The Naval Ship Code

1.1 Recognising that there is no naval body that is equivalent to IMO and that naval ships are not embraced by the work of IMO, NATO nations and their partners established a NATO Specialist Team to develop a “Naval Ship Code” (the Code). When the Specialist Team was disbanded the INSA (the International Naval Safety Association) was formed to manage the Code and to continue its development.

1.2 This annex describes:

1.2.1 how the Code is constructed and the principles used in its design.

1.2.2 how the Code is managed by the INSA and published by NATO.

1.2.3 the background to, and how to use, each of the Code’s chapters.

1.3 Relevant Articles from the UNCLOS Convention are included at Appendix 1.

The International Naval Safety Association

GOALS

1.4 The INSA exists to develop, maintain and promote adoption and application of the Code, and to capture feedback from the Code’s application.

MEMBERSHIP

1.5 The INSA has members from navies and classification societies.

ACTIVITIES

1.6 To make corrections and improvement to existing parts of the Code, the INSA processes proposed changes, accepting those found good.

1.7 To develop new parts of the Code or to make major changes, the INSA creates Working Groups as required.

CHANGING THE CODE

1.8 Code changes are considered at the INSA’s Annual General Meeting.

PUBLISHING THE CODE

1.9 Once endorsed by INSA, the new version of the Code is sent to the NATO MCG6 for approval and publication through NATO channels.

Application of the Code

1.10 The principles of application are outlined in Chapter I Regulation 1a and supplementary guidance is shown in Figure 1 below. The arrangement involves three parties:

1.10.1 The Owner is responsible for ensuring that design, material and equipment selection, construction and in-service operation and maintenance are carried out and demonstrating that this is undertaken correctly in accordance with standards agreed with the Naval Administration in the Concept of Operations Statement. Where verification of compliance and the issue of certification are not to be provided by the Naval Administration, the Owner is, with the agreement of the Naval Administration, to task a Recognised Organisation to do this;

1.10.2 The Naval Administration is responsible for putting in place arrangements for safety assurance and ensuring that standards are available that are suitable for naval ships. The Naval Administration is also responsible for ensuring the Owner has access to either the Naval Administration or a suitable and authorised Recognised Organisation who will confirm verification of compliance and issue certification against the ship role, operating and maintenance philosophy, environmental conditions, survivability and principle standards set out in the Concept of Operations Statement; and

1.10.3 The Recognised Organisation (typically a Classification Society) authorised by the Naval Administration who will, when tasked by the Owner, confirm verification of compliance and issue certification. The Recognised Organisation may also be called upon by the Naval Administration to assist in the development of safety assurance arrangements that supplement the Recognised Organisation's own standards.

1.10.4 Ideally, a naval ship will comply in all respects with the agreed standards throughout its seagoing life. However, there will inevitably be some aspects of the ship design, material, equipment or construction that fall short of the agreed standards. It is the responsibility of the Naval Administration (or the Recognised Organisation on behalf of the Naval Administration) to manage these.

1.11 There are a number of alternatives to how these non-compliances are managed:

1.11.1 Minor Non-Compliances. These can generally be demonstrated to either not affect the ship safety, or offer an equivalent solution that achieves at least the same level of safety. In these cases, the certifying organisation will record these as a Memorandum Item to capture the agreement for future reference.

1.11.2 Moderate Non-Compliances. These are of such a nature that ship safety is compromised. They will require rectification and the certifying organisation will need to agree a date by which the rectification work shall be complete, and the aspect of concern re-surveyed or re-assessed. In some cases, it may be necessary to issue temporary operating restrictions or instructions to control the extent of the hazard. These non-compliances are referred to as Conditions of Certification.

1.11.3 Refusal or Withdrawal of Certification. Ultimately, if the non-compliance is of a significant nature, the certifying organisation may refuse to issue or withdraw certification until the non-compliance has been rectified by the Owner to the satisfaction of the certifying organisation.

NSC Chapter I Reg 1a Principles	Owner	Naval Administration	Recognised Organisation
1.1 The definition of the Concept of Operations Statement (ConOps) that describes the role, ship attributes, required survivability, the environment and the operating and maintenance philosophies	Sets capability, undertakes concept design, engages with Naval Administration to set ConOps	Provides advice to Owner on clarity of ConOps	Provides advice to Owner and Naval Administration as required
1.2 The selection of solutions appropriate to the Concept of Operations Statement and the safety goal outlined at Regulation 0 Goal of Chapter I	Agrees solutions with Naval Administration and organisation to verify	Agrees solutions with Owner and organisation (NA and/or RO) who will verify	Provides advice to Owner and Naval Administration on solutions
1.3 The assessment of the ship against the solutions by which achievement of the safety goal can be judged	Provision of design information to demonstrate design complies with the solutions	Assessment of design, material, equipment and ship as agreed at 1.2	Assessment of design, material, equipment and ship as agreed at 1.2
1.4 The issue of certificate(s) by the Naval Administration (or its Recognised Organisation) to provide a visible demonstration of safety management and compliance with the safety goal	Rectification of shortfalls to ensure compliance with solutions	Issue of Naval Ship Safety Certificate as agreed at 1.2	Issue of Naval Ship Safety Certificate as agreed at 1.2
1.5 Periodic survey to ensure that the identified solutions are being met and compliance with the safety goal is maintained	Continual maintenance to ensure compliance with solutions	Periodic review of design and ship, and issue of Naval Ship Safety Certification as agreed at 1.2	Periodic review of design and ship, and issue of Naval Ship Safety Certification as agreed at 1.2

Figure 1: Application of the Naval Ship Code

Development Principles

1.12 The principles are to be used to guide the development of the Naval Ship Code and recognise the environment in which the Naval Ship Code will be latterly applied.

1.12.1 Naval Management Arrangements. Navies have differing arrangements for the procurement and in-service support of ships. The differences are most notable and relevant to the Naval Ship Code when considering the extent to which industry is engaged. This covers the use of consultants, shipyards, dockyards, equipment suppliers and Classification Societies and so on. The Naval Ship Code must be written in such a way as to be effective in these different environments.

1.12.2 Level of Detail. The different topic areas within the Naval Ship Code that are taken forward by Working Groups will require a level of detail that is most appropriate to the assigned topic areas. The text developed for the Naval Ship Code must therefore be suitable for Navies to refer to requirements at a high level and with sufficient detail to support the subsequent detailed design, construction, assessment and acceptance processes. This may be achieved within the Naval Ship Code or by referring to other relevant single or multiple publications, and may require differing levels of detail. To this end, the text of the Naval Ship Code should always start with goal-based requirements and strive to include prescriptive criteria wherever possible.

1.12.3 Progressive Acceptance. As a ship project progresses from concept through to manufacture, project teams in Navies and in industry are keen to establish a progressive acceptance process that addresses key issues early in the programme and which leads to a controlled reduction in risk. Where acceptance is only achieved at the whole-ship level, a high level of risk will remain in the program beyond the point where it is economically feasible to take corrective action. The Naval Ship Code must provide adequate definition of requirements and acceptance events in terms whereby key risks can be addressed early in the program and corrective action taken.

1.12.4 Benchmarking. Navies are under increasing pressure to benchmark their practices against equivalent arrangements in the commercial sector, notably but not exclusively associated with safety. There are a wide range of existing standards and publications available from organisations outside the MOD. In the first instance, Study Groups review current publications, and those under development, that are available from within and outside of NATO. These include:

1.12.4.1 Legislation (e.g. UN, IMO)

1.12.4.2 Other NATO documents (ANEPs, STANAGs)

1.12.4.3 International Standards (e.g. ISO, EN)

1.12.4.4 Classification Societies rules and regulations (e.g. NSCA members and associates)

1.12.4.5 IACS Unified Requirements

1.12.4.6 National legislative requirements (e.g. EC, Baltic Ice)

1.12.4.7 National Navy standards (e.g. MilSpec, NES)

1.12.5 Transparency. In applying the completed Naval Ship Code, the user will need to understand not only what is required, but why it is required. To this end, the text of the Naval Ship Code developed by Working Groups shall be transparent, encompassing the goals for a Topic Area (e.g. “Provide effective lifesaving”) and will then progressing into more prescriptive and detailed requirements (e.g. “fit 10 lifeboats”).

1.12.6 Mandating Requirements. Depending on the importance of the subject, some requirements may be made mandatory, while others may be optional. In considering the degree to which a requirement is made mandatory or not, Working Groups are to consider how the requirement is addressed in statutory legislation, namely IMO SOLAS. For requirements where SOLAS is mandatory and which are consistent with naval ships, the Naval Ship Code should also be mandatory. The inclusion of requirements becomes increasing less important. Thus, the following hierarchy should be adopted in the development of the text. Paragraphs 1.12.6.1 to 1.12.6.3 reflect the SOLAS baseline thus meeting the aim of the Naval Ship Code:

1.12.6.1 SOLAS requirements compatible with Naval Ships shall be included.

1.12.6.2 Essential Naval Ship safety requirements that replace SOLAS requirements shall be included.

1.12.6.3 Important Naval Ship safety requirements shall be included; Naval Administration may accept alternative arrangements subject to all risks being exposed and adequately managed.

1.12.6.4 Naval Ship safety requirements included; Naval Administration may adopt as an option for each ship.

1.12.6.5 Naval Ship requirements included as guidance note if there is safety benefit; Naval Administration may add detail on a national basis as required.

1.12.6.6 Naval Ship requirements with no safety implications not included in the Naval Ship Code.

Working Group Development

1.13 Working Groups present their work to INSA to be treated as Proposals at the next Annual General Meeting.

TIER 0 AIM

1.14 INSA sponsors the overall Aim, Philosophies and Principles of the Naval Ship Code.

1.15 In reviewing the development and application of the Naval Ship Code, INSA may identify areas where the Aim, Philosophies or Principles require amendment. Such instances should be managed as follows:

1.15.1 Aim. Should INSA identify a need to modify the Aim, the implications of a change on completed work are to be assessed, and the revised Aim re-submitted to NATO MCG6 for approval.

1.15.2 Philosophies and Principles. Should INSA identify a need to modify the Philosophies or Principles, it may do so subject to consideration being given to the impact of the change on work already completed.

TIER 1 GOAL

1.16 INSA shall oversee the setting of Tier 1 Goals for each Chapter of the Naval Ship Code. These are to be derived by considering the Naval Ship Characteristics (see Appendix 2).

1.17 The Tier 1 Goals are not intended to set prescriptive requirements or to give specific solutions. However, they should be clear, demonstrable, verifiable and long-standing and capable of adapting to changes in technology. Goals should be stated in terms that are potentially measurable, even if the precise measurement scale is not specified. Thus, goals may be stated in terms of impact on crew, general public, property or the environment, capability interruption/reduction, or any combination of these. Goals should address the primary concern of the document.

1.18 The Tier 1 Goals then form the basis of the mandate assigned to a Working Group charged with development of a particular Naval Ship Code Chapter.

TIER 2 FUNCTIONAL OBJECTIVES (REGULATIONS)

1.19 The responsibility for developing Tiers 2 and below falls to the relevant Working Group.

1.20 For each Naval Ship Code Chapter there will be a number of factors which can contribute to achieving the Tier 1 Goal. These are identified as the Functional Objectives and are used to establish the Regulatory framework for the Chapter.

1.21 Risk assessment techniques to identify hazards may be used to establish the Functional Objectives. A multitude of risk assessment methodologies is available which will assist the Study Groups through this and subsequent tiers. These can include HAZID, SWIFTS, Fault Tree Analysis, etc. Recently IMO have investigated and applied the Formal Safety Assessment (FSA) process, an outline of this is held by the INSA secretariat for guidance of Study Groups as required. The method adopted must be suitable for the subject being covered in the Naval Ship Code chapter.

1.22 In identifying the Functional Objectives, the Working Group is to conduct a literature survey of relevant publications, including SOLAS, the HSC Code and other relevant statutory and naval publications. The literature will later influence the work under Tiers 3 and 4 in developing requirements and solutions.

1.23 Once the Functional Objectives have been identified, these need to be grouped into a logical Regulatory framework - a set of Regulations.

1.24 In developing the Functional Objectives and the Regulatory framework, the Working Group must take into account that across several Naval Ship Code Chapters, there may well be common Functional Objectives. For example, fire safety may identify a bulkhead door as a Functional Objective to be considered as a Regulation. Bulkhead doors will also be identified as a Functional Objective for stability issues, perhaps under a Regulation associated with watertight integrity. Identifying the Functional Objectives will assist in cross-referencing of requirements from one chapter to another and this is best achieved at Tier 2 where the Regulatory framework of the Naval Ship Code is likely to be robust.

1.25 A template for a Naval Ship Code Regulation is included at Appendix 3.

TIER 3 PERFORMANCE REQUIREMENTS

1.26 At the third tier, for each Regulation, the Working Group is to define a set of requirements relevant to the Functional Objective which are to be complied with and verified during design, construction and operation, to meet the aforementioned aim, philosophies and goals.

1.27 The performance requirements are independent of the technical or operational solution and have a qualitative character. This will allow for future alternative technical or operational solutions, which were not available at the time of development of the Naval Ship Code text.

TIER 4 SOLUTIONS

1.28 For the fourth tier of each Regulation, the Working Group is to develop Naval Ship Code text that provides suitable methods to confirm that a ship is in compliance with the Tier 3 Performance Requirements.

1.29 Tier 4 describes the solution but also identifies activities for verification of solutions. The fourth tier will begin with a statement describing how it will be verified that the Performance Requirements are to be met. In some cases within the text there are specific activities prescribed. e.g. a survey, and plan approval, document review or a test, a detailed standard or verification procedures.

1.30 Standard text is provided in Appendix 3.

1.31 In developing detailed standards, Working Groups are to note that prescription presents minimum risk, i.e. risk of failure is greatly reduced once prescriptive criteria or standards are selected. A performance based solution (e.g. first principles calculations, risk assessment techniques, statistical analysis) is likely to be both expensive to apply and defers risk reduction until the full demonstration is complete. As such, performance based solutions should be avoided if possible.

TIER 5 JUSTIFICATION

1.32 The final tier requires a statement justifying how the Naval Ship Code text for Tier 3 Performance Requirements and Tier 4 Solutions satisfies the Tier 1 Goal for the chapter, and ultimately the Tier 0 Aim of the Naval Ship Code. This statement is essential for configuration control of the Naval Ship Code, and must capture all the key arguments and issues exposed during the course of developing the Naval Ship Code text.

1.33 This justification is the only tier which will not be present in the final document. It is to be used as reference work for future development of the Naval Ship Code text. (Note: Key issues are captured in the latter sections of this annex relating to the specific Naval Ship Code chapters).

2 GUIDANCE ON NSC CHAPTER I GENERAL PROVISIONS

Introduction

2.1 Chapter I of the Naval Ship Code sets out the safety framework within which the Naval Ship Code is to be applied. This section in the guide expands on how this framework is to be implemented.

Responsibilities

2.2 There are three principal organisations involved in the issue of a Naval Ship Safety Certificate whose relationships are shown on 3 below:

2.2.1 The Owner is responsible for ensuring that design, material and equipment selection, construction and in-service operation and maintenance are carried out and demonstrating that this is undertaken correctly in accordance with standards agreed with the Naval Administration in the Concept of Operations Statement. Where verification of compliance and the issue of certification are not to be provided by the Naval Administration, the Owner is, with the agreement of the Naval Administration, to task a Recognised Organisation to do this;

2.2.2 The Naval Administration is responsible for putting in place arrangements for safety assurance and ensuring that standards are available that are suitable for naval ships. The Naval Administration is also responsible for ensuring the Owner has access to either the Naval Administration or a suitable and authorised Recognised Organisation who will confirm verification of compliance and issue certification against the ship role, operating and maintenance philosophy, environmental conditions, survivability and principal standards set out in the Concept of Operations Statement; and

2.2.3 The Recognised Organisation (typically a Classification Society) authorised by the Naval Administration who will, when tasked by the Owner, confirm verification of compliance and issue certification. The Recognised Organisation may also be called upon by the Naval Administration to assist in the development of safety assurance arrangements that supplement the Recognised Organisation's own standards.

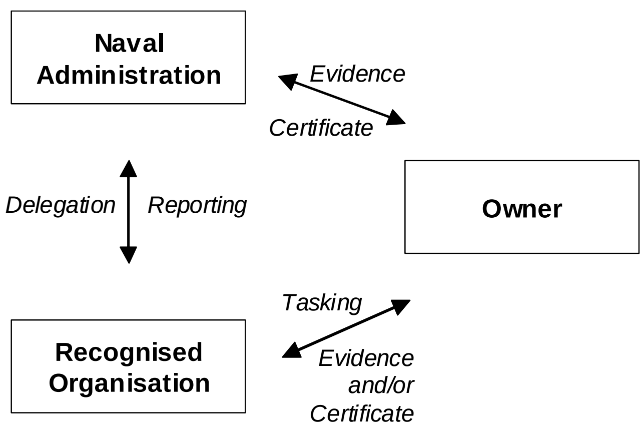

Figure 2: Relationships between Owner, Naval Administration and Recognised Organisation

Generic Ship Acquisition Model

2.3 The guidance in this annex is based on the need to cascade high level military requirements to designers, ship yards and equipment manufacturers as well as Naval staff and government departments charged with the operation and maintenance of ships. In order to maintain the integrity of safety management in accordance with the Naval Ship Code, it is necessary to define key information that must pass from one organisation to another (the key information is to be captured in a Concept of Operations Statement which is described at paragraphs 2.5 to 2.8 below). The generic ship acquisition model on which this guidance is based is as follows:

2.3.1 Operational Analysis. Navy undertakes Operational Analysis (OA) to define high level Ship Requirement

2.3.2 Ship Requirement. Owner converts high level OA into Ship Requirements (or Concept of Operations Statement) with description of the Role, Operating Philosophy, Extreme and Foreseeable Damage, Operating Environment, and Maintenance Philosophy

2.3.3 Ship Specification. Owner breaks out Ship Requirements into technical specification. Ship Specification includes owner's requirements and refers to Naval Ship Code and other applicable standards and identifies the Recognised Organisation (a Classification Society is the most appropriate).

2.3.4 Ship Design. Industry undertakes design against Ship Specification, seeking approval that owners' requirements have been met and from Naval Administration/Recognised Organisation that safety requirements have been met.

2.3.5 Equipment Selection. Industry/Owner selects equipment that complies with the requirements set out in the Ship Specification and related approval processes.

2.3.6 Ship Construction. Industry builds ship under supervision of the Owner (for capability) and the Naval Administration/Recognised Organisation (for safety).

2.3.7 Acceptance into Service. Industry sets ship to work and demonstrates functionality to Owner thus assuring compliance with Ship Specification. Safety aspects assured by the Naval Administration/Recognised Organisation.

2.3.8 Operation. Operation of the ship is undertaken by the Navy in accordance with safety instructions issued by the Naval Administration. Furthermore, the Navy is responsible for undertaking maintenance, as agreed with the Naval Administration, and providing access to the ship for Owner, the Naval Administration and the Recognised Organisation.

2.3.9 Maintenance. The Owner is responsible for maintaining the design, managing the material state and safety certification (in conjunction with the Naval Administration), and engaging the Recognised Organisation. For significant design changes, return to step 1.

2.3.10 Disposal. Ship is prepared for disposal (sold or broken up) by the Owner.

Maintenance of Ship and Equipment

2.4 In respect of the review required by Chapter I, Regulation 11, Paragraph 6, the minimum requirements of the IMO ISM Code Section 10 should be complied with. This may include a review of the machinery and equipment arrangements conducted to identify single points of failure. This could be done through workshops with experienced people or other appropriate risk based methods such as FMEA.

Defining the Concept of Operations Statement

2.5 To enable the Naval Administration and the Recognised Organisation to understand the nature of the ship and thereby to agree the appropriate Tier 3 Performance Requirements and Tier 4 Solutions, the Owner must define the "Concept of Operations Statement" of the ship.

2.6 Referring to Appendix 4 for guidance, key aspects of the Concept of Operations Statement to be defined by the Owner must include:

2.6.1 Primary and secondary roles. These should include descriptions of all roles, be they military, constabulary or benign (see Table 2.1 below).

2.6.2 Ship Attributes. This should include the identification of key ship attributes including:

2.6.2.1 details of cargo and payloads including emergency and disaster relief loading, weights, volumes and locations, and the means by which they are to be embarked, used and disembarked;

2.6.2.2 numbers and type of embarked personnel, and the accommodation philosophy (space, access, key facilities);

2.6.2.3 key performance aspects (speed, endurance); and

2.6.2.4 anticipated life of the ship.

2.6.3 Survivability. The required post-damage operational capability, the extent of damage to be taken into account, and the recovery philosophy must be defined (see appendix 5);

2.6.4 Environment. Taking into account the sea areas to be navigated, a definition of the environmental characteristics that will affect the design and operation of the ship including meteorology, climatology, sea conditions, oceanography, geotechnical and human aspects of the environment (see paragraph 2.11 below);

2.6.5 Operating philosophy. Key aspects must be defined such as the:

2.6.5.1 Operational life and the level of maintenance anticipated;

2.6.5.2 Manning philosophy, operating regime, crew experience and training;

2.6.5.3 Operating restrictions and limitations (e.g. coastal transit only); and

2.6.5.4 Specific philosophy for each technical area (i.e. structure, buoyancy and stability, machinery, electrical, fire safety, escape, evacuation, rescue, radiocommunications and carriage of dangerous goods).

2.6.6 Maintenance philosophy. Covering both survey and maintenance:

2.6.6.1 Survey periodicity (e.g. continuous or periodic, time between major and minor upkeep periods, extent and depth of different surveys);

2.6.6.2 Upkeep and repair philosophy; and

2.6.6.3 Disposal philosophy and associated environmental issues.

MILITARY	CONSTABULARY	BENIGN
Deterrence	Embargo, Sanctions & Quarantine	Disaster relief
Operations against enemy forces	Peacekeeping	Assistance to refugees
Combat operations against the land	Anti-piracy operations	Peace building operations
Combat operations in support of land forces	Fishery protection	Search and rescue
Protection of Maritime Trade	Drug interdiction	Salvage
Evacuation Operations	Contraband operations	Ordnance disposal
Naval Force in support of Diplomacy	Oil and gas field patrols	Pollution control
Peace Support Operations	Maritime counter-terrorism	Hydrographic survey
	Support to counter-insurgency operations	Vessel traffic services
	Enforcement of maritime agreements	Military assistance to foreign governments

Table 2.1: Example Warship Roles

2.7 It is noted that the Operating Philosophy section of the ConOps includes a CBRN (NBCD) section. This section should be used to capture the machinery systems requirements when operating in CBRN conditions. The code does not cover CBRN requirements.

2.8 A template for the Concept of Operations Statement is included in Chapter I.

5.8 A Default Concept of Operations Statement for Fire Safety is presented in Section 10 of this Guide.

Defining the Standards Plan

2.9 To enable the Naval Administration and the Recognised Organisation to agree the appropriate standards to meet the Tier 3 Performance Requirements and Tier 4 Solution Criteria, the Owner must define the 'Standards Plan' for the ship.

2.10 Key aspects of the Standards Plan to be defined by the Owner must include:

2.10.1 Principal Standards and Authorities. For each Naval Ship Code chapter:

2.10.1.1 Principal standards to be applied to each regulation with modifications if necessary for the specific ship;

2.10.1.2 The Naval Administration contact point;

2.10.1.3 Any Recognised Organisation; and

2.10.1.4 The scope of delegation to the Recognised Organisation.

Defining the Environment

2.11 In order to design the ship to be capable of operating in the desired sea locations and times of year, it is necessary to define the environment that is likely to be encountered. Thus, the following information needs to be defined by the Owner and agreed with the Naval Administration:

2.11.1 Meteorology and climatology (above surface). Wind, precipitation, air temperature – high, air temperature – low, air humidity, visibility, atmospheric pressure, solar radiation, electro-magnetic discharge, air quality, flora and fauna.

2.11.2 Sea surface (interface). Waves, tide, green seas and spray, ice navigation, sea surface quality (floating objects, pollution), ship motions, and vibration.

2.11.3 Bathymetry and oceanography (below surface). Pressure (depth), ocean currents, water quality, sea temperature, flora and fauna.

2.11.4 Geotechnical. Bottom/ground conditions, and banks (inc. canals).

2.11.5 Human Caused Environment. Berthing, beaching, docking (inc. inspection of the underwater parts of the ship), towing and salvage, acoustic and electro-magnetic fields, launching, noise and vibration, and superimposed equipment loads.

Authorising Recognised Organisations

OVERVIEW

2.12 This section assumes that Classification Societies are the only organisations authorised to act as Recognised Organisations on behalf of the Naval Administration as they set a benchmark for providing standards and assurance. Without their involvement, Naval Administrations will need to define and resource alternative and equivalent systems of assurance.

2.13 The approach to delegation within the Naval Ship Code is based upon the IMO model used by Flag Administrations (IMO MSC/Circ.710 Model Agreement for the Authorization of Recognized Organizations Acting on Behalf of the Administration). The schedule of delegation to be used by the Naval Administration is provided as an Annex to Chapter I of the Naval Ship Code.

2.14 The organisations involved and their relationship with other organisations is presented in Figure 3 below. For illustrative purposes the naval organisations are overlaid on their civil counterparts.

2.15 Subsequent to the authorisation to act as a Recognised Organisation being made by the Naval Administration to the Classification Society, it is then necessary for the Owner to engage the Recognised Organisation for a specific ship. Noting the interfaces between different organisations shown on Figure 3, it is important that the Classification Society, the Owner and the Naval Administration are authorised to communicate relevant information in a timely manner.

2.16 It should be noted that the Naval Administration may need to tailor international policy and standards to suit national needs.

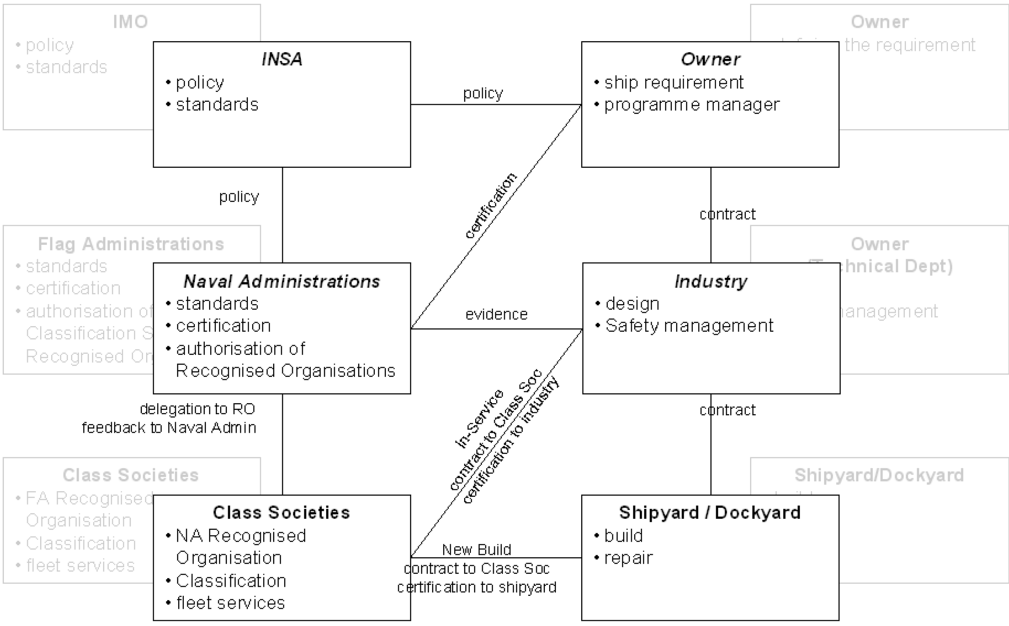

Figure 3: Recognised Organisation Framework

ASSESSING A RECOGNISED ORGANISATION

2.17 Prior to authorising a Classification Society to act on behalf of the Naval Administration, the Naval Administration must be satisfied that the Classification Society is competent to undertake those duties specified by the Naval Administration under contract to the Owner or their industrial supplier.

2.18 The scope of the assessment is dependent upon the level of delegation defined in the schedule (see Schedule of Delegation in Annex to Chapter I of the Naval Ship Code) and is set out below. Note: the assessment criteria may also be applicable to a Naval Administration.

2.19 Scope of Assessment for Limited Authorisation:

2.19.1 Corporate Competence

2.19.1.1 Role in support of Naval Administration regulation identified for limited period and specific ship.

2.19.1.2 Proven track record of similar work.

2.19.2 Corporate Procedures and Processes

2.19.2.1 Agreement on requirements for surveying and reporting defined.

2.19.2.2 Examples of similar work made available.

2.19.3 Specialist Skills

2.19.3.1 Demonstrable expertise in areas relevant to specified survey task.

2.19.4 Staff Competence

2.19.4.1 Staff competence and experience compatible with specific survey task.

2.19.4.2 Adequate staff technical competence demonstrated.

2.19.5 Infrastructure and Administration

2.19.5.1 Team or individual undertaking work has adequate resources available to achieve the specified survey requirements.

2.19.6 Possible corporate profile for “Limited Authorisation”

2.19.6.1 Independent small company; individual (named) person.

2.20 Scope of Assessment for Partial Authorisation in addition to that for Limited Authorisation:

2.20.1 Corporate Competence

2.20.1.1 Role in support of Naval Administration regulation clearly identified in corporate documents.

2.20.1.2 Significant corporate experience demonstrated, proven track record.

2.20.1.3 Relationships with external bodies and internal organisation clearly defined.

2.20.2 Corporate Procedures and Processes

2.20.2.1 Procedures for undertaking design, construction and in-service surveys and reporting clearly defined and available.

2.20.2.2 Recognition of Naval Administration certification requirements.

2.20.2.3 Quality control procedures in place and evidence that they are being followed.

2.20.3 Specialist Skills

2.20.3.1 Demonstrable expertise Naval Administration regulation.

2.20.3.2 Documented guidance on the determination of equivalence available.

2.20.3.3 Competence in the application of the specified rules.

2.20.4 Staff Competence

2.20.4.1 Staff competence and expertise in supporting Naval Administration regulation.

2.20.4.2 Technical competence of staff demonstrated, training to maintain skill set available.

2.20.4.3 Interviews of staff to demonstrate understanding of staff role and responsibilities.

2.20.5 Infrastructure and Administration

2.20.5.1 Team undertaking work adequately resourced, adequate office and IT facilities.

2.20.5.2 Location/facilitates/ease of access to ships being surveyed.

2.20.5.3 Technical tools available (e.g. finite element package, technical library, standards, etc).

2.20.5.4 Administrative IT tools and appropriate skills available to support engineering assessments.

2.20.6 Possible corporate profile for “Partial Authorisation”

2.20.7 Established naval consultancy; technical department of a navy; classification society with limited naval experience and/ or naval expertise.

2.21 Scope of Assessment for Full Authorisation in addition to that for Partial and Limited Authorisation:

2.21.1 Corporate Competence

2.21.1.1 Support to Naval Administrations clearly defined as core purpose of the corporate entity.

2.21.1.2 International recognition of competence.

2.21.1.3 Experience of risk management.

2.21.2 Corporate Procedures and Processes

2.21.2.1 Requirements for specified Naval Administrations documented and maintained.

2.21.2.2 Procedures for the determination of equivalence defined.

2.21.2.3 Procedures for certification defined.

2.21.2.4 Procedure for routine audits, assessments and reviews defined and being followed.

2.21.2.5 Procedures for complaints/arbitration available.

2.21.3 Specialist Skills

2.21.3.1 Ability to undertake all aspects of regulation defined in Naval Administration regulations.

2.21.3.2 Procedures for the development of standards and guidance documents based on R&D and feedback from completed work available.

2.21.4 Staff Competence

2.21.4.1 Expertise available to resolved complex technical and procedural problems.

2.21.4.2 Suitable recruitment, training and development procedures maintained.

2.21.4.3 Robust and transparent staff appraisal.

2.21.5 Infrastructure and Administration

2.21.5.1 Clearly defined administrative procedures and associated infrastructure.

2.21.5.2 Record keeping arrangements fully acceptable.

2.21.5.3 Corporate expertise accessible to Owners and the Naval Administration through defined procedures.

2.21.5.4 Feedback on Fleet certification status available.

2.21.5.5 Access to technical information to support resolution of complex technical issues.

2.21.5.6 Systems and equipment manufacturing approvals scheme.

2.21.6 Possible corporate profile for “Full Authorisation”

2.21.6.1 Classification Society with proven naval experience and expertise.

2.21.6.2 Also applicable to a Naval Administration.

2.22 Possible Sources of Evidence

2.22.1 For Corporate Competence

2.22.1.1 Corporate vision.

2.22.1.2 Annual Report (financial independence/strength).

2.22.1.3 Track record; technical press, customer satisfaction.

2.22.1.4 Corporate structure – internal.

2.22.1.5 Corporate structure – external, e.g. ownership/holdings, partnerships, relationships (independence).

2.22.1.6 Forward R&D plan.

2.22.2 For Corporate Procedures and Processes

2.22.2.1 Procedures, internal and external, specific to Naval Administration, e.g. survey procedures, design rules, certificate issue procedure.

2.22.2.2 Example reports in support of authorisation, e.g. survey reports.

2.22.2.3 Quality control and management systems (ISO 9001).

2.22.2.4 Risk management skills.

2.22.2.5 Specific processes related to Naval Administration procedures.

2.22.3 For Specialist Skills

2.22.3.1 Examples of recent work demonstrating breadth and depth of corporate knowledge of naval requirements, and regulation for other organisations (e.g. IMO)

2.22.3.2 Guidance on managing defects.

2.22.3.3 Procedures for developing standards etc. from R&D and feedback from ongoing work.

2.22.3.4 Contributions to learned institutions.

2.22.4 For Staff Competence

2.22.4.1 Staff competence; CVs, qualifications, “license to survey” scheme.

2.22.4.2 Interviews with staff.

2.22.4.3 Staff appraisal, procedures and sample forms.

2.22.4.4 Training and development procedures.

2.22.4.5 Recruitment, brochures, adverts, technical publications.

2.22.5 For Infrastructure and Administration

2.22.5.1 Capacity to resource work.

2.22.5.2 Availability for emergent work, e.g. call-out procedures.

2.22.5.3 Administrative facilities; records, databases & files.

2.22.5.4 Security clearance.

2.22.5.5 Survey facilities, e.g. equipment.

2.22.5.6 Geographic location.

2.22.5.7 Computer and IT tools.

2.22.5.8 Technical library.

ENGAGING A RECOGNISED ORGANISATION

Naval Administration Certification: Specific requirements concerning the duties of Recognised Organisations

The [Ship name or class] is required to comply with the requirements of the Naval Ship Code. In order to meet this requirement the Recognised Organisation [specify] is required to provide services in accordance with its authorisation by the [name of Naval Administration] and issue the specified Certificates and reports to the [Owner].

Scope

The Naval Administration Certificates to which this requirement applies includes, but is not limited to, [Insert name(s) of certificate(s) as appropriate].

Requirement

The Recognised Organisation is required to undertake surveys and issue reports and, where authorised, certificates as specified in [Appendix to the contract or other document. This should include class notations where classification supports the issue of a Naval Authority certificate] to the timetable specified. These certificates and reports are to be supported by such additional information as is required by the respective Naval Administration.

Irrespective of the level of authorisation held, all survey and certification work shall be undertaken in accordance with Naval Administration requirements; as a consequence the Recognised Organisation shall be allowed unrestricted access to the relevant Naval Administration. Such access may be arranged without recourse to the [Owner], but all relevant correspondence or minutes (including invitations to attend such meetings) shall be copied to the [Owner].

Irrespective of the type of reports and/or certificates to be issued by the Recognised Organisation, the Recognised Organisation is to agree that all work that supports or has relevance to Naval Administration certification is to be undertaken by the Recognised Organisation in its capacity as a Recognised Organisation. Where the ship is, or is to be classed by a Classification Society, the Classification Society is to agree that its Classification work relevant to the Naval Administration certificates forms a part of its work as a Recognised Organisation.

This requirement is to be cascaded down to suppliers as necessary to achieve Naval Administration certification in a timely and efficient manner.

In the event that [name of Recognised Organisation] loses its Recognised Organisation status, the work under this contract may be terminated by the [Owner].

Figure 4: Model Words for Engagement of a Recognised Organisation

Validating Tier 4 Solutions

2.23 Where the Code requires an external standard such as Classification Society Rules to be used, the Naval Administration should ensure that the standards proposed meet the requirements of the Code.

2.24 The assessment should be undertaken at the lowest level required to demonstrate full compliance for each performance requirement or regulation. In some cases a number of standards may be required to fulfil the requirements of the code.

2.25 The assessment of standards should be undertaken and documented. It is recommended the following format is used to encourage a common approach by Naval Administrations.

Ch	Reg	Para.	Code Requirement	Covered	Reference	Justification	Alternative route to compliance
IV	**1**	9	The availability of engineering systems associated with essential safety functions shall be sustained or restored by means of:				
IV	**1**	9.1	Reliability, especially of any single points of failure, taking account of e.g. erosion, fatigue, corrosion and mechanical damage due to vibration; and/or	**Y/N/P**	Naval Rules V2 Pt1 Ch1 S4.2	The Rules require a FMEA for key systems.	

Notes:
Y – Yes: Code requirement fully covered by Standard
N – No: Code requirement not covered by Standard
P – Partial: Code requirement partially covered by Standard further clarification required by the Naval Administration

The reference should be a detailed reference with an explanation of how the performance requirement of the code is met.

Table 2.2: Example Assessment Table

2.26 Alternatively the IMO process for assessing goal based standards could be used. MSC.1/Circular.1394 – Generic Guidelines for Developing IMO Goal-Based Standards – (14 June 2011) - Verification of conformity (Tier III).

3 GUIDANCE ON NSC CHAPTER II STRUCTURE

Background

THE STUDY GROUP

3.1 This Chapter was developed by a Study Group throughout the year 2006. Principal contributors included the Defence Departments of Canada, Norway, Sweden and the United Kingdom, supported by the Classification Societies Det Norske Veritas and Lloyd's Register.

3.2 The authority for the Study Group came from the Specialist Team constituted under NATO MCG6 to which all NATO Navies, Partners for Peace Navies, and Naval Classification Societies that were members of the Naval Ship Classification Association were invited.

3.3 A brief history of the Study Group and the principal agreements:

Date	Place	Principal agreements/comments
September 2005	-	September 2005; MCG6 ST authorises the formation of a Chapter II Study Group, Informal discussions held and Group members identified.
February 2006	Høvik	Ch II would be "a standard for standards", Would use as much as possible of existing class systematics, Concentrate on ships of steel, aluminium and fibre reinforced composite construction.
April 2006	London	Work of IMO on goal-based standards would be considered, The Format of the Chapter agreed to follow the stages in the life of a ship.
June 2006	Høvik	First draft presented; "while in need of refinement, the text is agreed as generally sound", The Societies will consider the implications for classification, Consideration would be given to the ship's structure when dry-docked, There is an underlying assumption that the structure will be damaged, Disposal and the environment, while very important, would not be considered at this time.
October 2006	Bristol	Second draft presented; "very good though some changes to regulation 3 needed", The classification societies agreed in principle that they could implement the Code, The Code is now in need of testing.
October 2006 note:		• Changes to the structure of Regulation 3 made (dated 14 October 2006). • Application of this Chapter will commence in the UK January 2007.

3.4 Comments on the principal agreements noted above:

3.4.1 All members of the Specialist Team were invited to participate; those that did are noted above. Collectively, the navies represented on the Study Group operated a wide range of ship types, size, style of construction, and operational areas.

3.4.2 A number of baseline standards were considered; these included those published by the classification societies, national defence departments, Standards published by national and international civilian authorities, IMO, and the creation of a new standard. Using the criteria of (a) cost-efficiency, (b) those with which the end-user industry was most likely to accept, (c) the need for maximum harmonisation between nations, and (d) a proven track-record of acceptance and service delivery throughout all stages of a ship's life, the selected approach was for "a standard for standards" which would provide direction to the classification societies in the development of their standards.

3.4.3 It was envisaged that adoption of a particular standard by nations was a matter for that nation using Recognised Organisation procedures[1] and would not be limited to those published by classification societies. This is in line with SOLAS[2].

3.4.4 For the time being, the Study Group considered it appropriate to limit consideration to ships constructed of materials that met the requirements of the majority of the Specialist Team's fleets.

3.4.5 The Study Group was aware of the work of IMO[3] and due cognisance was taken of its work and subsequent developments.

3.4.6 After consideration and preliminary development of several options for a structure to the Chapter, the structure that found greatest favour was to follow the life of a ship programme from concept to disposal.

3.4.7 Clearly if the strategy of developing "a standard for standards" is to work, the authority publishing the more detailed standard (e.g. Classification Society Rules for Naval Structures) needs to be convinced that the Code (a) forms an appropriate umbrella Code, and (b) that it is both sufficiently taut yet flexible to permit innovation.

3.4.8 There was a strong feeling that a Code which essentially addressed the safety of embarked persons, should apply whether the ship is afloat or dry-docked. The Specialist Team concurred with this view and directed that the Study Group include routine dry-docking (and other similar scenarios (e.g. beaching of landing craft)) within the scope of Chapter II.

3.4.9 Most ships are damaged during their operational life; some damage is through wear and tear, other damage is more dramatic. The Study Group felt that today's society demanded that the possibility of the structure being damaged was addressed by the Code, and that the structure be provided with a degree of damage tolerance for the more common incidents.

3.4.10 Although the Study Group were keen to address environmental issues, disposal (and the wider environmental issues associated with the construction and operation phases) is not within the current terms of reference of the Specialist Team. For the time being the issue is "parked".

3.4.11 Written comments are captured in Comment Form B. Comments made informally or during meetings are captured in the summary of the meetings. Both form part of the background information to the development of the Code[4].

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1. Naval Ship Code Part I Regulation 6
2. SOLAS Consolidated Edition 2004 Chapter II-1 Part A-1 Reg 3-1
3. At the time of writing the latest work is as reported at MSC80 in WP.8
4. Available from the Secretariat to the NATO Naval Ship Code

REFERENCES

3.5 A wide range of references were consulted directly and indirectly by the Study Group, and the principal ones are noted towards the end of this Guide.

FORMAT OF CHAPTER II

3.6 With the exception of Regulation 0 Goal, each Regulation is divided into three tiers that support the Chapter Goal. This is in accordance with the Guide to the Naval Ship Code. The Tier 5 Justification level is not included in Chapter II, and this Guide is the primary document which justifies the statements in the Code (this Guide is Tier 5).

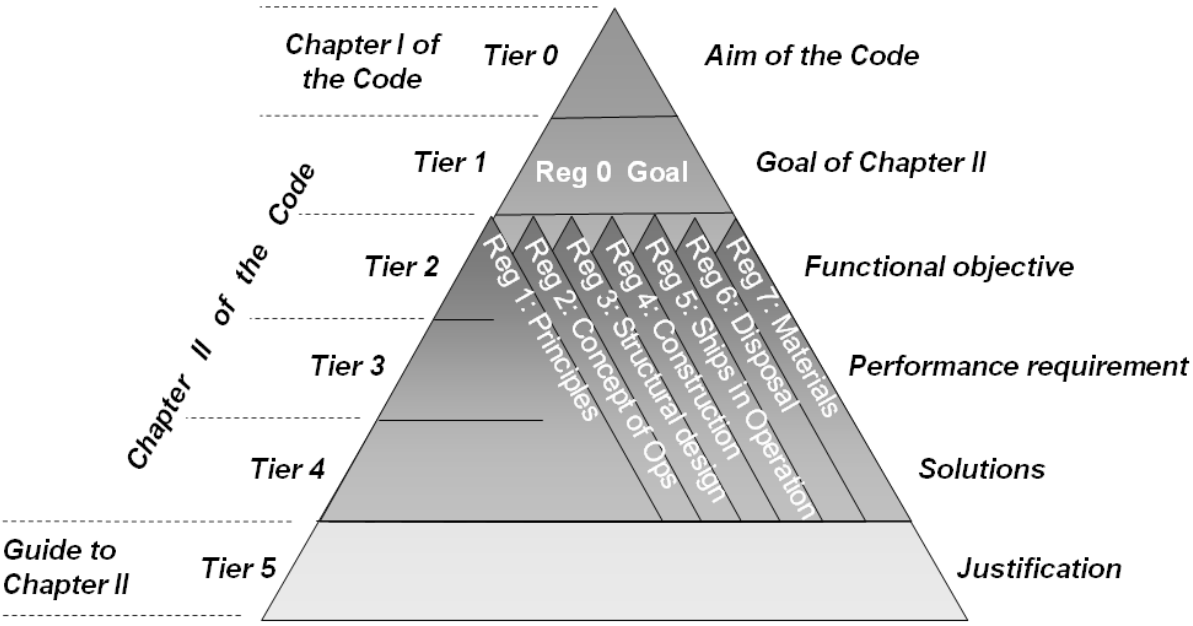

Figure 5: Format of Chapter II Structure

Regulation 0 Goal

3.7 Here the four principal objectives that need to be satisfied by the design, construction, maintenance and repair of a ship's structure are stated. These objectives make up the Tier 1 Goal for Chapter II (Regulation 0) which, in turn, supports the overall Aim (Tier 0) of the NATO Naval Ship Code.

3.8 The Goal for Chapter II (and other Chapters) was derived from DNV's work commissioned by the UK MoD[5]. This work pre-dated the formation of the Study Group, its purpose being to develop the unstated goals that SOLAS was believed to be addressing. Other combinations of sub-goal (objectives) were debated by the Study Group, but no alternative was found to be any more robust. The Study Group therefore considers the Goal both workable and comprehensive a far as the achievement of the Aim of the Code is concerned. The Group also found the Goal of this Chapter not only compatible with the purposes of classification vis à vis the safety of life but went further than the scope of classification in a few areas.

5. *Performance Goals for Naval Craft*, DNV Report 2005-0497 dated 13 July 2005

3.9 Detailed comment on the individual sub-goals is probably unnecessary at this stage, and it will become apparent from later Regulations how the Regulation 0 Goal is addressed. However, it is probably worth highlighting a few points that have been debated by the Study Group:

3.9.1 The word “sea” does not appear. That the Code is concerned with ships is obvious from its title “Naval Ship Code”. A ship, by definition, proceeds to sea. Other vessels which are the concern of the Code are considered as defied in Chapter I of the Code, and this includes ships that may be used on inland seas or other restricted waters. It also follows that the sea makes demands on the structure just as the cargo, equipment, etc. does.

3.9.2 The word “strength” does not appear. There is rarely a need for the structure for its own sake even where it is to satisfy a function such as aesthetic appeal (the aesthetic appeal being the function). In a ship, the fundamental requirement for “strength” comes from the need to provide weathertight and watertight integrity, to withstand other environmental forces, and the need to meet the demands imposed by the equipment and persons.

3.9.3 The Goal requires the structure to protect the embarked persons. This includes, for example, surveyors undertaking surveys on board or at sea if that is what is foreseeable, and persons seeking a place of safety in, for example, the case of a fire. The former requires adequate attention to the structural solution so that it is not a hazard in itself, while the latter requires that decks, etc. do not soften to an extent that all means of reaching a place of safety are barred.

3.9.4 The Goal does not specify where the place of safety is; that is a design function. For a larger ship it could be at one or more locations on board, while for the smaller craft operating in restricted waters it could be ashore. The essential feature is that the structure remains functional until that place of safety has been reached (or the threat has receded).

3.9.5 There is no ship life defined. This has been a matter of considerable debate within IMO and in other maritime forums. The Study Group was in little doubt that a specific ship life (e.g. a ship design life of 25 years) is not something to be specified by a Safety Code, especially where that Code sought to embrace a wide range of ship types of differing materials of construction. As will become apparent in later regulations, the essential requirement of this Chapter is that the structure performs as intended throughout the life of the ship.

Regulation 1 Principles

FUNCTIONAL OBJECTIVE

3.10 No comments.

DEFINITIONS

3.11 The definitions section which unique to this Regulation, defines a number of term:

3.11.1 The terms for limit state design, etc. were selected after consulting a number of sources[6].

3.11.2 Ships in Operation (or SiO for short) is an IMO term used to cover all aspects of ship ownership from entry into service to disposal.

6. Sources include BS5400 Steel, composite and concrete bridges (latest version), BS5950 Structural use of Steelwork in Building, EN1990 Eurocode – Basis of structural design, Ultimate Limit State Design of Steel-plated Structures (Paik et al) ISBN 0 471 48632 9, Common Structural Rules for Double Hull Oil Tankers (ABS, DNV and LR), ISO 18072 Ships and marine structures: requirements for their limit state assessment (draft), DNV Offshore Standard DNV-OS-C101 April 2004.

PERFORMANCE REQUIREMENT

GENERAL

3.12 In making the decision to develop a "standard for the selection of standards" the Study Group noted the large number of structural standards available today, all of which have been proven to result in sound structural designs and material solutions. To develop yet another standard seemed not only unnecessary but quite beyond the resource available to the Study Group. Consequently, it has not been the intention to supplant existing standards for structural design, construction and repair; rather, the intention is to provide direction to authorities who develop and publish structural standards.

3.13 Where it has been necessary to identify a standard as an example in order to provide focus for the work of the Study Group, the assumed standards have been those published by the Classification Societies that publish naval ship rules on the basis they are available, maintained, international, and, most importantly, comprehensively cover the assessment of the structure from design, through material supply, construction, and in-service survey, to modification and repair. This will become most apparent from the verification activities defined in the Solutions section for each Regulation.

3.14 The Group felt it appropriate to highlight structural issues that, while not excluded by SOLAS, are de facto not covered under SOLAS (dry-docking, structure not to be a hazard, access, etc.). All such issues need to be satisfied if the Goal of Chapter II is to be met.

3.15 The structure of Chapter II was agreed by the Study Group after considering several other alternatives. It is illustrated diagrammatically earlier in this Guide.

APPLICATION

3.16 Covered at high level in Chapter I, the extent of application for Chapter II is here identified. This is the same approach as that adopted by SOLAS.

SOLUTIONS

3.17 It is important to distinguish between something that tells the designer, builder or repairer to do something, and one which requires verification that the thing has been done satisfactorily.

3.18 A design standard typically says how something should be done.

3.19 A consulting surveyor typically says whether something complies or not with a defined standard.

3.20 Classification tells how a structure may be designed, says whether or not a standard has been complied with, and requires satisfactory. It is unique to the shipping world. While there are other schemes that will result in the same degree of assurance, classification does commend itself as a route to demonstrating compliance with Chapter II throughout the working life of the ship.

Regulation 2 Concept of Operations Statement

FUNCTIONAL OBJECTIVE

3.21 If the way in which the ship is to be used is not shared with the Naval Administration and its Recognised Organisation, certification becomes that much the weaker and may impose demands that do not need to be met.

3.22 The word "ship" as appearing in the title of this Code and as amplified by Chapter I implies a basic Concept of Operations Statement (e.g. it shall float, move, and be able to withstand the weather and cargo loads, etc.). The type of ship being ordered will also provide additional definition (e.g. does it look like a large ocean-going ship or fast littoral craft). But some operations will not be discernible from these general ideas, which is why the Concept of Operations Statement is an essential pre-requisite to the application of this Code.

PERFORMANCE REQUIREMENT

3.23 Imposition of requirements by the Naval Administration. There may be cases where the Owner states that there is no intention to damage the ship or use it in rough weather. The Naval Administration will take a view on whether the Concept of Operations Statement may need to be supplemented by additional requirements to bring the ship up to the standard expected for an equivalent merchant ship.

3.24 A template for the Concept of Operations Statement is in the Naval Ship Code at Chapter I Annex A.

3.25 The Working Group noted the need to embrace risks created by the procurement policies of the navies. Recognising that decisions were not always made on the basis of technical competence, a survey and inspection regime tailored to the capabilities of the selected suppliers in order to keep the risk of a structure under-performing at an acceptably low level must be considered.

SOLUTIONS

3.26 The baseline rules, standards and procedures may need to be modified and/or amplified to suit the needs of the ship as identified in the Concept of Operations Statement. Any such modifications are to be embraced by the Owner, the Naval Administration and, where appointed, the Recognised Organisation throughout the life of the ship.

Regulation 3 Structural Design

PREAMBLE

3.27 The terms “demand” and “capacity” are used throughout this Regulation:

3.27.1 While structural engineers primarily concern themselves with loads and the collapse mechanisms that may result if the strength is inadequate to carry that load, the load-carrying capacity (i.e. strength) of the ship is not the sole concern of this Chapter. The Goal may not be met if the vibration is excessive, or the deflection of a structural sub-assembly (e.g. deck, bulkhead, mast) gives rise to a lack of confidence or causes failure of an equipment which relies on the structure remaining in an essentially un-deformed shape (e.g. lift guide-rail support structure).

3.27.2 The structure must also not be a hazard in itself; it must not unjustifiably impede access and must be free from sharp edges.

3.27.3 If the capacity dictates the demand the demand may need to be limited. This is frequently done in the form of a limitation or operating restriction. Before allowing such an approach, the Naval Administration should take into account the ability of the operator to remain within the proposed limitation or restriction.

3.28 Structural demand and capacity models:

3.28.1 Limit state design methods are good, but in practice can be rather academic (purist); they will not generally be familiar to the shipping industry. The thought processes behind them are transparent and, while ending up at much the same place, do provide a good philosophical framework, and the opportunity to know how variability in one parameter may affect the resultant demand or capacity. Limit State methodology also provides essentially a two-stage digitisation of the analogue concept of “graceful degradation”. Another way of looking at the approach is to define “green”, “amber” and “red” zones where green equates to “safe”, amber to “take care/start taking remedial action”, and “red” equates to take remedial action immediately”. Such information is of great use in providing guidance information to the ship and to inform decision-making in an emergency.

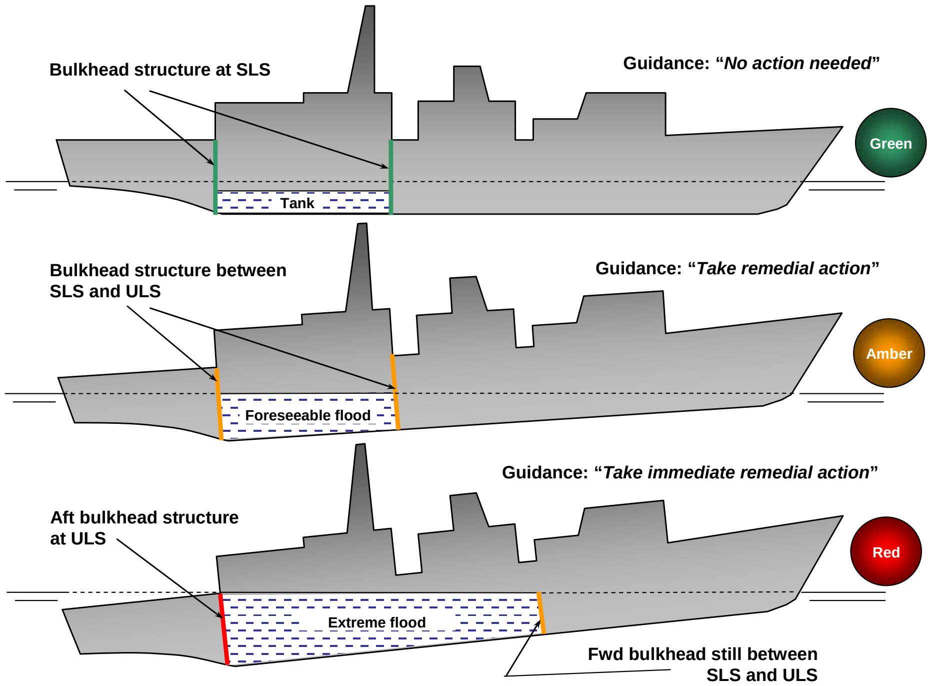

Figure 6: Structural Limit State Zones

3.28.2 For these reasons, the Code encourages the use of ULS and SLS methods for standards' development.

3.28.3 Acceptable margins of safety (probability of non-exceedance figures) should ideally be inserted in this Chapter to guide the structural standards and rule-making authorities. Unfortunately agreement has not been possible within the time and resource available to the Study Group.

3.28.4 The hierarchy of limits states is not well understood in marine circles. There are only two generic limit states: the Serviceability Limit State and the Ultimate Limit State. For each of these two limit states a number of scenarios need to be developed, and these should generally be based on the reaching of a defined structural capacity (e.g. fracture, elasto-plastic buckling of a hull girder flange in compression when subjected to a characterisation of loads and load combinations as a single uniaxial load, and avoidance of fatigue crack initiation as established from a series of laboratory-scale fatigue specimens (commonly referred to as the Fatigue Limit State), etc. Terms like Accident limit State may be convenient but have no meaning without a precise definition of the limiting criteria (or the demand).

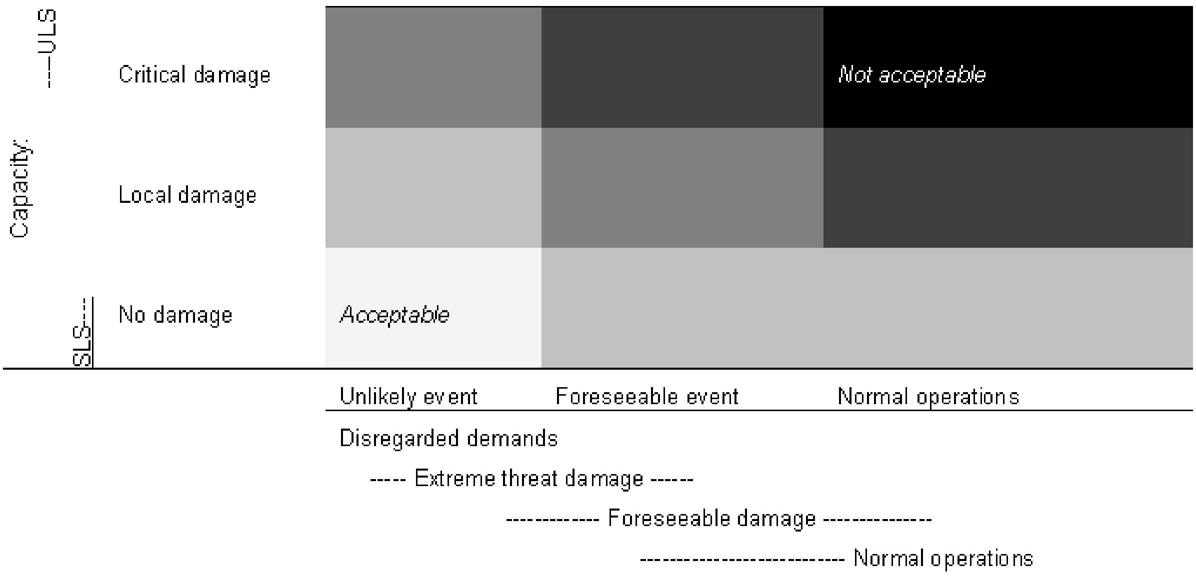

Figure 7: Diagrammatic Demand / Capacity Model

3.29 The demand made by access on structure is not well-covered by SOLAS and not generally covered by classification or other commonly-used structural standards. The Study Group felt the Code needed to devote some space to the role played by structure in providing safe access and safe escape routes, and the need to minimise the requirement for special arrangements (e.g. scaffolding or temporary ladders) be minimised for all routine survey requirements whether used by embarked staff or visiting shore-based personnel.

FUNCTIONAL OBJECTIVE

3.30 The fundamental objective of structural design is to demonstrate that the structural capacity exceeds the demand taking cognisance of the ship type and the duties specified for it in the Concept of Operations Statement

PERFORMANCE REQUIREMENT

3.31 Foreseeable demands include normal operating loads (including berthing, carriage of equipment and cargo, etc.), extreme environmental demands (rough weather), accidents (collision and grounding), and even demands caused by the foreseeable degradation of the structure over time.

3.32 Unless specifically requested by the Owner and agreed by the Naval Administration, foreseeable demands to not include demands made under extreme threat conditions, and certification under Chapter II of the present Code is optional.

3.33 By definition, if a demand is foreseeable, a decision on whether the structural capacity is to be assessed must be made. The fundamental responsibility for making this decision rests with the owner of the ship. Demands can be:

3.33.1 Disregarded for all ships. For a few, a simple decision based on a qualitative assessment of expectations will be made that the structural capacity does not need to be assessed. (e.g. a falling cow crashing onto the ship[7]). In probability/consequence terms: the probability is so low that whatever the consequence, a structural capacity assessment is not necessary.

7. Apparently, a USAF transport plane was on a famine relief mission when one of the heifers on board went berserk at 3,000 feet, knocking a soldier unconscious. In their concern for the safety of the plane and the rest of the cargo the cargo door was opened and the poor cow disappeared over the Caspian Sea - only to land on a ship! (1995)

3.33.2 Required for some ships. Generally the requirement will result from the ship type or the Owners' Concept of Operations Statement:

3.33.2.1 The satisfaction of pre-determined structural capacity criteria already published as an optional design assessment notation. An example is the rules of a classification society concerning the carriage of oil or the satisfaction of a "Replenishment at Sea" notation.

3.33.2.2 The need to undertake a ship-specific assessment based on a hazard identification study involving experienced naval or marine structural engineers. A decision will be made on whether the structural capacity needs to be assessed. If "no", the basis for the decision will be documented in the ship's design portfolio and the structural capacity not assessed. If "yes", structural capacity criteria will need to be developed, the demand quantified (if possible) and an assessment method agreed. In both cases, it is the responsibility of the Owner to initiate the study and seek the agreement of the Naval Administration or its recognised organisation.

3.33.3 Required for all ships. In the majority of structural design standards, these foreseeable demands will already have been addressed (e.g. the ability of the structure to withstand sea loads). If they have not, the Naval Administration should work with the owner of the standards to address the weakness. In the event of a reluctance to address these demands, the Naval Administration should consider whether Recognised Organisation status is inappropriate.

3.34 Accidents. It may seem odd, but accident demands are not explicitly seen as requiring any separate treatment from any other demand. Generally, the structure will be "re-configured" in an accident and this may give rise to new loading cases. But they are just foreseeable events, which will (generally) be analysed using ULS methods.

3.35 Fatigue. Though fatigue damage is extremely important to understand and control, in recent decades fatigue seems to have assumed a life independent of any other structural criterion. Yet fatigue is not a failure mechanism; like corrosion, it is a damage mechanism that may lead to one or more failure mechanisms. Fatigue damage, like accident damage or rust, is another foreseeable event, which must be assessed using an appropriate methodology against appropriate SLS/ULS criteria.

CYCLIC DEMANDS

3.36 Cyclic demands shall be assessed where their magnitude and frequency of occurrence may give rise to structural damage.

3.37 A cyclic demand will typically have a typical probability of occurrence in a ship's life that exceeds 10.000 cycles. Cyclic demands are typically generated by waves, induced by natural vibration of the hull, or induced by machinery. Other possible cyclic demands could include thermal loads or loads induced by slamming for high-speed craft; these are to be assessed where their magnitude and frequency may give rise to structural damage.

3.38 Loads and deflections that give rise to fatigue cracking are the most common form of cyclic demands requiring assessment.

3.39 Safe life design: There is a high degree of certainty that no damage will occur during the specified design life. An example might be a fatigue assessment of the hull for the design life.

3.40 Serviceability limit state (SLS): The condition beyond which a loss of utility or cause for concern may be expected and remedial action required (e.g. Excessive or permanent deflection).

3.41 SLS assessment:

3.41.1 Structural demand: A load spectrum based on ship utilisation (life, availability, sea areas and seasons of the year, etc.).

3.41.2 Structural capacity: A fatigue assessment. For guidance: probability of non-initiation of a fatigue crack at each structural detail to be not less than 98% (mean – 2 sigma) over the ship's life. Where the safe life is to be less than the expected remaining life of the ship at the time of assessment (i.e. a damage-tolerant philosophy is proposed), should generally be agreed with the Naval Administration or its Recognised Organisation.

3.41.3 A vibration assessment for crew comfort and habitability may be required.

3.41.4 A SLS fatigue assessment may not be required:

3.41.4.1 For certain simple, low stress ship types.

3.41.4.2 Where the number of cycles to which the structure is subjected is expected to be less than 1.000.000 cycles over the ship's life.

3.42 ULS assessment:

3.42.1 Structural demand: The time to reach a place of refuge or 30 days whichever is greater based on ship utilisation (life, availability, sea areas and seasons of the year, etc.) may be a suitable definition. If adopted, a characteristic crack/delamination/debonding length that has a high probability of being detected will need to be specified.

3.42.2 Structural capacity: A fracture/delamination/debonding propagation assessment is being suggested. For steel this could be along the lines of: "following detection at the characteristic crack/delamination/debonding length, an 85% (mean – 1 sigma) probability of avoiding fast fracture over 30 days".

3.43 In order to ensure a degree of damage tolerance, it is recommended that a ULS fracture assessment is not waived. Depending on the ship type, its operating environment, the number of cycles and the magnitude of the loads, such an assessment could be either by the simple specification of appropriately tough material or by an in-depth fracture analysis.

DYNAMIC DEMANDS

3.44 Terminology: The term "dynamic demand (load)" tends to be used for local effects and higher accelerations (e.g. slamming), whereas the term "inertial demand (load) is generally reserved for overall effects and low accelerations (e.g. ship heave). Where there is sufficient historical evidence, inertial loads may be treated as quasi-static where the enhancement due to the inertia is expressed as a partial factor of safety. In a more limited number of cases, dynamic loads may be similarly treated, though caution should be exercised at higher accelerations, structures near to resonance, or where damping is low.

3.45 Inertial demands are typically caused by:

3.45.1 Self-weight, deck, equipment and cargo loads for ships at sea where V ≥ 7.16 x D0.1667 (V (speed) is in knots and D (displacement) is in tonnes).

3.45.2 Self-weight, deck, equipment and cargo loads for large, unsupported spans (e.g. flight decks over aircraft hangars).

3.45.3 Wave-induced bending moments.

3.45.4 Operational and environmental loads that are essentially transient in nature (green seas, moderate slamming, berthing and mooring loads, etc.).

3.46 Dynamic loads are the same in nature as inertial loads but are normally associated with higher rates of loading (e.g. greater than 50 microstrain/sec) or higher accelerations (e.g. greater than 1g). Dynamic loads include typically:

3.46.1 Generated by lifting equipment “snatch” loads, weapon firing loads, aircraft landing loads, etc.

3.46.2 Cargo loading and unloading loads, and rate of loading.

3.46.3 Unintentionally applied abnormal loads which are of an occasional nature such as dropped equipments, etc.

3.46.4 Extreme examples of environmental loads (e.g. slamming of high-performance craft, localised impact loads, etc).

3.47 Structural demand. Quantification of the load-time history – the characteristic load-time history – should be chosen that is as representative as possible of the expected history and partial factors of safety included to account for uncertainties in the modelling techniques, and experimental or trials assessment methods. In a limited number of cases, the energy to be absorbed by the structure may be a more useful measure.

3.48 Where the inertial or dynamic load is of a repetitive nature with a large number of cycles (e.g. greater than 10.000 cycles in a ship life), consideration is to be given to assessing them as a cyclic load.

3.49 Structural capacity. In general the structural capacity will be assessed using the dominant ULS and/or SLS methods. Both assessments will be used where the dominant failure modes are different in each limit state (e.g. avoidance of permanent set (deflection) of a flight deck for normal operations (SLS) and rupture of the flight deck in a crash-landing scenario (ULS)).

3.50 Where the structural or structural material can tolerate local impact or dynamic load with cosmetic damage only (“bumps and scrapes”), assessment of the structural capacity may be disregarded.

STATIC DEMANDS

3.51 Static demands are typically:

3.51.1 Environmental demands that do not need to be considered as inertial or dynamic demands (loads, diurnal temperature changes).

3.51.2 Still water bending moments.

3.51.3 Intentionally applied loads which are of an occasional nature such as test loads, dry docking loads, maintenance loads.

3.51.4 Demands made by the embarked machinery, equipment, lifting appliances, weapon systems, life-saving appliances, cargoes and stores that do not need to be considered as inertial or dynamic demands.

3.52 Structural demand: The structural demand will be determined from a characteristic value appropriately factored by partial factors of safety to describe the uncertainties introduced during its characterisation. A further partial factor may be applied where the demand is to be treated as quasi-static (i.e. a dynamic demand equivalent to a static demand). The formulations used for the quantification of overall longitudinal bending moment are the most obvious (and important) examples of a quasi-static approach to a dynamic load.

3.53 Structural capacity: In general the structural capacity will be assessed using either the dominant ULS/SLS methods or rule formulations developed from a generic ULS/SLS assessment. Both ULS and SLS must be used where the dominant failure modes are different in each limit state (e.g. satisfactory performance of a gun recoil support structure may be deflection limited (SLS), whereas collapse of the same structure may be buckling limited (ULS)).

DEMANDS LIMITED BY CAPACITY

3.54 The demands made upon a structure may need to be limited by the capacity. Examples include the cargo carrying capacity (intact or damaged), the availability of the flight deck to embark visiting helicopters, or equipment and system alignment demands being dictated by the configuration and materials of hull construction.

3.55 Capacity commonly dictates the demand for high-speed craft, though this is generally referred to as an operational restriction or limitation.

3.56 Both ULS and SLS methods are appropriate for the assessment of such demands.

3.57 Limitations must be consistent with the Owner's Concept of Operations Statement. The Naval Administration must be satisfied that the limitations are acceptable for the role of the ship and consistent with the ship type. The Naval Administration may call for a justification of the limitation.

3.58 Guidance information available to the Commanding Officer in a form that can be readily understood on board is invariably required.

UNQUANTIFIABLE DEMANDS

3.59 Demands that are not quantifiable include ruggedness and vibration assessment. Collision is also generally addressed from a statistical assessment of casualties and the provision of alternative load paths or containment structure (e.g. collision bulkheads or double bottom requirements).

3.60 An unquantifiable load or load effect is not to be confused with a disregarded load or load effect. The latter has such a low probability/consequence index throughout the life of the ship that it may be disregarded.

3.61 In general such demands will be based on prescriptive solutions with a proven record of satisfactory performance either against SLS and/or ULS criteria.

3.62 The Naval Administration may need to be satisfied that the demands are indeed unquantifiable. For example, while not available in definite terms, some parametric calculations may be possible.

3.63 Examples of unquantifiable demands include:

3.63.1 Vibration analysis. Generally such analyses restrict themselves to the avoidance of resonant frequencies rather than quantify the magnitude of the imposed accelerations and deflections,

3.63.2 Components or assemblies whose structural capacity is determined by the statistical analysis of past events (e.g. ruggedness, collision requirements (double-bottom, etc), minimum scantlings, certain types of dynamic response),

3.63.3 A demand is one that causes and response in the structure that cannot be represented as an applied load (e.g. thermal loads).

3.64 Structural capacity: As appropriate to the role and size of the ship. Justified by experience or other parametric statistical criteria.

DESIGN FOR MANUFACTURE

3.65 Manufacturing organisations are to be consulted during the design process to ensure that the ship can be constructed and repaired with little risk of the design being compromised.

3.66 Consideration is also to be given to the design being compromised because of limitations imposed by:

3.66.1 Geographical (e.g. national or international build), political (e.g. use of in-country processes), and contracting strategy (e.g. risk sharing strategy),

3.66.2 Managerial expertise and experience (is there genuine experience in ship construction or is it just by ephemeral academic management qualification),

3.66.3 Whether the manufacturing processes are unique to one authority (e.g. an advanced technique protected by patent). This could impose a risk if that authority is not available to undertake future work,

3.66.4 Operational scenarios identified in the Concept of Operations Statement that may require in-theatre repair.

SOLUTIONS

3.67 Owner. It is envisaged that the Owner is responsible for agreeing that the selected standards are appropriate for:

3.67.1 The use of the ship as defined in the Owner's Concept of Operations Statement,

3.67.2 The design,

3.67.3 The method, processes and procedures to be used for the ship's construction,

3.67.4 The ship's through-life operating, maintenance and repair philosophy (the SiO phase),

3.67.5 The disposal philosophy.

3.68 Naval Administration. It is the responsibility of the Naval Administration or its Recognised Organisation to verify that:

3.68.1 The selected rules or standards fully meet the requirements of this Chapter in its entirety.

3.68.2 The selected standards are authoritative and are likely to be continually updated to benefit from structural developments and in-service experience,

3.68.3 The authority interpreting the rules has experience in implementing them as well as recourse to an in-depth knowledge of the background to their development,

3.68.4 The authority implementing the standards is available for consultation throughout the SiO phase of the ship's life,

3.68.5 The authority implementing the rules or standards is at all times accountable to the Naval Administration[8].

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8. Naval Ship Code Chapter I Regulation 7(f)

Regulation 4 Construction

FUNCTIONAL OBJECTIVE

3.69 The fundamental objective is to demonstrate that the quality of construction and the materials used meet the assumptions of the designer and the selected structural design standards.

PERFORMANCE REQUIREMENT

QUALITY OF WORKMANSHIP

3.70 The quality of work and work processes is to be undertaken to the satisfaction of the Naval Administration or its Recognised Organisation in:

3.70.1 In facilities that are appropriately accredited,

3.70.2 By appropriately accredited and experienced persons.

3.71 Chapter II recognises that in many cases, a functional test of the resultant ship's structures is impossible (e.g. the overall strength of the hull in extreme seas, the test of structure in a degraded end-of-life state, or the ULS strength of a flight deck under crash-landing conditions). Experience has shown that audit of management processes alone is inadequate to ensure the necessary quality.

3.72 Consequently, audit of the manufacturing processes and the quality of the product throughout all stages of manufacture and construction is seen as an essential part of achieving certification to the present Code.

3.73 There are many construction quality standards in use for steel and aluminium ships, and most are very similar. It should not be assumed that occasional builders of ships can meet them.

3.74 There are fewer constructional quality standards for FRP and ships of advanced design. It is essential that the designer recognises the risk is an onerous standard is demanded that the builder cannot routinely achieve.

QUALITY OF MATERIALS

3.75 Materials, including jointing materials (welds, fasteners, adhesives, etc.) used for construction are to comply with Regulation II-7.

SOLUTIONS

3.76 The Naval Administration or its Recognised Organisation is to assure itself that the construction and repair processes and procedures are consistent with the designer's assumptions.

3.77 The achieved quality of construction is to be recorded in areas of both high demand/low capacity, and where failure may be catastrophic in nature.

3.78 Assessment and analysis. The standard achieved during the construction phase is to be verified by the Naval Administration or its Recognised Organisation as:

3.78.1 Complying with the designer's drawings,

3.78.2 Complying with the fabrication processes and standards,

3.78.3 Being constructed of materials of certified provenance and performance.

3.79 In the event that there has been a localised shortfall in the structure, verification that it provides an equivalent capacity to that intended. The provisions of Chapter I Regulation 5 are also of relevance.

3.80 Visual or other non-destructive inspection methods are processes which rely heavily upon the skill of the surveyor or operator. The Code implies that both the processes and the persons should be approved by the Naval Administration or its Recognised Organisation.

3.81 Testing. Some structures do lend themselves to physical testing as a verification method:

3.81.1 Where testing is proposed or is required, such tests are not to be regarded as a substitute for design to recognised standards. For example, it would seem unreasonable to expect the ULS capacity of a structure to be ascertained by test.

3.81.2 Testing, which may be to demonstrate loading capacity, deflection or vibration limits, is to be conducted in accordance with recognised standards and procedures approved to demonstrate the normal demands that will be experienced in the SiO phase.

Regulation 5 Ships in Operation

FUNCTIONAL OBJECTIVES

OPERATION

3.82 If the operational limitations are not available on board in a form that can be readily understood by the intended reader, then the basis of certification is undermined.

3.83 Notwithstanding the assertion by some authorities that the ship's life is, say 25 years, there is no such thing as a ship which can remain in service for 25 years without survey and maintenance. The design standard must take due cognisance of the survey and maintenance regime stated in the Concept of Operations Statement or, in the absence of any statement, the default merchant ship regime.

3.84 Drydocking. Traditionally SOLAS/IMO and classification societies do not cover dry-docking. This seems to be an anomaly:

3.84.1 Persons are embarked while the ship is in dry-dock;

3.84.2 Certificates are not withdrawn while a ship is in dry-dock;

3.84.3 A naval ship is just as operational in a 24-hour dry-docking as she is when alongside an ammunition berth or visiting a foreign port. We see no reason why a ship that is “in routine” should not be certified just because the water has been replaced by dock blocks.

3.85 Clearly the situation is different when in a major refit or modernisation, in which case a full assessment of the arrangements may need to be undertaken. The Naval Ship Code is not intended to apply in such circumstances.

3.86 The Study Group agreed that a ship should at least be able to get through the week-end (hence 72 hours) and still remain certified (i.e. the embarked persons enjoy the same level of safety assurance as if the ship were afloat).

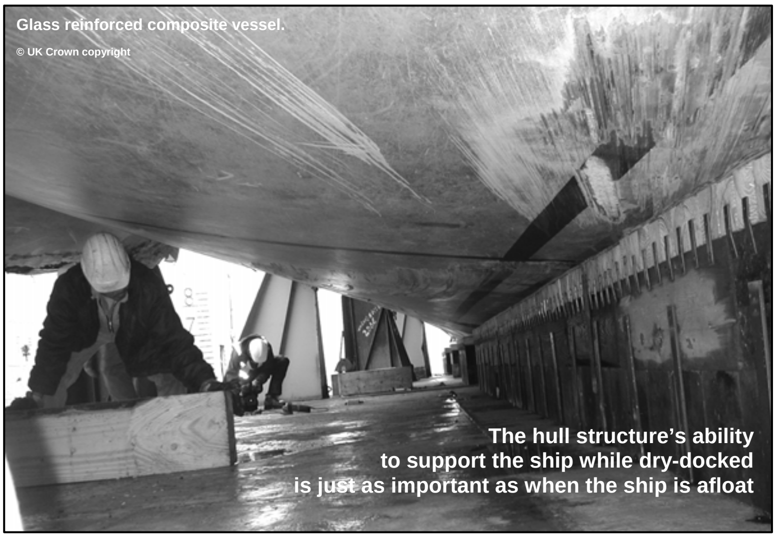

Figure 8: Underneath a Docked Ship

SURVEY

3.87 In service damage can be occur through three principal mechanisms:

3.87.1 A gradual deterioration through life (e.g. rust in steel, water absorption in GRP),

3.87.2 A specific incident in which the damage may or may not be detected and reported by the ship's staff (e.g. berthing damage, exceeding operational limitations), and

3.87.3 Unauthorised or misguided modification that compromises the designer's intent.

3.88 All the above mechanisms lead to a requirement that the structure is periodically inspected to ensure the structural capacity has not been adversely affected.

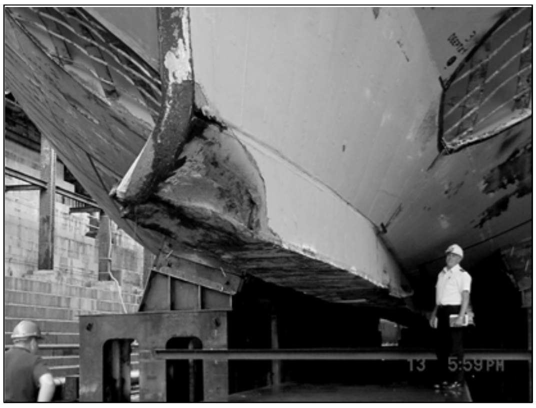

Figure 9: Damaged Ship

MODIFICATION AND REPAIR

3.89 Modification and repairs should generally be undertaken in accordance with the designer's intention using the same processes and acceptance criteria as were used during construction. However, there will be occasions that require a departure from this philosophy:

3.89.1 Improving the design where the designer "got it wrong",

3.89.2 Using alternative structural practices/processes where the original manufacturing practice/process would be uneconomic,

3.89.3 Changing the design and/or material state where the Owner has updated his Concept of Operations Statement.

PERFORMANCE REQUIREMENT

OPERATION

3.90 Guidance must be clearly understood; if the Ship's Officers do not know what Ice Class 1A means by reference to publications available to them on the Bridge, the information no longer offers guidance.

3.91 Normal operating limits and ultimate failure limits need to be defined by the designer at the time the design is being undertaken and/or assessed by the Naval Administration or its Recognised Organisation.

3.92 The form and content of the Operator Guidance information is to be agreed by the Naval Administration before a certificate in accordance with the requirements of Chapter I of the present Code can be issued.

3.93 Operator Guidance is to be provided covering normal operations, emergency operations and maintenance procedures that are likely to be within the competence of the embarked personnel. They are to include (but not necessarily be limited to):

3.93.1 Weather and other environmental limitations (sailing limitations):

3.93.1.1 Air temperature and ice navigation,

3.93.1.2 Anchoring, mooring and towing limitations,

3.93.1.3 Sea state-speed limitations.

3.93.2 Loading limitations:

3.93.2.1 Cargo and fluid loading limitations,

3.93.2.2 Flight deck loading limitations (normal and emergency),

3.93.2.3 Deck loading capacity including ramps and elevators (normal and emergency),

3.93.2.4 Watertight closing devices used at sea,

3.93.2.5 Dry-docking.

3.93.3 Damaged strength of the ship:

3.93.3.1 Sea-state limitation damaged,

3.93.3.2 Capacity of the ship to navigate,

3.93.3.3 Capacity of sub-division structures to contain damage.

3.93.4 Access manual.

3.93.5 Survey requirements: These will only needed where onboard survey is part of the Concept of Operations Statement (e.g. where a classification society has authorised ship's staff to undertake routine surveys):

3.93.5.1 Structural key plan indicating primary strength members and materials,

3.93.5.2 Ship-specific areas prone to deterioration.

3.93.6 Repair guidance for embarked staff. Only needed where repair by embarked personnel is identified in the Concept of Operations Statement.

3.93.7 Military guidance (optional).

SURVEY

3.94 The ship is to be surveyed in accordance with the requirements of Chapter I and all repairs of modifications undertaken to the satisfaction of the Naval Administration or its Recognised Organisation. It is perhaps worth re-iterating the clarification note in Chapter I of the Code that, for the purposes of the present Code, "…a survey is said to be complete when the deficiencies or other departures have been rectified or justified as adequate".

MODIFICATION AND REPAIR

3.95 In all cases where a departure from the original design is intended, the design and implementation of the modification or repair is to be re-assessed and accepted by the Naval Administration or its Recognised Organisation to ensure the structural capacity remains at least as effective as would have been intended.

SOLUTIONS

3.96 The Naval Administration or its Recognised Organisation is to assure itself that the material state philosophy and Operator Guidance information are consistent with the designer's assumptions and the owner's Concept of Operations Statement for a ship of the specific type.

3.97 Assessment to recognised procedures of the Naval Administration or its Recognised Organisation. This assurance must include a significant degree of engineering product audit; audit of management processes alone is not sufficient.

Regulation 6 Disposal

3.98 In accordance with Specialist Team directive June 2006, this Functional Objective has not been fully developed for the present Code. Before this directive was issued the Study Group did consider the issue of disposal, and these are noted below as a matter of record.

3.99 The Study Group did not find the title "Disposal" adequate, and felt that there is far more to a study of the environmental impact. This will be apparent from what appears in italics below. This was another issue raised with the Specialist Team, but remains unresolved at the time of writing.

FUNCTIONAL OBJECTIVES

3.100 To encourage the selection and use of materials and manufacturing processes that minimise the impact on the environment.

DEFINITIONS

3.101 Environmentally-friendly materials: Materials and processes used in the manufacture, construction and repair that minimise the impact on the environment. Greenhouse gases that result from the burning of fossil fuels may need to be considered.

3.102 Environmentally-friendly processes: Processes used in the manufacture, construction and repair that minimise the impact on the environment from the production of greenhouse gases and other atmospheric pollutants.

PERFORMANCE REQUIREMENT

3.103 This Regulation seeks to encourage:

3.103.1 Recycling as the best means of disposal of ships, consumables and materials used during manufacture and repair of the hull structures,

3.103.1.1 The use of environmentally-friendly materials and process during all stages of the ship's life (from concept to disposal) whether forming part of the ship or produced as a by-product of the manufacturing and repair processes,

3.103.2 Compliance with the relevant national and international legislation[9].

SOLUTIONS

3.104 Assessment to the recognised procedures of the Naval Administration or its Recognised Organisation or international shipping regulations whichever is more demanding.

Regulation 7 Materials

FUNCTIONAL OBJECTIVES

3.105 If the materials of construction and repair (including the jointing materials) do not behave as the designers assumes, then there is no basis for assuming the requirements of Chapter II have been met.

PERFORMANCE REQUIREMENT

3.106 The materials are not to become a hazard in themselves. Protection of structural materials that exhibit such tendencies (e.g. the use of thermal insulation) is, subject to appropriate approvals, acceptable as a solution.

SOLUTIONS

3.107 Audit of the manufacturing processes and the quality of the product throughout all stages of manufacture and construction is seen as an essential part of achieving certification to the present Code.

9. IMO's primary focus currently appears to be with recycling. There are probably more environmental issues to be addressed than would be addressed by a consideration of recycling alone.

3.108 Where the materials are not normally characterised in a way that is consistent with the use of the ship as identified in the Concept of Operations Statement, additional characterisation is required. Examples include the use of FRP composites in extreme hot areas of the world where the glass transition temperature, Tg, may be exceeded.

3.109 Characterisation of the materials in a way consistent with the ship's use as specified in the owner's Concept of Operations Statement is the responsibility of the Designer.

3.110 The Naval Administration or its Recognised Organisation is to provide assurance that the material as characterised is appropriate for the use the designer intends.

Other information

REFERENCES

3.110.1 Naval publications:

3.110.2 Naval structural design, construction and repair standards and guides from the countries of the Study Group members (Canada, Norway, Sweden, and the UK)

3.110.3 UK MoD Ship Safety Management, JSP 430 Pt 3: Naval Authority Regulations

3.110.4 The work of the Naval Ship Code Secretariat and other Study Groups.

3.111 IMO and Classification Society publications:

3.111.1 SOLAS Consolidated Edition 2004, IMO

3.111.2 2000 HSC, IMO

3.111.3 Code of Safety for Special Purpose Ships, IMO, 1984

3.111.4 IMO Goal based standards, WP.8, MSC80

3.111.5 IACS Unified Requirements Z-series (and others)

3.111.6 Rules and Regulations for the classification of ships, naval ships, high speed craft and special service craft published by DNV and LR

3.111.7 Common Structural Rules for Double Hull Oil Tankers (ABS, DNV and LR)

3.111.8 DNV Offshore Standard DNV-OS-C101 April 2004

3.111.9 Selected writings of the officers of DNV and LR

3.112 Other publications and sources:

3.112.1 DNV assessment of SOLAS "goals" March 2005 (DNV report 2005-0497); MSC 78/6/2 5 Feb 2004.

3.112.2 EN1990 Eurocode – Basis of structural design

3.112.3 ISO 18072 Ships and marine structures: requirements for their limit state assessment (draft)

3.112.4 BS5400 Steel, composite and concrete bridges

3.112.5 BS5950 Structural use of Steelwork in Building

3.112.6 Ultimate Limit State Design of Steel-plated Structures (Paik et al) ISBN 0 471 48632 9

ACKNOWLEDGEMENT

3.113 The Study Group gratefully acknowledges the assistance and facilities made available to it by the parent organisations of the members, and the many other organisations and officers who have assisted in the work.

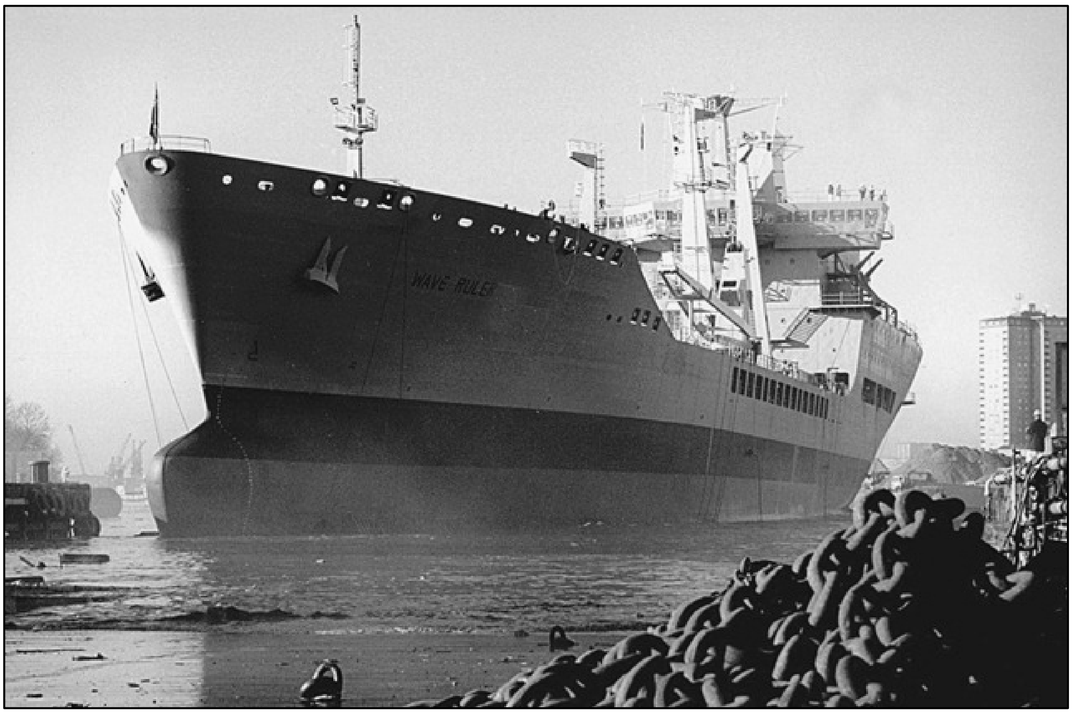

Figure 10: Ship Launch

4 GUIDANCE ON NSC CHAPTER III BUOYANCY, STABILITY AND CONTROLLABILITY

Background

THE DEVELOPMENT GROUPS

4.1 This Chapter was developed by a Study Group in 2006 from the Specialist Team constituted under NATO NG/6 to which all NATO Navies, Partners for Peace Navies, and Naval Classification Societies that were members of the Naval Ship Classification Association were invited. It was reviewed by an INSA Working Group in 2010/12. Principal contributors in 2006 included the Defence Departments of Australia, Canada, Italy, Netherlands, Spain and the United Kingdom and in 2010/12 Canada, Netherlands, Sweden and the United Kingdom and on both occasions with input from the Naval Stability Standards Working Group.

Comments on the work of the development Groups

4.2 The navies represented on the Study Group and latterly the INSA Working Group operated a wide range of ship types, size, style of construction, and operational areas.

4.3 Due to the variety of available Naval Standards on stability and on-going work in other bodies to understand the dynamics of the stability problem and the measure of safety provided by current standards, it was decided not to develop another detailed quasi-static stability standard for Editions 1-3. In 2010 INSA created a Working Group to develop an intact stability standard as a solution to the performance requirements and a review of the Chapter.

4.4 The Working Group was aware of the work of IMO and due cognisance was taken of its work.

4.5 It was identified that maintenance of watertight integrity, stability and the safety of persons on board relied not only on the arrangement of the hull and spaces but also on the operator. Furthermore, aspects of controllability contribute to reducing the potential for collision or broach and ship motions impact the safety of the crew and other persons onboard. Until such times as these broader aspects are covered in other parts of the Code they (controllability and ship motions) are addressed at a Performance Requirements level in so much as they impact the buoyancy and stability of the ship.

4.6 It is recognised that Chapter III has links to Chapter II Structures, Chapter IV Engineering Systems, Chapter VII Escape, Evacuation & Rescue and Chapter IX Navigation.

REFERENCES

4.7 A range of references were consulted directly and indirectly by the Study Group and latterly the INSA Working Group. The principal references are noted towards the end of this Guide.

Regulation 0 Goal

4.8 The primary goal of Chapter III has been set to provide the ship with the ability to remain afloat in an “upright” orientation in all Foreseeable Operating Conditions including loading, environment (including heavy weather) and applied “foreseeable” disturbances including cases of damage causing loss of watertight integrity.

4.9 The goal acknowledges that design and material state cannot satisfy the requirements and requires that the ship is operated by trained persons, in a way consistent with proven good seamanship, who are provided with sufficient guidance to maintain the “upright” orientation of the ship.

4.10 The goal continues, requiring the provision of an environment for persons onboard that is as safe as reasonably practical, thus acknowledging the inherent risk of placing people in a maritime environment and the need to design and maintain the ship in a way that minimises the risk to those onboard whilst achieving the primary goal.

4.11 Further, the final element of the goal is to provide a margin on the required buoyancy and stability to give persons onboard a reasonable chance of escape from a stricken ship following an extreme event, using the ships own evacuation system.

Regulation 1 General

ASSUMPTIONS

4.12 The functional objectives of this regulation illustrate some of the differences between Naval and Merchant shipping concept of operations.

4.13 The fundamental operational philosophy unpinning the need to provide adequate reserve of buoyancy and stability is that naval ships must safeguard life and property at sea whilst maintaining freedom of manoeuvre. A navy will desire the ability to achieve rapid deployment to any area of conflict or humanitarian crisis within their area of interest. It will also operate in close proximity to other shipping, particularly during replenishment at sea, blockade, interdiction or multi-platform operations.

4.14 In this regard a Navy cannot be restricted to operating in shipping lanes or fair weather and furthermore, it is assumed that they will frequently depart from shipping lanes, remain on station during or transit through adverse weather and operate in potentially restricted or littoral waters. These operational scenarios require that the ships and their crews are sufficiently capable of contending with the foreseeable risks they may encounter.

4.15 The preceding operational philosophy requires that a ship has a level of inherent seaworthiness including ship motions tolerable by equipment and persons onboard, controllability and above all the ability to remain afloat and not capsize. Further, “sufficiently capable crew” implies that the ship will be operated under the precepts of good seamanship.

4.16 Naval ships face many hazards to meeting these fundamental requirements. Chapter III of the Code provides regulations to assist the Naval Administration in maintaining a level of risk due to buoyancy and stability hazards that is as low as reasonably practical in all Foreseeable Operating Conditions both intact and damaged.

4.17 In general, Naval ships are designed to survive extreme hostile acts and although not included in the regulations of the code, this scenario is not excluded and may be addressed if required in the Concept of Operations Statement.

HAZARDS

4.18 Foreseeable hazards for buoyancy and stability are detailed below.

ENVIRONMENT

4.19 Foreseeable environmental conditions may include extremes of wind, wave height, modal period and temperature. Operating environments refer to the ship specific conditions which limit the operational capability. For example, an aircraft carrier would not be expected to be able to launch aircraft in very high sea states.

4.20 To assist in defining the Foreseeable Operating Conditions and therefore bounding the risks due to the sea environment for a given ship, the type of service and environment that a ship is expected to endure should be defined in the Concept of Operations Statement. One approach is to define a service classification which has an associated environment such as those provided in the Tables below.

SERVICE CLASSIFICATIONS[10].

Service	Description	Weather & Sea Characteristics	Survival & Rescue Infrastructure
Ocean Unlimited	Fully independent operation at sea, able to hold station in all but extreme conditions, able to resume duties after conditions abate	Severe tropical cyclone or equivalent, extreme winds and extreme seas.	Early rescue not likely. Probable extended period in survival mode.
Ocean Limited	Independent operation at sea, avoiding centres of tropical disturbance, able to resume duties when conditions abate	Storm force weather or equivalent. Very high winds and very high seas.	Early rescue not likely. Probable extended period in survival mode.
Offshore	Independent operation within 200 nautical miles or 12 hours at cruising speed (whichever is less) of a safe haven. Return to safe haven if winds likely to exceed Beaufort 8.	Gale force weather and very rough seas.	Survival in moderate conditions or early location likely and within helicopter range for rescue.
Restricted Offshore	Restricted operations within 4 hours travel at cruising speed of a safe haven.	Near gale force weather and rough seas.	Survival in benign conditions or early rescue.
Protected Waters	Operates within specified geographical limits or within 2 hours travel at cruising speed of a safe haven in waters specified as 'partially smooth'.	Strong breeze winds and moderate seas.	Rescue facilities and/or shoreline nearby.
Smooth Waters	Operates within specified geographical limits or within 1 hours travel at cruising speed of a safe haven in waters specified as 'smooth'.	Strong breeze winds and operates only in small waves.	Rescue facilities and/or shoreline nearby.

Table 4.1: Service Classifications

10. Available from the Secretariat to the NATO Naval Ship Code

ENVIRONMENT CONDITIONS[11].

Service Class	Operational			Survival			Damage		
	Wind Speed		Sig. Wave Height (m)	Wind Speed		Sig. Wave Height (m)	Wind Speed		Sig. Wave Height (m)
	Nominal (B'fort)	Design (knots)		Nominal (B'fort)	Design (knots)		Nominal (knots)	Design (knots)	
Ocean Unlimited	9	70	6.0	12	100	17.7	26	39	2.5
Ocean Limited	8	60	6.0	10	80	11.2	26	39	2.5
Offshore	7	50	4.0	8	60	6.2	24	36	2.2
Restricted Offshore	6	40	2.5	7	50	4.3	22	33	1.8
Protected Waters	5	30	1.25	6	40	2.5	20	30	1.5
Smooth Waters	5	30	0.5	6	40	0.8	20	30	0.5

Table 4.2: Environment Conditions

LOSS OF WATERTIGHT OR WEATHERTIGHT INTEGRITY

4.21 A damage incident for the purposes of this chapter is defined as a breach of watertight or weathertight integrity.

4.22 When the watertight or weathertight integrity of a ship is breached by any mechanism the ship is at risk of loss due to flooding. The extent of the breach and the ship's initial loading condition and material state will dictate the likelihood of the ship being lost.

4.23 Irrespective of whether the damage is caused by an accidental or hostile event all damage can be categorised. The level of safety and performance following damage will depend on the severity of the damage incident. This is illustrated in the diagram below showing a Green, Amber and Red condition corresponding to Foreseeable, Extreme and Catastrophic Events.

4.24 A Catastrophic Event (caused by damage that the ship and persons on board would not be expected to survive) will result in an undefined ship state that may lead to rapid loss of the ship.

4.25 Following an Extreme Event, resulting from damage more severe than foreseeable but not catastrophic, the ship would be expected to remain afloat in a condition that will allow personnel to evacuate if required.

4.26 In the event of damage below the extreme level (Foreseeable damage), the ship would be expected to survive. The level of real operational capability will depend on a particular Navy's Concept of Operations Statement. Chapter III is primarily concerned with Foreseeable Operating Conditions up to extreme damage, with exception of the Regulation 6 Preservation of Life.

11. Available from the Secretariat to the NATO Naval Ship Code

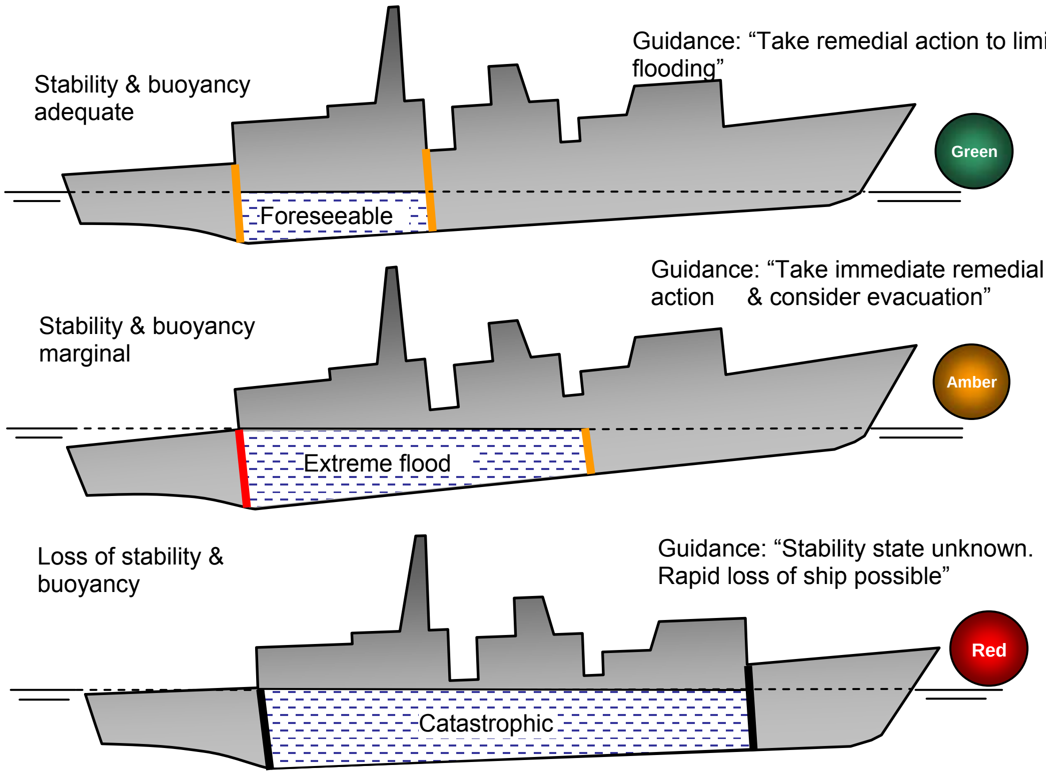

Figure 11: Foreseeable, Extreme Flood and Catastrophic Damage

STATIC CAPSIZE

4.27 This is caused due to a reduction in the righting arm lever and is often a sudden event. The cause of static capsize is the application of a disturbance that is sufficient to overcome or diminishes the ships inherent ability to remain in an equilibrium at or near upright. This could be due to lifting, towing, loss of watertight integrity, load shift, loss of waterplane area, grounding or other disturbance.

DYNAMIC CAPSIZE

4.28 The loss of dynamic stability will occur due to a lack of righting energy under a variety of conditions (intact or damaged). The capsize mode is often one of 4 phenomena:

4.28.1 Dynamic Rolling – Generally occurs in stern quartering seas. This is the generation of large amplitude fluctuations in roll, surge, sway and yaw motions. The roll behaviour is asymmetric in nature and builds with each wave encounter, resulting in capsize.

4.28.2 Parametric Excitation – This mode of capsize is as a result of a gradual build up of excessively large rolling. A low cycle resonance can occur when travelling at the wave group speed at approximately the natural roll period and simultaneously at twice the wave encounter period.

4.28.3 Resonant Excitation – This mode of capsize occurs in beam seas when a ship is excited at or close to its natural roll period.

4.28.4 Impact Excitation – This mode of capsize occurs when steep or breaking waves impact the ship and cause extreme rolling.

BROACHING

4.29 Broaching is a type of ship directional instability which is characterised by a sudden large yaw from the original course. A broach can arise in following and stern quartering seas and may manifest itself in a number of ways:

4.29.1 Successive Overtaking of Waves – This mode of broach occurs during the passage of several steep waves gradually forcing the ship into beam seas.

4.29.2 Low Frequency Large Amplitude Yaw Motions – This typically happens at higher ship speeds in moderate stern quartering seas. A gradual oscillatory build up of yaw occurs as the ship is overtaken by a wave. As the motion hits resonance, yaw amplitude increases until large amplitude yaw motions are displayed.

4.29.3 Broaching Caused by a Single Wave – Usually the result of one or a number of motions that includes surf riding or bow submergence and coupled pitch, roll and yaw instability at high speed. All are possible in following or stern quartering seas.

SHIP HANDLING

4.30 The operator can have a significant influence on the survivability of a ship whether it is intact or damaged. Loading and securing for sea, ship course and speed selection may make the difference between the ship surviving and the ship being lost.

OPERATING CONDITIONS

4.31 All operating conditions must be assessed; this is to include the full range of foreseeable displacements and centre of gravity, including accumulation of ice, fire fighting water and other disturbances. Poor loading can lead to static capsize or reduce the margin against dynamic capsize.

4.32 The expectations on buoyancy and stability need to be defined in the Concept of Operations Statement, particularly with regard to the hazards of environment, anticipated operating conditions and acceptable consequence of breach of watertight integrity. Assumptions of good seamanship are inherent in practically all stability methods that can be applied to verify the performance requirements of “The Code”.

DEFINITIONS

4.33 Regulation 1 also provides chapter specific definitions to ensure clarity of interpretation of the requirements by each Naval Administration.

OBJECTIVES, REQUIREMENTS AND VALIDATION METHODS

4.34 In general, the requirements and solutions have been written to allow any stability method approved by the Naval Administration to be applied to the ship. This allows different methods to be applied to different platform types as appropriate including methods under development (such as dynamic stability assessment).

4.35 Where requirements or solutions are more prescriptive or specifically require Naval Administration (or Recognised Organisation) action, this is generally due to these areas presenting a particular risk to the buoyancy or stability of the ship if poorly managed. In some cases, referral to the Naval Administration is required as slightly different concepts are applied by various Navies to achieve the same objective. It is recommended that the Naval Administration develop and maintain a policy regarding these specific aspects.

Regulation 2 Watertight Integrity

4.36 The main focus of this chapter is to prevent the accumulation of water within the ship. Although ingress of water is not desirable, it is acknowledged that some aspects of design may result in minor ingress being unavoidable. This can be managed provided the design does not allow such ingress to accumulate to a level that poses a danger to the ship.

4.37 In this area, aspects that need particular attention are:

4.37.1 The location and maintenance of the watertight & weathertight boundaries;

4.37.2 The location of the down flooding points;

4.37.3 The location of the collision bulkhead;

4.37.4 Limitations to the placement of openings / closures in bulkheads;

4.37.5 Location of penetrations in watertight boundaries; and

4.37.6 The need to have a system to remove water from weather, waves and accidental discharge from onboard systems and for example, the accumulation of fire-fighting water.

4.38 The bilge system should address all foreseeable hazards but would not be expected to adequately address a hull valve failure or moderate accidental loss of watertight integrity to the shell.

4.39 Naval Administrations approving power-operated doors below the submergence limit should be cognisant of the associated SOLAS regulation such they are to have remote operation capability from anywhere above the submergence limit, e.g. from the navigation bridge.

4.40 The weatherdeck is shown in the diagram below, illustrating that it can be over a number of decks depending upon the design.

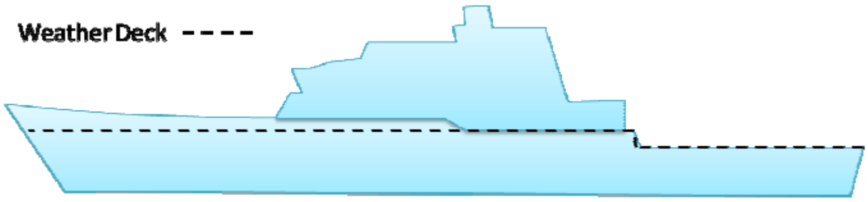

Figure 12: Weather Deck Illustration

SUBMERGENCE LIMIT & OTHER SUBDIVISION

4.41 The regulation includes a requirement to enclose machinery spaces with a watertight boundary fore and aft extending to the submergence limit. This requirement reflects SOLAS and provides protection to the remainder of the ship from fire and flood, which are of higher risk in this area. Further subdivision e.g. bulkheads and decks may be required in order to satisfy damage stability requirements. Such structure and the openings therein are to be capable of withstanding the head of water resulting from damage.

4.42 Attention is drawn to the requirement not to use portable plates unless approved by the Naval Administration. Where portable plates are used guidance should be given to the operator noting that every portable plate closing an opening below the submergence limit in any portion of the internal structure of a ship which is required to be watertight must be fitted in place before the ship proceeds on any voyage and kept in place, except in case of urgent necessity, until the ship has been secured at a berth or anchorage. In replacing any such plate all reasonable precautions is to be taken to ensure that the joints are watertight.

4.43 The maintenance of watertight integrity will impact resistance to loss in a damage state. Material state surveys provide assurance that the ship, within the scope of the NSC, reflect the Naval Administration approved plans and is constructed of materials and equipment that are of an approved type. As such, Appendix 6 provides an example of the scope of the survey conducted to verify the adequacy of the material state.

Regulation 3 Reserve of Buoyancy

4.44 Closely linked to watertight integrity, reserve of buoyancy focuses on attributes that can lead to the sinking of the ship. This includes excessive green seas on deck that can damage equipment and the deck, cause adverse stability effects and result in increased displacement. Not only is adequate freeboard required to prevent foundering (sinking) in the case of damage, attention to the freeboard forward is required to reduce green seas.

4.45 Another dangerous aspect is plunging which can occur when the mass of the ship is close to the maximum displacement and a change in wave profile causes the deck to momentarily be submerged.

4.46 A key aspect to meeting the requirements of reserve of buoyancy is weight control. This is an important aspect of design, construction and through life management that requires proactive management and configuration control. Monitoring and configuration control for the centre of gravity is similarly important for the Reserve of Stability (Reg 4).

4.47 In the area of reserve of buoyancy, aspects that need particular attention are:

4.47.1 Calculation and provision of the minimum freeboard;

4.47.2 The placement of draught marks to aid the crew in the management of the ships displacement and trim; and

4.47.3 Sub-division or other means of ensuring buoyancy after damage

Regulation 4 Reserve of Stability

4.48 The provision of stability in both the intact and damage condition is essential. In this regulation the notion of “upright” is specifically defined to account for platform types (such as yachts) that are not necessarily designed to operate with the deck horizontal and stem vertical.

4.49 The regulation requires attention to both the damper side of the ship (or the ability to resist roll) and the spring side (or the ability to return to the original state). A list of typical disturbances that need consideration is contained in the definitions however this may not be exhaustive.

4.50 As should be expected this regulation is concerned with stability in both benign and adverse weather and as such a requirement for adequate controllability to maintain heading is included. The intent here is for the designer to consider provision of control to minimise the likelihood of surf riding, broaching and other hazards identified that may occur in heavy seas. As with reserve of buoyancy, it is envisaged that manoeuvring to maintain control will eventually move to a more appropriate section.

4.51 There are a wide choice of stability standards available that traditionally satisfy the Performance Requirements. The 2010/12 Working Group was requested to develop a solution to the Performance Requirements for Intact Stability. This does not prevent the Naval Administration selecting an alternative, there are indeed the following choices (dependent upon the ConOps), a) Chapter III solutions, b) IMO International Code on Intact Stability (ISC), c) naval & national standards or d) a classification society standard. To assist in the choice between the a) & b), the ISC is appropriate for ships with similar foreseeable operating conditions to, and a requirement to have similar survivability to, merchant ships whereas the Sarchin & Goldberg criteria contained in the chapter are appropriate for ships with a requirement to have similar survivability traditionally expected of naval ships.

4.52 The decision to propose Sarchin & Goldberg criteria as an intact stability solution for Ch III Reg 4 was based on an investigation and comparison of Sarchin & Goldberg, ISC, UK & Canada naval standards and Van Harpen criteria. Using a solid critical vertical centre of gravity approach the standards were compared for a range of ship types and criteria. The IMO Passenger Ship standard was used for heeling levers. The influence of the righting levers and heeling levers on the solid critical KG were compared between the standards. An example is shown below for a Frigate where the more onerous UK derivatives of IMO [ISC] criteria dominate. Conversely in the following figure the Van Harpen criteria are most onerous for the combined heeling and righting lever approach for a large auxiliary. In one case, for a frigate, the IMO heel in turn was the dominant criteria as the angle of heel is 5 degrees more onerous than the selected naval standard. The application of a passenger safety and comfort standard that may limit military performance demonstrates the importance of standard selection for naval ships. In general Sarchin & Goldberg was consistently more onerous than the ISC but the differences between the standards were not consistent across the ship types.

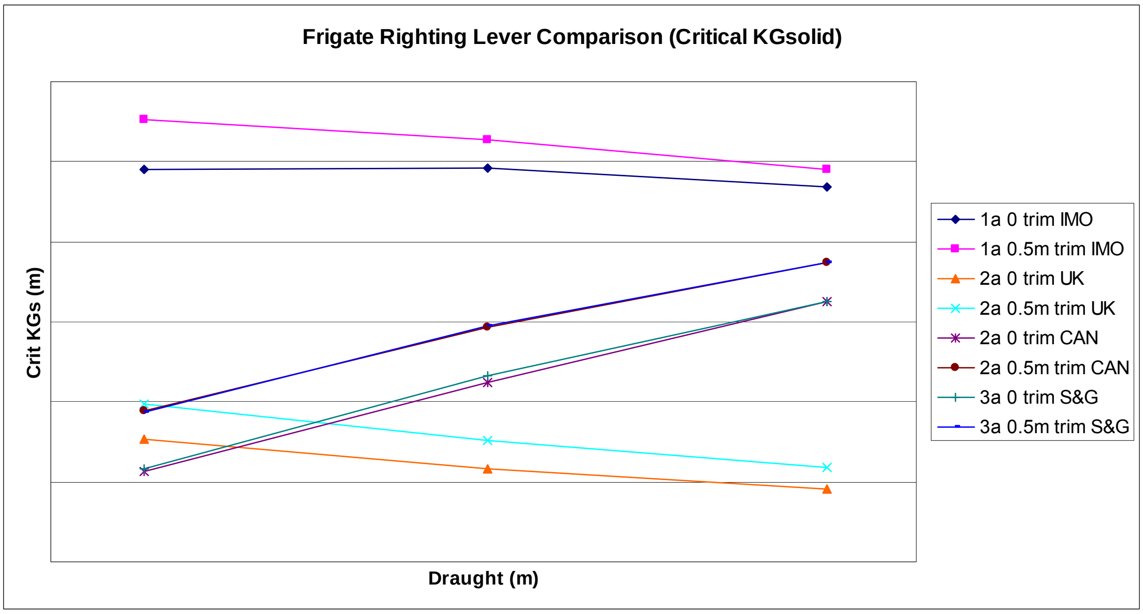

Figure 13: Comparison of righting levers for a Frigate

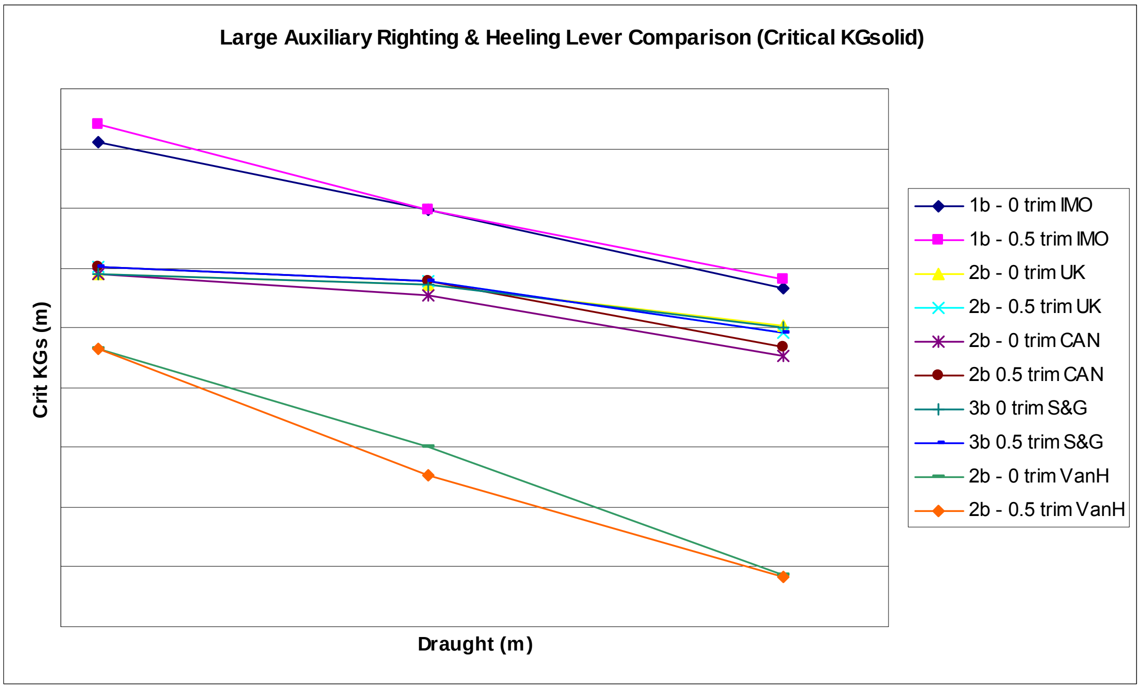

Figure 14: Comparison of righting & heeling levers for a Large Auxiliary

4.53 The Working Group consulted the Naval Stability Standards Working Group (NSSWG) on the results of the comparison of naval & ISC righting and heeling levers who agreed that a Sarchin & Goldberg stability standard would be the most appropriate choice for a naval intact standard for the NSC as it has a good safety history, was well known and is the basis of many nations standards and lastly computer tools to verify performance are widely available. Furthermore their research had shown that for frigate and destroyer type ships these criteria had a better correlation with capsize risk than the ISC.

4.54 The Naval Stability Standards Working Group, a collaborative naval group with representation from Australia, Canada, France, Netherlands, United Kingdom & United States of America has been studying dynamic stability since 1990. Their contribution to Chapter III has been an intact stability standard for Frigates & Destroyers that is based on the dynamic performance of these ship types that provides an equivalent level of safety to established naval standards but also provides a parameter with a better correlation with capsize probability. The correlation is based on an analysis of 11 frigates and destroyers using the Collaborative Research Navies FREDYN dynamic stability code FREDYN. North Atlantic wave scatter was used with each ship run at a range of headings at 17kts for a one hour simulation, the probability of capsize (exceeding a roll angle of 70 degrees) was then derived. Reference 20 outlines the basis of the first approach to derive a suitable parameter and also contains the philosophy behind selection of the relative capsize probability for the derivation of the AT criteria which is based on the following considerations:

4.54.1 The relative capsize probability level for the Minimum Operating Conditions;

4.54.2 The relative capsize probability level for 2 load conditions for WWII destroyers which were lost in a typhoon of 1944; and

4.54.3 The relative capsize probability level for 2 load conditions for WWII destroyers which would be expected to have survived the same typhoon.

4.55 Reference 21 provided validation of the approach in particular the sensitivity of the criteria to the range of rudder size and damping coefficient, in doing so the NSSWG concluded the potential variations in capsize probability and correlation at low capsize probabilities were too great to use this approach. Therefore, Reference 22 analysed the correlation using a single parameter, validated also against capsize probabilities at zero speed with the ship free to drift. The parameter AT has been selected as single parameter that has one of the best correlations with capsize probability based on the 11 frigates and destroyers analysed. This work has been incorporated into Reference 23 containing the NSSWG intact stability standard for frigates and destroyers. It is the intention of the group to continue its work to also derive new intact parameters and criteria for the following and in the future also for surviving damage:

4.55.1 topside icing effects;

4.55.2 lifting of heavy weights;

4.55.3 high-speed turning;

4.55.4 accidental payload movement; and

4.55.5 crowding of passengers.

4.56 The verification of this section in particular is left at the discretion of the Naval Administration requiring maintenance of a policy for stability verification at design and through life (including weight and moment monitoring), the use of techniques such as inclining experiments and operator guidance (see Regulation 7 for detailed requirements for Operator Guidance).

Regulation 5 Controllability

4.57 As indicated earlier, reserve of buoyancy is required to counter the consequences of damage. This regulation also includes requirements to minimise the likelihood of damage, which is the first step in mitigation against a such a risk. Specifically, a minimum level of manoeuvrability is required to allow the ship to avoid collision. The IMO has requirements for large ships that sets a minimum level for safety. The Naval Administration should ensure that the ability to turn and stop provided in the design is sufficient to prevent collision or grounding in foreseeable conditions. This would logically extend to the need to provide adequate charts and, guidance for operating without charts, along with other aids to navigation such as lighting, radar and depth gauges, generally covered in the International Regulations for Preventing Collisions at Sea (COLREGS).

Regulation 6 Safety of Persons Onboard

4.58 This regulation arises from the need to provide a habitable environment that is as safe as reasonably practical. This requires a balance between what is required to meet the other regulations of this chapter and the need to integrate the human in such a way that the persons onboard can operate the ship in all environments it is intended to operate. The major focus of this regulation is to minimise the ship motions to an extent that allows both work (to maintain safety functions) and rest (so as not to create a situation of reduced safety due to fatigue), minimises damage to essential safety features and other equipment or cargo that may result in adverse impact on stability (such as damage to the hull from equipment or shifting cargo causing an unacceptable disturbance).

4.59 It must be understood that this is in direct conflict with the requirement to provide stability and therefore a balance of the two is required. The regulation is not intended to deliver the capability to conduct missions beyond the ability of persons onboard to safely sail the ship in the environment that it is intended to operate.

4.60 In some instances where deck inclinations are to be considered for safe movement about the ship and functionality of essential safety systems, consideration of IACS defined inclinations may be appropriate. Consideration should also be given to which parts of the ship persons onboard will be required to access in heavy weather (including emergency tow points, evacuation stations, boat stations or similar) and adequate protection provided to perform these tasks (such as handrails or other forms of restraint).

4.61 Particular attention here should focus on:

4.61.1 The impact of heavy weather on crew and essential safety functions;

4.61.2 Access routes; and

4.61.3 Guard rails, handrails, seat belts, harnesses and safety points.

Regulation 7 Preservation of Life

4.62 The intent of this regulation is to provide a margin on buoyancy and stability that enables persons onboard, following an extreme event, to escape from the stricken ship. An extreme event is defined in Chapter I of the Code whilst Chapter III defines a catastrophic event as an event beyond which the ship is likely to be rapidly lost. It is important that the Naval Administration define the point which loss of ship with all hands is accepted to bound the limits of required buoyancy.

4.63 As an example, the acceptable damage standard may be two compartment damage. This is the damage that is expected to be withstood under "Foreseeable Operating Conditions" or damage in the environment and of the type that could occur under operations excluding extreme hostile acts.

4.64 This could present a catastrophic event where the design is such that the ship could rapidly sink should the damage extend into a third main sub-division compartment and therefore the Escape, Evacuation and Rescue (EER) equipment defined in Chapter VII of the Code is only required in the case of any survivors being fortunate enough to have managed to get off the ship into the sea.

4.65 The scenario above demonstrates the need for this regulation to provide a margin between foreseeable damage and a catastrophic event as the scenario above is not likely acceptable to any Naval Administration. Further, Chapter VII is not written for the scenario above.

4.66 Therefore this regulation has been included in the Code. It defines the performance requirements needed to allow the EER systems required in Chapter VII to be used to abandon ship in the case of an event that warrants such use.

4.67 It should be noted that if the Concept of Operation Statement requires extreme hostile acts that are more severe than anticipated foreseeable damage extent to be withstood then it is likely that this regulation will be satisfied.

Regulation 8 Operator Guidance

4.68 The importance of accurate operator guidance to maintain the stability of the ship cannot be underestimated. Whilst this regulation could be included disparately under each of the aforementioned regulations as part of the Solutions, it has been included as an additional regulation to ensure that adequate buoyancy and stability information is provided and maintained with the ship.

4.69 It is required to inform the crew of the limitations of the ship thus allowing them to make appropriate decision to preserve the safety of those onboard and minimise the risks faced as covered by this chapter.

4.70 The 5 areas of operator guidance covered requiring Naval Administration approval are:

4.70.1 Watertight Integrity;

4.70.2 Buoyancy & Stability;

4.70.3 Collision Avoidance;

4.70.4 Ship Dynamics; and

4.70.5 Dry Docking.

4.71 Changes to the ship may invalidate of any aspect of the above 5 areas of operational information. The Naval Administration should be consulted on the impact of any change and revised operational information submitted for re-approval as appropriate.

References

Naval publications:	
1	DEFSTAN 02-109, "Stability Standards for Surface Ships", Issue 2, 2011
2	DEF(AUST)5000 Volume 3 Part 2, "Stability of Surface Ships and Boats", Issue 2, May 2003
3	Canadian Forces Technical Order Stability & Buoyancy Requirements For Surface Ships C-03-001-024/MS-002
4	Stability Criteria for Surface Vessels of the Royal Netherlands Navy
NATO Publications:	
5	STANAG 4154 Common Procedures For Seakeeping In The Ship Design Process
6	STANAG 4194 Standardised Wave and Wind Environments and Shipboard Reporting of Sea Conditions
7	STANAG 4721 Common Framework For Naval Surface Ship Manoeuvring Performance And Requirements
8	ANEP 70 Guidance For Naval Surface Ships Mission Oriented Manoeuvring Requirements
9	ANEP 78 Naval Surface Ships Mission Oriented Manoeuvring Requirements : Specification And Verification Templates
10	ANEP 79 Controllability And Safety In A Seaway
IMO publications:	
11	SOLAS Consolidated 2009 Edition
12	International Code on Intact Stability 2009 Edition
13	International Load Line Convention, 2005 Edition
14	High Speed Craft (HSC) Code, 2008 Edition
15	IMO Resolution MSC.137(76) – Standards for Ship Manoeuvrability
16	IMO Resolution A.601(15) – Provision and Display of Manoeuvring Information on Board Ships
17	IMO MSC/Circ.707 – Guidance to the master for avoiding dangerous situations in following and quartering seas
Other publications:	
18	Sarchin and Goldberg, Stability and Buoyancy Criteria for U.S. Naval Surface Ships. SNAME 1962
19	Alman, P. R. et al. Dynamic Capsize Vulnerability: Reducing the Hidden Operational Risk, SNAME Transactions Vol 107, 1999
20	Harmsen, E. Deriving Intact Stability Criteria from the Capsize Probability of Naval Frigates, 11th International Conference on the Stability of Ships and Ocean Vehicles, 2012
21	Perrault, D. Evaluation of Effects of Damping and Relative Rudder Area, July 2012
22	Peters, A. Single parameter AT evaluation & verification of zero speed, July 2012
23	Naval Stability Standards Working Group. Stability Criteria for Naval Ships, Issue 1, 2012

5 GUIDANCE ON NSC CHAPTER IV ENGINEERING SYSTEMS

Background

5.1 Chapters IV and V were nominated for significant review and amendment at the AGM in October 2008. The Working Group that was set up to undertake this task, determined that in view of the instruction to ensure consistency between the chapters and to adopt a more specific 'Goal Based' approach in line with the underlying philosophy of the Code, that a thorough rewrite the Chapters would be required, noting the areas that had been captured so far, but also adding other sections as their relevance was recognised.

5.2 In order to ensure consistency, a template for each regulation was developed which was used to define the overall functional objective of the regulation, the design and construction issues for the function required and then consideration of the high level hazards associated with normal, reversionary and emergency scenarios. It was recognised that these scenarios would need to be defined in the platform and machinery systems Concept of Operations Statement if designers were to properly allow for the required functionality. The headings of this template have been removed from the resultant Code and Guide, but the organisation of the Regulations will in general follow this approach.

5.3 The overriding philosophy applied in developing the new regulations, was to ensure that the following criteria were applied:

5.3.1 They should be goal based with no prescriptive requirements unless no other approach could be identified;

5.3.2 Verification that the design solution is 'safe' would require compliance with suitable technical standard, which would most likely be a set of Classification Society Rules, though other national or international standards would be appropriate;

5.3.3 The Naval Administration would need to 'agree' the verification standards and the process of assurance required, including delegation to a competent Recognised Organisation.

5.4 During the development of the Regulations, a significant amount of background reasoning was documented and this, after review and consolidation, has been used to explain the regulation within the Guide. During the generation and editorial work on the contents for the Guide, it was noted that the working documents which had had both regulation and Guidance notes in a tabular format, made use of the Guide much easier. It was therefore proposed and agreed that contents of the Guide would include the Regulation text, suitably formatted to differentiate between the two. For the Code, only the Regulation text would be included to show what is specifically required to be achieved.

5.5 At an early stage of the Working Groups discussions, it was noted that when considering machinery in terms of 'Goal Based' requirements, we were considering machinery and electrical SYSTEMS. As it is impossible at this level to separate machinery, electrical or control aspects, the arrangement of the requirements into two chapters was not logical, so the regulations have been arranged into a single chapter. Chapter V is now 'Not Used' in order to save the need for major adjustment of the cross referencing between chapters.

5.6 The sequencing of the regulations within the chapter is on the basis of propulsion and manoeuvring aspects; specific electrical requirements; safety systems and controls; 'human element' aspects; and finally other machinery systems.

Regulation 0 Goal

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	The Engineering Systems shall be designed, constructed, operated and maintained to:	
1.1	Enable their operation in all Foreseeable Operating Conditions.	
1.2	Minimise danger to embarked personnel in all Foreseeable Operating Conditions;	
1.2	Operate in a predictable manner with a level of integrity commensurate with operational requirements;	
1.3	Ensure the watertight and weathertight integrity of the hull, and meet the requirements of Chapter III (Buoyancy and Stability);	
1.4	Enable the restarting of shut-down systems and equipment necessary to provide essential safety functions ("dead ship" starting) without external aid in all Foreseeable Operating Conditions;	
1.6	Minimise the risk of fire;	
1.7	Provide support to the embarked persons and provide essential safety functions in the event of all foreseeable damage at least until the persons have reached a place of safety or the threat has receded;	
1.8	Enable the maintenance and repair in the ship's maintenance plan.	The term 'ship's maintenance plan' does not necessarily refer to a written plan, it is a maintenance and repair philosophy for an individual ship. It is an understanding of which repairs will be undertaken in harbour or in dock and which will be undertaken at sea. A navy may have a different plan for its small ships and its larger ships. The 'ship's maintenance plan' could influence the design; if the equipment is required to be operational and it can't be repaired at sea then it would need to be duplicated. Elements of the 'ship's maintenance plan' will normally be captured in the Ship's Maintenance Management System.

Regulation 1 General

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	The purpose of this Regulation is to outline the principles and framework of Chapter IV Engineering Systems and its application.	
Definitions		
	Note: Definitions which are applicable to all Chapters are located in Chapter I, Regulation 2.	

Definitions and International Maritime Organization (IMO) Documents Tables [not replicated in Guide]

2	The requirements for flashpoint of the fuel used for engineering systems within this Chapter are as defined in Chapter I.	Risk: High risk of fire with the use of Low Flashpoint Fuels. The flashpoint of all fuels should be 60 Deg C or higher. Emergency generators may use 43 Deg C Flashpoint or higher. This does not apply to main generators being used in lieu of emergency generators. For ships which carry low flashpoint fuel in bulk, refer to Chapter VI, Regulation 14.Operational procedures for the safe disposal of low flashpoint fuels are to be developed along with a safe means of disposal. For example low flashpoint aviation fuel can be mixed with other fuels and used for propulsion. Consideration of the quantities permitted to be carried of low flashpoint fuels. Note that this is not just aviation fuel – also other vehicles / tools.
Application		
3	In addition to the requirements contained elsewhere in the present regulations, ships shall be designed, constructed and maintained in accordance with the structural, mechanical and electrical requirements of a classification society whose rules and procedures are recognised and validated by the Naval Administration, or with applicable standards of the Naval Administration which provide an equivalent level of safety.	

4	Chapter IV Engineering Systems is written in a goal based format which specifies high level objectives and relies upon verification against an agreed standard for compliance.	Examples of standards are: • Classification society rules; • Naval standards, • National Standards; • International Standards. It is anticipated that a combination of the above will be required and that in some cases only parts of each standard will be necessary as agreed by the Naval Administration.
5	For certain ship types, novel craft or for operational reasons the compliance in full with the regulations of this chapter may not be required subject to justification and acceptance by the Naval Administration.	Examples where non compliance may be considered are: • For small craft operating within protected waters; • For craft that will never operate alone and can therefore seek assistance.
General Performance Requirements		
6	Engineering systems shall be designed and constructed to operate in all Foreseeable Operating Conditions defined in the ship's Concept of Operations Statement.	
7	For all engineering systems installed, the choice of materials and component's construction as well as the design, location and ship installation shall be made according to the environmental, maintenance and operating conditions in order to ensure the continued function of the equipment during all Foreseeable Operating Conditions and reduce the risk of:	For any equipment or systems intended to be installed on the vessel, consideration should be given to not only its intended function but also the conditions within which it must operate. Examples include: • Ambient temperature range; • Relative humidity; • Salt laden atmospheres; • Sea water quality; • Vibration; • Ships motions and attitude; • Materials selected to ensure toxic fumes are not to be released in fire; • Location and effect on other systems • Accessibility for operation and maintenance • Health and safety requirements; • Environmental and pollution prevention requirements. Machinery equipment and installations shall be protected to reduce to a minimum any danger to embarked persons, with due regard being paid to moving parts, hot surfaces and other hazards. Consideration should be given to the verification method when designing systems. Electrical cables are to be designed, manufactured and tested in accordance with a recognised standard accepted by the Naval Administration.
7.1	injury to embarked personnel;	
7.2	damage to the equipment, the system it is contained within or adjacent equipment and systems;	
7.3	damage to the vessel;	
7.4	damage to third parties;	
7.5	pollution of the environment.	

		Individual naval vessels may have an operational requirement for shock capability and where this is the case, shock should be considered.
	Note: For all ships, new installation of materials which contain asbestos shall be prohibited	
8	Where applicable, engineering systems including system components may be required to operate in one of three modes as agreed by the Naval Administration:	During transition from one mode to another, a reduced level of functionality for a specified period of time may be accepted by the Naval Administration. (The time period may be indefinite for some systems.)
8.1	Normal operation;	
8.2	Reversionary operation;	
8.3	Emergency operation.	
9	Safe access shall be provided to all machinery and systems including access provision in the event of equipment failure.	For example: • Gratings and handrails to mitigate hydraulic fluid leakage; • Walkways around machinery; • Suitable location of high pressure pipework; • The location and direction of discharge from a pressure relief valve.
10	Engineering systems shall be designed in such a way that the essential safety functions can be continuously available following one single operational error and/or system/equipment fault.	Compliance with this requirement can be met using risk based techniques.
11	The availability of engineering systems associated with essential safety functions shall be sustained or restored by means of:	The Naval Administration, having regard to overall safety considerations, may accept a partial reduction in capability from normal operations providing that essential safety functions are maintained.
11.1	Reliability, especially of any single points of failure, taking account of e.g. erosion, fatigue, corrosion and mechanical damage due to vibration; and/or	
11.2	Redundancy to minimise single points of failure.	
12	Means shall be provided to ensure isolation of equipment and systems to allow maintenance to take place safely.	Double isolation may be required for high energy systems. An appropriate management process should be agreed and followed. When working on a stored energy source (e.g. battery) that cannot be depleted, a safe method of work should be agreed.

13	Emergency sources of electrical power, fire pumps, bilge pumps except those specifically serving the spaces forward of the collision bulkhead, any fixed fire-extinguishing system required by Chapter VI and other emergency installations which are essential for the safety of the ship, except anchor windlasses, shall not be installed forward of the collision bulkhead.	Essential safety functions are defined in Chapter I definitions and for ships required to provide safe return to port essential systems are listed in Ch VI Regulation 10.

Solutions

14 Verification that the ship complies with this chapter shall be by the Naval Administration. Provision of evidence to support verification shall be by the owner. All decisions that affect compliance with the requirements of this chapter shall be recorded at all stages from concept to disposal and these records be maintained throughout the life of the ship.

Regulation 2 Concept of Operations Statement

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	The Concept of Operations Statement document is the Owner's vision of how the engineering systems of the ship are to be operated and maintained throughout the life of the ship and is to be shared by the Naval Administration and, where appointed, it's Recognised Organisation.	Where a vessel may be required to have a primary capability associated with humanitarian relief and evacuation, arrangements for safe return to port in accordance with IMO Resolution MSC.216(82) should be considered. It should be noted that the IMO requirements will likely require some tailoring to meet naval operating practices.
Performance Requirements		
2	The scope of the information to be provided is defined in Annex A of Chapter I of the Code. For the purposes of this Chapter, particular importance is to be attached to:	Modes of operation in accordance with the requirements of Regulation 1, paragraph 6 should be defined.
2.1	Mobility – within the operational requirement, a ship's ability to manoeuvre, as and when required by the Command but still remaining within the designed or imposed limitations;	
2.2	Operating and maintenance procedures – documentation relating to equipment and systems, operating and maintenance procedures and requirements, including reversionary modes and breakdown drills;	
2.3	Personnel – including all individuals whose intervention is relied upon to maintain safety.	
Solutions		
3	Approval of the Concept of Operations Statement shall be by the Naval Administration.	

Regulation 3 Provision of Operational Information

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	Operators shall be provided with adequate information and instructions for the safe operation and maintenance of all machinery and systems.	Changes to system configuration should be documented through life including the provision of updated manuals and drawings.
Performance Requirements		
2	Information and instructions shall be supplied to the operator to ensure the safe operation, fault finding and maintenance of machinery, under all Foreseeable Operating Conditions.	Information and instructions include but is not limited to: • Ship as-built construction drawings; • System drawings; • Operational manuals; • Capacity plans; • Procedure manuals.
3	Such instructions shall define the safe operating limits and make it clear that operation outside these limits is unsafe and can damage equipment and systems.	
4	The operator instructions shall be presented in a language and format that can be understood by the operator in the context in which it is required.	
Solutions		
5	The operational information is to be approved by the Naval Administration as being compliant with the above Performance Requirements.	The Naval Administration may delegate the approval of operational information to its Recognised Organisation.

Regulation 4 Propulsion

CODE REQUIREMENTS	GUIDANCE ONLY
Functional Objective 1 The propulsion machinery shall enable the ship to manoeuvre as and when required by the Command but still remain within the designed or imposed limitations.	
Performance Requirements	**CONSTRUCTION GUIDANCE** Risk: Machinery, components or systems will fail prematurely. The machinery, boilers and other pressure vessels, associated piping systems and fittings should be of a design and construction adequate for the service for which they are intended and should be so installed and protected as to reduce to a minimum any danger to persons on board, due regard being paid to moving parts, hot surfaces and other hazards. The design should have regard to materials used in construction, the purpose for which the equipment is intended, the working conditions to which it will be subjected and the environmental conditions on board. Main propulsion machinery and all auxiliary machinery essential to the propulsion and the safety of the ship should, as fitted in the ship, be designed to operate to the pitch and heel angles arising from compliance with Chapter III.
2 To enable the vessel to manoeuvre, this regulation shall be applied in conjunction with Regulation 5 Manoeuvring.	
3 Redundancy of propulsion equipment shall be provided. The Naval Administration shall give consideration of the reliability of single essential propulsion components on application.	Risk: Vessel at sea with no propulsive power due to loss of a single component The use of non-duplicated machinery & systems or lack of redundancy can only be accepted by a Naval Administration upon demonstration of the Machinery or System reliability using appropriate risk assessment tools. The Naval Administration may require a separate source of propulsion power sufficient to give the ship a navigable speed, especially in the case of unconventional arrangements. Operation of several craft together or within a distance from support nominated by the Naval Administration may be a mitigation against single propulsion failure.
4 The propulsion equipment and systems shall be designed, constructed and maintained to minimise danger to personnel onboard in all Foreseeable Operating Conditions.	Risk: Operation of Machinery or Systems causing injury to personnel during normal or failure conditions Foreseeable Operating Conditions may include partial flooding up to underside of shaft. Auxiliaries may also be required to operate at this level of flooding.

5	Essential safety functions shall be continuously available or recoverable without compromising the safety of the vessel following a single operational action or system / equipment fault.	Risk: Destruction of Machinery or Systems from operating outside normal envelope of operation including risk to personnel injury. Where risk from over speeding of machinery exists, means should be provided to ensure that the safe speed is not exceeded. Internal combustion engines of a cylinder diameter of 200 mm or a crankcase volume of 0.6 m^3 and above should be provided with crankcase explosion relief valves and arranged to ensure that discharge from them is so directed as to minimise the possibility of injury to personnel. Turning gear and associated machinery is required for main propulsion machinery to: Allow shafts to be turned periodically during long lay ups to prevent Brinelling of bearings; To allow shafts/Turbines to be rotated during cool down i.e. Steam turbines. For Electric Propulsion motors there should be a means to detect and mitigate the following risks: earth fault; overload (voltage and current); regenerated energy causing overload. The Naval Administration may accept a reduced level of functionality. Consideration of group shutdowns should be undertaken to ensure that they do not affect machinery other than that in a specified compartment or system. Appropriate protection devices should be fitted to all propulsion machinery equipment.
6	The design, construction, installation and operation of propulsion equipment shall not cause interference or excessive forces that could lead to its failure or failure of other equipment and systems. Note: The Naval Administration may impose additional requirements for the reduction of vibration for operational reasons.	Risk: System to System interaction causes adverse reaction, unintended operation or machinery/system/component destruction. The propulsion machinery systems should be completed so that any mode of vibrations should not cause undue stresses in the machinery or adjacent machinery within the normal operating ranges. For electrical propulsion machinery when supplied from a central power generation system, the propulsion machinery should not cause interference such as electrical distortions or overload conditions in other electrical circuits.
7	The requirements for manoeuvrability as required by Chapter III Regulation 5 Controllability apply in addition to these requirements.	Propulsion systems should allow for additional forces and loads imposed by rapid manoeuvring. Propulsion Machinery and Systems are considered part of the Manoeuvring System and as such will be used to demonstrate acceptable performance for: • The vessels ability to change its velocity (speed & direction) to avoid collision; • Crash Stop; • Turning circle; • Turning prediction; • Manoeuvring Trials; • Zig-Zag and Spiral Manoeuvre abilities.

8	Effective means of communicating orders from the normal and emergency conning positions to any position from which the speed and direction of thrust of the propellers can be controlled shall be provided.	At least two independent means should be provided for communicating orders from the normal conning positions to the position in the machinery space or in the control room from which the speed and direction of thrust of the propellers are normally controlled. At least one of the means of communication should be independent of the ship's main electrical supply. A single means should be provided for communicating orders from the emergency conning position to the position in the machinery space or in the control room from which the speed and direction of thrust of the propellers are normally controlled. A single means of communication should be provided from the normal and emergency conning position and the engine-room to any other position from which the speed or direction of thrust of the propellers may be controlled.
9	Means shall be provided whereby normal operation of propulsion machinery can be sustained or restored even though one of the essential auxiliaries becomes inoperative.	Special consideration should be given to the malfunctioning of: • a generating set which serves as a main source of electrical power; • the sources of steam supply; • the boiler feedwater systems; • the oil fuel supply systems for boilers or engines; • the sources of lubricating oil pressure; • the sources of water pressure; • a condensate pump and the arrangements to maintain vacuum in condensers; • the mechanical air supply for boilers; • an air compressor and receiver for starting or control purposes; • the hydraulic, pneumatic or electrical means for control in main propulsion machinery including controllable pitch propellers. However, the Naval Administration, having regard to overall safety considerations, may accept a partial reduction in propulsion capability from normal operation.
10	Means shall be provided to ensure that the propulsion machinery can be brought into operation from the dead ship condition without external aid.	Risk: Under total power failure conditions, it is not possible to restart essential safety functions.
11	Fuel supply arrangements from internal storage tanks are to be such that adequate reserve of fuel is available without continuous transfer of fuel and that means are provided to ensure that this reserve is of a suitable quality for use.	Period of supply to be agreed by the Naval Administration in relation to the vessels operational requirements. Two service tanks may be required so that one tank remains available if the other becomes contaminated.
Solutions		
12	Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.	

Regulation 5 Manoeuvring

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	The manoeuvring equipment shall enable the ship to manoeuvre as and when required by the Command whilst remaining within the design or imposed limitations.	Risk: To allow the ship to manoeuvre and to avoid collision.
Performance Requirements		
2	Machinery and systems required for manoeuvring shall meet the relevant requirements of Chapter III Regulation 5 Controllability.	
	Note: Consideration should be given to the effects of the failure of stabilisers (if fitted) and use of steering gear for roll compensation.	
3	The manoeuvring equipment system shall exhibit sufficient redundancy to cope with single failures without the loss of manoeuvring capability.	Risk: To minimise the risk of equipment failure & damage, and to remove as far a reasonably practicable the risk of single point failures Does not include, tiller, rudder stock, quadrant or rudder. Layers of protection should match the requirements of the ConOps. The Naval Administration may specify higher levels of redundancy for manoeuvring equipment where an emergency backup may be required to provide limited system functionality for “get you home” scenarios, for example, a hydraulic hand pump to move the rudder in the event of total loss of motive power. For ships with a function of bulk fuel carriage, as a minimum the solution should be equivalent to SOLAS Chapter II-1, Part C, Reg 29.
4	It shall be considered whether a single failure in the manoeuvring equipment could lead to the possibility of mechanical locking.	Consideration should be given to hydraulic locking or any other condition where the equipment becomes mechanically locked and so can not be operated.
5	It shall be possible to operate the manoeuvring equipment from a number of locations to be agreed with the Naval Administration.	Risk: To remove the risk of not being able to operate the manoeuvring equipment both locally and remotely.
6	The operational status of the manoeuvring equipment shall be clearly visible at each control station.	Appropriate indicators are required at both the control stations and conning positions. This does not require the full duplication of indicators for example, hydraulic motor running status would only be required at the control stations however the rudder angle indicator would be required for both positions.
7	The manoeuvring equipment control system shall exhibit sufficient redundancy to cope with single failures of components and electrical supply.	

8	Effective means of communicating orders from the normal and emergency conning positions to any position from which the speed and direction of thrust of the propellers can be controlled shall be provided.	Two independent means of communication shall be provided between all manoeuvring control stations and conning positions where the manoeuvring equipment can be operated.
9	The motive power supply shall exhibit a level of redundancy, diversity and capacity to ensure that the manoeuvring equipment remains operational and shall exhibit a level of continuity to ensure continuous operation. Note: This is to include provision of supplies and control in the event of damage to the platform.	Risk: To remove the risk of the electrical system not being available or of sufficient capacity Diversity refers to different power supplies etc.
10	Sufficient electrical protection measures shall be provided to prevent machinery & control system damage in accordance with Regulation 12 Electrical Protection Arrangements.	
11	The manoeuvring equipment shall fail safe and exhibit alternative modes of operation to fulfil the manoeuvring requirements during a failure condition.	Risk: Any single point failure shall not result in the manoeuvring capability being disabled.* *Does not include, tiller, rudder stock, quadrant or rudder.
12	Clear system diagrams and instructions shall be provided detailing the change over procedures and the actions to be completed in the event of machinery breakdown.	These should be located at the conning positions.

Solutions

13 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 6 Pressure and Piping Systems

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	Pressure vessels and associated piping systems and fittings shall be of a design and construction adequate to safely contain media, taking account of the anticipated pressure and temperature profiles and the service for which they are intended.	The Naval Administration is to determine the thresholds above or below which this regulation applies. This regulation includes systems under vacuum conditions.
Performance Requirements		
		CONSTRUCTION GUIDANCE Risk: Premature Failure of systems & Pipework Choice of materials should consider unusual circumstances such as fire e.g. Plastic pipes giving off toxic fumes and not containing media.
2	The system shall be designed and constructed to operate safely in static and transient conditions.	The forces exhibited upon a closed piping system during transient conditions may exceed static conditions.
3	Surface temperatures of pipes shall not pose a danger to personnel or become a source of ignition in case of flammable fluid leaks.	Risk: Exposed hot pipework injures personnel or ignites leaking flammable liquids.
4	Provision shall be made to reduce to a minimum the entry of contaminants into pressure systems and to provide drainage points for systems as required.	Means should be provided for draining every steam pipe in which water hammer action might otherwise occur. Where direct air starting of internal combustion engines is fitted, the system should be adequately protected against ingress of oil into the pipework and the effects of backfiring and internal explosion in the starting air pipes.
5	Where media quality is required to be maintained, system materials and system operation shall be compatible with the media. Means of testing and treatment shall be provided.	
6	Valves associated with maintaining watertight integrity shall be operable from a position as defined in Chapter III Buoyancy, Stability and Controllability.	
7	Suitable precautions against the build up of electrostatic charges shall be provided.	Fluid flow through certain pipe materials will cause a build up of static charge.

8	Pressure relief arrangements shall be fitted to prevent overpressure in excess of the design pressure in any part of a pressure system. The relief setting, quantity, location and flow capacity of the pressure relief devices installed shall be suitable to mitigate the consequences of excessive overpressure.	Means should be provided to prevent overpressure in any section of a pressure system that may be isolated from the remainder of the system, in all Foreseeable Operating Conditions. Note the maximum firing rates of boilers or heat exchangers should be taken into account when considering overpressure.
9	Pressure relief arrangements shall not pose a danger to personnel, the environment or any other ship system. Where the media contained poses a safety hazard to personnel or the environment, arrangements shall be put in place to minimise the risk following release.	
10	Failure of a joining arrangement shall not pose a further risk (e.g. Due to atomisation of hydrocarbons, leakage of water onto electrical equipment etc).	Consideration to the location of pipe flanges should be given to minimise risks upon joint/gasket failures.
11	Essential systems may require suitable means of reconfiguring the system to be provided.	In case of physical damage it may be necessary to isolate and re-configure systems.

Solutions

12 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 7 Ship Stabilising Systems

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	Where considered necessary, Ship Stabilising Systems shall be fitted to reduce ship motions to limits compatible with personnel endurance and the ships sea-keeping requirements.	Ship Stabilising Systems may be required to meet the requirements of Chapter III Buoyancy, Stability and Controllability, Regulation 0, Paragraph 1.3 and Regulation 6, Paragraph 10. Stabilisers may not be a classification item, but they significantly affect the vessels sea-keeping characteristics in order to allow operational activities to be carried out safely.
Performance Requirements		
		<u>**CONSTRUCTION GUIDANCE**</u> Risk: Premature Machinery failure and or water ingress, fire hazards associated with Oil Mists The stabiliser system shall consider the forces that could be exerted upon the system during all operational conditions, including running at Maximum Astern Speed The watertight integrity must be maintained at all times.
2	The requirements for manoeuvrability as required by Chapter III Regulation 5 Controllability.	Stabilisers should be considered part of the manoeuvring system as their use or non-use may affect the vessels manoeuvring capability.
3	The requirements for watertight integrity and stability required by Chapter III Regulation 2 Watertight Integrity and Regulation 4 Reserve of Stability apply in addition to these requirements.	
4	The requirements of Chapter VII, Regulation 22, Paragraph 8.5 apply in addition to these requirements.	
5	The ships stability requirements shall not be reliant on ship stabilising systems.	Stabilisers should not be used to meet stability requirements.
6	The ship stabilising system shall be fully automatic in operation.	Risk: Operating stabilisers incorrectly could amplify ships rolling motion exceeding the vessels stability limits. Once operational, the entire Stabiliser operation shall be automatic without any requirement for operator action. Provisions for an Automatic Forced Roll Facility can be provided as long as: • A selector switch is located on the Navigating bridge and protected from inadvertent operation • The roll amplitude and period are to be manually adjustable and located on the navigating bridge; • Arrangements are agreed with the Naval Administration. Forced induction of rolling motion is not to result in an unsafe condition for the vessel, equipment or crew.

7	Control systems shall be in accordance with Regulation 13 Machinery Control.	The fin feedback position is to be independent of the actuating system.
8	Alerts and indicators shall be in accordance with Regulation 14 Alerts and Safety Systems.	Risk: The loss of stabilisers will affect the ships sea-keeping and manoeuvrability. Personnel unaware of this loss could put the vessel into danger. The Alarms and indicators will be dependent upon the system installed and shall include but not limited to: • Stabiliser System Active Indication; • Fault conditions (Exceeding normal operational conditions, hydraulic locking etc); • Power Supply Failures (both Main and control system); • Low Fluid Levels.
9	It shall be considered whether a single failure in the ship's stabilising equipment could lead to the possibility of mechanical locking.	Consideration must be given to hydraulic locking or any other condition where the equipment becomes mechanically locked and so can not be operated. Where the ship stabilising system is designed to avoid hydraulic locking, this feature is to be demonstrated Where the ship stabilising system cannot avoid the risk of mechanical locking, a clear indication should be provided and operational instructions of what the operator shall do in this event should be defined.
10	It shall be possible to lock the stabiliser fins in a known position.	Risk: During control / hydraulic system failure the fin moves uncontrolled leading to potential danger. In the event of power failure (electrical/hydraulic) it shall be possible to move the stabiliser fin to a known position, for example using a hand pump, and then secure the fin in that position.
11	Failure of any part of the stabiliser unit or its control system shall not result in an unsafe condition which will have detrimental effect on the ship's operating or sea-keeping capability.	Risk: Failure of stabiliser systems makes the vessel exceed sea-keeping requirements or make vessel operations unsafe. Failure includes foreseeable damage scenarios such as exterior damage to fin.

Solutions

12 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 8 Other Essential Safety Functions

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	The ship's machinery outfit shall provide services for essential safety functions not described elsewhere in this Code.	
Performance Requirements		
2	Arrangements for the continuous supply of energy to essential machinery shall be provided.	Risk: Damage renders essential machinery inoperative. This covers energy sources in addition to electrical supplies: hydraulic, air etc. Suitable redundancy arrangements should be provided for essential machinery and services. Consideration of the separation of separate electrical supplies should be given in order to minimise the risk of damage.
3	A fire main system shall be available which is capable of providing essential safety functions required by Chapter VI Fire Safety Regulation 9.	A Fire ring main, fixed sprinkler system In addition to redundancy arrangements, independently powered fire pump to pressurise the Fire Ring main on the total loss of power or fire pumps are required in accordance with Chapter VI, Regulation 9, Paragraphs 5 and 7.
4	Where a ship is expected to receive low-flashpoint fuels, a suitable system is required for its storage, use or safe disposal.	Fuels originating from aircraft, motor vehicles, portable appliances, outboard engines etc.
5	Bilge pumping arrangements are to comply with the requirements of:	The bilge pumping arrangements should not pose a risk to the ship's stability and they should be of sufficient pumping capability to prevent flooding during normal operation.
5.1	Chapter III Buoyancy, Stability and Controllability;	Sizing of bilge pumping arrangements is to be in accordance with a recognised standard.
5.2	Chapter VI Fire Safety.	Common bilge systems between compartments should consider the effect on hazardous areas zoning.
6	Where operation of essential safety functions are reliant on the continuous removal of heat, they shall be provided with an alternative method of cooling or appropriate redundancy.	This could be the use of air or sea water cooling instead of chilled water. Risk: if an essential safety function requires cooling and this fails, the equipment will fail.
Solutions		
7	Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.	

Regulation 9 Electrical Generation and Power Supplies

CODE REQUIREMENTS	GUIDANCE ONLY
Functional Objective	
1 Sufficient electrical power shall be provided to supply the required services and habitability requirements during all operational conditions without recourse to the emergency electrical supply.	Operational requirements include the need to maintain equipment at sea so adequate reserve is also required.
2 Sufficient electrical power shall be provided to supply services for essential safety systems during various emergency conditions.	Essential Electrical Services include: • Main Broadcast system; • General emergency alarm system; • Fire detection & Alarm system; • Emergency lighting (see Secondary and Tertiary lighting definitions); • Radio communication equipment; • Electrically powered way finding systems; • Power operated doors (if fitted); • Fire Fighting System; • Salvage systems,; • Boat davits, motors & controls; • Medical facilities; • Steering system; • Navigation system; • RAS communications.
3 Transitional power supplies shall be provided where no interruption of the electrical supply to essential safety systems is required.	
Performance Requirements	
	Construction Guidance Risk: Premature failure of equipment and failure of one electrical supply degrades or disables the supply from other supplies. Due care and attention must be paid to the location and separation of generators to minimise the impact of a generator failure or other casualties within the machinery space. The effects of failures and action damage should be limited as far as possible e.g. by redundancy and separation.

4	Suitable arrangements shall be provided for the supply of electricity sufficient to supply the consumers agreed by the Naval Administration during:	For sizing of power plants and respective generator sets a load estimation should be established which will determine the power demand of all consumers necessary for operation of the vessel in a high readiness state. The consumers active during the high readiness state and the use of applicable diversity/load factors should be defined by the Naval Administration. Consideration should also be given to the starting loads when estimating the generation capacity. The sizing of generators and electrical components may include spare capacity for future upgrades as directed by the Naval Administration.
4.1	All operational conditions;	
4.2	Irrespective of the direction of the propulsion shaft rotation;	
4.3	Without any requirement to use emergency supplies.	
5	Suitable redundancy arrangements shall be provided to supply essential safety functions in the event of loss or unavailability of the largest generator.	
6	Suitable protection measures shall be provided in accordance with Regulation 12 Electrical Protection Arrangements.	Risk: Degraded operation, damage, destruction, Fire risks and injury to personnel associated with abnormal operation of electrical generation. Consideration for protection from the following, but not limited to: • Overload conditions; • Earth Faults; • Short circuit; • Risks associated with parallel operation; • Risks associated with HV installations; • Mechanical & Thermal effects i.e. over-speeding & over-temperature; • Solid, liquid & Dust ingress. Protection systems are to be developed using a systemic design procedure incorporating verification and validation methods to ensure successful implementation of the required protection.
7	No electrical equipment shall be put into use where its strength and capability may be exceeded in such a way as may give rise to danger or may affect essential safety functions.	Risk: Machinery & Systems operation degrading, stopping or becoming damaged due to variations in the electrical supply voltage, frequency or EMC. Consideration should be given to electrical power required for sensitive loads. An acceptable Naval Standard such as STANAG 1008 or equivalent may be used. For battery chargers & battery combinations used as a DC source, consideration of voltage characteristics during charging, boost charging and discharging of the battery should be given.
8	Where applicable, facilities to safely connect shore side electrical power shall be provided.	Risk: Damage to vessel from incorrect connection, injury to personnel from inadequate isolation. Consideration of Connection arrangements, Protection (overload & earth arrangements), Isolation (to allow connection) and operation (indication of when live & correct phasing) should be given.

9	Facilities shall be provided to regain sufficient power to restore essential safety functions from a dead ship condition.	Risk: Not able to start main and emergency generators after a blackout. The availability of suitable starting arrangements and conditions for all generators driven by internal combustion engines and gas turbines should be assured. It should be possible to start the generators with the ambient temperatures specified within CONOPS. A primary source of stored energy which allows a minimum of three consecutive start attempts should be maintained. The stored energy can consist of but not limited to: • Electrical; • Hydraulic; • Compressed Air. And must be located adjacent to the generator. The additional capacity can be supplied directly from the emergency source of electrical power or in combination with the remaining generator sets as long as the essential services are maintained. Means to prevent the critical depletion of the primary stored energy should be provided for automatic starting arrangements unless a secondary source of stored energy with a capacity of three consecutive start attempts being available within a time accepted by the Naval Administration.
10	Suitable arrangements for the safe installation and use and maintenance of energy storage devices shall be provided.	Risks: • Explosion and Fire risks associated with charging. • Unintentional Discharging • Spillage/contamination of Electrolyte. This includes all batteries, UPS's, fuel cells or other kinetic energy storage devices. Consideration of, but not limited to: • Location • Capacity • Protection of immediate area around battery from electrolyte damage and corrosion • Ventilation • Charging Arrangements • Discharging rates • Access arrangements for inspection & replacement Continuous monitoring of accumulator batteries supplying essential services with suitable indication of when the battery is discharging should be provided. Accumulator batteries supplying essential services should not be located within the same spaces as the main or emergency sources of power, except batteries required for the starting of generators.

11	In the event of failure of the Main Electrical Supply, a means to supply sufficient electricity to supply the Essential Electrical Services shall be provided within a specified time and a duration accepted by the Naval Administration.	Risk; Totally blacked out conditions without sufficient capacity to supply essential safety functions for long periods Emergency Electrical Supply: Is the electrical supply with sufficient capacity and duration to supply the Essential Electrical Services and may include: • An Emergency Generator; • An Accumulator Battery; • Through system design one of the main generators as long as compliance with the requirements for Location, redundancy, independence, capacity and distribution are met. The required time for the emergency power to come online is to be agreed with the Naval Administration. However, loss of supply to functions that potentially affect the safety of other ships (e.g. navigation lights, daylight signalling lamps and the ship's whistle) should be considered and the time for reconnection to an electrical supply should be kept to a minimum.
12	Where a main generator is used in lieu of the emergency generator, subject to complying with necessary requirements, the requirements of the emergency source of power are to be applied to the main source of power.	Risk: Not all essential services supplied, especially after generator failure, sustained damage or other casualty. Consideration of ability to override protective devices should be agreed by the NA.
13	For essential safety functions for which an interruption to supply is unacceptable, transitional electrical supplies with sufficient capacity and duration accepted by the Naval Administration shall be provided.	Risk: Loss of electrical supply to a critical essential safety function. Some essential safety functions will require independent UPS as directed by the Naval Administration.
14	The power supply to Escape, Evacuation and Rescue systems is to be provided as per the requirements of Chapter VII Regulation 14 Power Supply to Escape, Evacuation and Rescue Systems.	

Solutions

15 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 10 Electrical Distribution and Equipment

CODE REQUIREMENTS	GUIDANCE ONLY
Functional Objective	
1 Electrical power shall be distributed safely to consumers.	Risk: Failure of supply to machinery & systems, hazards to personnel and Fire risks. Consideration should be given to but not limited to: • Adequate space around electrical equipment for operation, maintenance and survey; • Location of flammable materials within the vicinity; • Hazardous areas, i.e. explosions; • Risk of mechanical injury due to damage from steam, water or oil; • Mechanical connections of cables; • The use of materials to reduce the risk of fire or to prevent propagation of an external fire. Compliance with the latest version of IEC 60695 Fire testing, or an equivalent standard may be accepted by the Naval Administration. Distribution systems are to be so arranged that a fire in any one main fire zone will not interfere with either main or emergency distribution systems & services in any other such zone.
Performance Requirements	
2 Electrical equipment is to meet the requirements of Regulation 9 paragraph 7 in terms of suitability for the quality of electrical power supply.	Consideration of the heating effects due to harmonic distortion of the power supply. Consideration of EMC requirements.
3 Electrical equipment and distribution systems are to meet the requirements of Regulation 12 Electrical Protection Arrangements.	
4 The electrical system voltages and frequencies shall be selected to ensure safe provision of electrical power to systems and to minimise the risk of exposure to personnel-.	Risk: Injury or death of crew and embarked personnel during normal and foreseeable abnormal conditions. Identification of the system voltages in accordance with recognised standard voltages agreed by the Naval Administration for: • Power Generation & Distribution; • Cooking and Heating equipment; • Domestic Electrics i.e. Lighting, heaters and consumer sockets located in crew/embarked personnel accommodation areas. The Naval Administration may require particular voltages and frequencies to ensure interoperability and consistency across their fleet and other navies' ships.

5	The design of the type and configuration of the distribution system is to consider earthing arrangements to minimise the risk to personnel and equipment under normal and foreseeable abnormal conditions.	Risk: Inadequate or unsuitable earthing arrangements present a risk to the vessel and personnel. Consideration should be given to but not limited to: • High Voltage neutral earthing; • Exposed conductive parts; • equi-potential bonding; • earthing and bonding connections; • EMC; • earthing associated with hazardous areas including Intrinsically Safe systems; • Helicopter and RAS operations; • Operation of protective equipment under earth fault conditions; • protection against galvanic corrosion, static discharge & lightning. Earthing arrangements on non-steel vessels is to be considered. The Naval Administration may require a particular type of distribution system to ensure interoperability and consistency across their fleet and other navies' ships.
6	The number, size, installation and arrangement of electrical switchboards and distribution centres shall be suitable for the functional requirements of the vessel.	Risk: Significant loss of electrical power due to one fault/failure. Consideration to be given but not limited to: • The split of power distribution throughout the ship; • Sources of supply for electrical machinery to maintain services; • Physical location; • Local control; • Reversionary control; • Control system power supply; • Protection from physical damage; • Maintenance of supplies in event of loss of a compartment(s), depending on stability criteria; • Inter-connection of switchboards; • Power management system.
7	Emergency sources of power and its distribution system shall be designed and arranged with a high level of integrity and availability.	Risk: The larger the distance between the emergency generator and the emergency switchboard, the higher the risk that the switchboard sustains damage whilst the generator remains available. Where an emergency generator is fitted, the emergency switchboard associated with it should be located in the same or an adjacent compartment. It may be sited in an adjacent compartment for example; to meet citadel requirements.

8	Materials used in electrical distributions systems, particularly cables, are to comply with Regulation 1, paragraph 7.	Risk: Potential injury to personnel caused by by-products of fire. Materials used in electrical systems should not pose a risk when exposed to fire in agreement with the Naval Administration. All electric cables and wiring should be at least of a flame-retardant type and should be so installed as not to impair their original flame-retarding properties. For particular applications the Naval Administration may permit the use of special types of cables which do not comply with a recognised standard. In certain circumstances, the Naval Administration may accept small quantities of cable in equipment which is not certified as non-toxic. Consideration of both electrical and smoke inhalation hazards should be given. Compliance with a recognised standard by the Naval Administration may be accepted
9	Cables shall be installed such that risk of injury to personnel or damage to the system is minimised when equipment is operating in foreseeable or under fault conditions.	Consideration of the following should be included but not limited to: • Cable proximity to other ship installations (e.g. Cables installed alongside handrails); • Personnel health (exposure to magnetic fields); • Overheating (due to bunching or painting); • Mechanical support and securing arrangements when cabling is exposed to fire or other scenarios within the CONOPS (e.g. use of metal rather than plastic cable ties); • Bend radius; • Through bulkhead connections (maintaining water and gastight integrity); • Physical protection; • Maintenance of ingress protection; • Joints and terminations; • Short circuit.
10	Main and emergency supplies, where required for a single consumer, shall be separated as widely as possible.	Risk: Single point of failure removes both supplies (i.e. fire or mechanical damage in compartment).
11	The continuity of supply to Essential safety functions shall be ensured.	Risk: Loss of electrical supply to essential safety functions. Consideration to the duplication of services or the supply to the services shall be given and include: • Source of supplies; • Auto change-over provisions; • Separation of supply cables; • Connection of emergency supplies if applicable.

12	Suitable arrangements for the isolation and switching of distribution circuits shall be provided.	Risk: Cannot isolate electrical distribution systems due to damage or maintenance requirements. Consideration shall be given to the switching and isolation of electrical services whilst on load for maintenance and/or isolation. Suitable arrangements shall be provided to prevent any circuit from being inadvertently re-energised, for example: • Circuit breaker locks; • Removable operating handle from circuit breakers; • Interlocks; • Removal & retention of fuses.
13	Installation of cables shall not cause mutual interference between systems.	Risk: Electromagnetic interference between systems causes malfunction or disablement of Machinery & Systems or injury to personnel. Consideration to the effects of generated/absorbed EM waves upon machinery & Systems shall be given. Means to reduce the risk include but not limited to, separation, isolation, shielding and exclusion of personnel. EMC requirements can be satisfied by compliance with international or national standards for example IEC 60533 Electrical and electronic installations in ships: Electromagnetic compatibility (Edition 2, 1999) and IEC 60945 Maritime navigation and radio communication equipment and systems. General requirements: Methods of testing and required test results (Edition 4, 2002) or EU EMC Directive 2004/108/EC or alternative standard accepted by the Naval Administration.
14	Suitable protection arrangements for the use of portable electrical equipment shall be provided	Risk: Portable electrical equipment may overload the distribution system or present a hazard to personnel. The use of portable electrical equipment must be controlled on board otherwise uncontrolled loads and hazards to the distribution system and personnel will emerge. Both hardware and procedural processes will be required. For hardware consideration of: • The use of an earthed low voltage distribution system; • The use of unique plug/socket arrangements; • The use of appropriate protection devices i.e. Fuses, MCB's etc; • Periodic testing arrangements.
15	Effective means of communications, complying with the requirements of Chapter VIII, Regulation 6, are to be provided between all switchboards.	This is considered to be an essential electrical service in accordance with Regulation 9 Electrical Generation and Power Supplies. Two independent means of communication should be provided.
16	Where a damage control emergency distribution system is installed, it shall not introduce additional risk of harm to personnel, equipment or the platform.	Consideration should be given but not limited to: • Resistance of cables to physical damage (i.e. When in use); • Personnel safety (both during connection and in situ); • Identification of phases.

Solutions

17 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 11 Lighting

CODE REQUIREMENTS	GUIDANCE ONLY
Functional Objective	
1 Illumination shall be provided appropriate for location and operational requirements in both normal and emergency conditions.	
Definitions	
2 For the purpose of this regulation the following descriptions of lighting systems have been used to provide a common vocabulary (Reproduced from Definitions in Regulation 1 General):	
2.1 Primary lighting: Fixed lighting provided for safe access around the ship and those compartments accessed during normal operations. Carrying out operations at control stations.	May also be termed as main lighting.
2.2 Secondary lighting: Fixed replacement lighting in event of primary lighting failure. This may be at a lower illumination level.	May also be termed as emergency lighting. Secondary lighting will be supplied from an alternative power source. Secondary lighting is likely to be required at the following locations: • Embarkation stations; • Corridors, stairways, and exits en route to embarkation stations; • All service and accommodation corridors, stairways and exits, including personnel lifts; • Machinery spaces and generating stations inc control positions; • All control stations; • All stowage positions for fire-fighting outfits; • Steering gear; • At fire pump and starting positions for pumps. • Any other location required by the Naval Administration (i.e. ammunition spaces).
2.3 Tertiary lighting: Fixed independent lighting system to provide a minimum level of illumination on failure of primary and secondary lighting.	May also be termed as automatic escape lighting. Tertiary lighting consists of an independent source of power which may be central or integral to the light fitting. Low location lighting is considered to be a tertiary lighting system.

2.4	Transitional lighting: Fixed lighting provided upon loss of primary lighting and prior to the operation of the secondary lighting, where a level of continuous illumination must be maintained for operational purposes.	
2.5	Escape, evacuation and rescue lighting: A combination of secondary and tertiary lighting specifically arranged to enable escape, evacuation and rescue.	
2.6	Operational lighting: Fixed lighting as required for special purposes with different levels of illumination from primary and secondary lighting.	Operational lighting is likely to included as part of the primary and secondary lighting circuits and includes but is not limited to: • Red lighting; • Lighting compatible with night vision goggles; • Aviation lighting; • Medical facilities; • Offices & workstations; • Workshops; • Galleys.
2.7	Portable lighting: Non-fixed, portable lighting which may be used to support other lighting systems.	For example: lamps with batteries or other energy storage devices, torches, mains powered inspection lamps.
Performance Requirements		
3	The light fittings selected for a particular compartment shall be appropriate for the hazardous zone classification of the compartment. Refer to Regulation 18 Hazardous Areas.	Hazardous spaces include but are not limited to: • Ammunition space; • paint store; • battery shop • vehicle decks; • aircraft hangars.
4	Siting of light fittings is to consider the transfer of heat to adjacent surfaces.	
5	Illumination levels are to meet operational requirements.	The effects of glare are also to be addressed.
6	Lighting systems are to permit the vessel to be operated in accordance with the CONOPS.	
7	Primary lighting systems are to provide a suitable level of illumination:	
7.1	to allow safe access to areas of the vessel that require it for normal operations;	

7.2	To allow operation and control of the vessel.	
8	The lighting system is to be arranged such that a single failure will not cause total loss of illumination in any compartment.	Risk: Personnel are injured whilst trying to exit compartments in total loss of lighting. The arrangements for lighting system may be either or a combination of: • Dual circuits for primary lighting in a compartment; • Secondary lighting; • Tertiary lighting. Where duplicated circuits are provided for primary lighting, they should be separated as widely as practicable. For compartments where access to the exit is unobstructed (such as cabins, stores etc), total loss of illumination may be accepted.
9	In the event of loss of primary lighting, at locations where a level of illumination must be maintained for operational purposes, transitional lighting shall be provided until the secondary lighting is operational. The transitional lighting is to be available for a period acceptable to the Naval Administration.	Transitional lighting illumination levels may be less than that required for primary or secondary lighting.
10	To meet operational requirements, lighting levels are to be controllable locally.	This level of control could be the ability to turn lights on and off or the use of a dimmer control to reduce the level of illumination. Examples include but not limited to: • Navigation at night; • Flying operations; • Darken ship requirements. Consideration shall be given to the level of glare from equipment indicator lamps (i.e. LED's on COTS equipment) when operating in a reduced illumination state.
11	Operational lighting shall be provided in areas where there is an operational requirement for different levels of illumination from that provided by the primary system.	This should be provided where either a reduced or increased level of illumination is required. Operational lighting may either by permanent (i.e. in a medical facility) or configurable (i.e. Switching between white and red lighting).
12	Lighting required for escape, evacuation and rescue shall be as defined in Chapter VII Regulation 15 Lighting During Escape, Evacuation and Rescue Emergencies and Regulation 18 Way Finding System.	
13	Navigation lights shall be as defined in Chapter IX Regulation 9.	

14	Where provided, portable lighting shall be appropriate for the hazardous zone classification of the compartment in which it will be used. Refer to Regulation 18 Hazardous Areas.	

Solutions

15 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 12 Electrical Protection Arrangements

CODE REQUIREMENTS	GUIDANCE ONLY
Functional Objective	
1 All electrical equipment shall be suitably protected against damage to itself under fault conditions and to prevent injury to personnel.	
Performance Requirements	
	<u>**CONSTRUCTION GUIDANCE**</u> The construction of electrical equipment should be suitable for the environment where it will be located and will: • afford protection to the equipment from external factors; • prevent inadvertent exposure and injury to personnel. Whilst maintaining suitable operating conditions i.e. equipment ventilation/cooling arrangements. Cabling should be secured such that when exposed to fire it does not pose a risk to personnel (obstruction to access) or lead to loss of essential safety functions.
2 Exposed metal parts of electrical machines or equipment which are not intended to be live but which are liable under fault conditions to become live shall be earthed.	Risk: Electrical equipment & systems unintentionally become live and touch voltages lead to personnel injury or death. All electrical equipment should be suitably earth bonded. Other arrangements for low voltage systems may be accepted by the Naval administration i.e. Double insulation.
3 A means to detect and alert of insulation breakdown with respect to earth within equipment and distribution systems shall be provided.	All insulated distribution systems for power, heating and lighting circuits should be provided with continuous monitoring of insulation level with respect to earth with an alert to indicate low levels of insulation resistance including circuits supplied through transformers. If the fault current exceeds a level agreed by the Naval Administration, an alarm should be provided and the circuit disconnected.
4 Suitable protection arrangements from the ingress of solids, liquids and gases shall be provided for all electrical equipment and distribution systems.	Risk: Electrical equipment and distribution systems fail with the ingress of foreign media leading to potential personnel injury. All electrical equipment and distribution systems should consider its intended location with enclosures designed and installed to protect electrical connections from the ingress of solids, liquids or gases. This is to also include the possibility of inadvertent exposure of electrical connections to personnel. I.e. Equipment ventilation slots should not be large enough so as to allow personnel fingers to touch exposed electrical connections. Consideration to mechanical damage should also be given in regions where moveable machinery i.e. cranes, lifts and hoists etc could come into contact with electrical equipment and distribution systems. Suitable mechanical protection should be provided in these cases. Where liquid coolants are used, consideration should be given to the detection of liquids in an equipment enclosure and provision of an alert indication. Electrical equipment should be provided with suitable cable glands, bushings or conduit entries. All entries should maintain the degree of protection provided by the enclosure of the associated apparatus.

5	Efficient means, suitably located, shall be provided for protecting from excess of current every part of a system as may be necessary to prevent danger.	Risk: An excess current on a piece of electrical machinery or system disables the electrical supply. Suitable selectivity using appropriate, breakers, MCB's, Fuses and where required, redundancy should be incorporated within distribution networks to ensure continued supply to non-fault equipment and machinery. Equipment will need to withstand faults for a short time until protective devices operate.
6	Suitable arrangements for the protection of mechanically connected equipment due to the effects of electrical overloads shall be provided.	Risk: Mechanical & Electrical overloads cause system failure, destruction or fire. Consideration should be given but not limited to: • Reverse power; • Over-speed rotating machines; • Excess torque; • Torque pulsations; • Mechanical constraint of equipment and distribution systems during fault conditions, i.e. cable securing arrangements.
7	Suitable arrangements for the protection of electrical equipment due to the effects of mechanical overloads shall be provided.	Consideration should be given but not limited to: • Over speeding of rotating machines; • Stalled motors; • Torque overload.
8	Essential safety functions agreed by the Naval Administration shall be supplied using fire-resistant cable.	Risk: Loss of essential safety function due to fire damage of cabling.
9	Electrical Equipment and distribution systems shall be suitably protected from mechanical damage.	Risk: Damage to equipment, exposure of live conductors to personnel. Consideration of the following hazards: • People walking on cables and machinery; • Damage from fixed and portable equipment i.e. hoists, cranes etc.
10	Suitable Security arrangements to prevent unauthorised access to live electrical connections and electrical control shall be provided.	Risk: injury to personnel and potential damage to equipment & distribution systems. Consideration should be given to the Unauthorised access to electrical equipment & systems, or spaces & compartments containing electrical installations and suitable security arrangements provided.
11	Suitable protection arrangements for lightning strikes shall be provided.	Risk: A lightning strike leads to damage of electrical equipment or distribution systems. Lightning protection should: • Consider the use of masts and hulls to direct the energy to earth; • Comply with IEC 60092-401 Electrical Installation in Ships: Installation and test of completed installation (Edition 3, 1980), or an alternative standard agreed by the Naval Administration; • Consider alternative arrangements for non-steel ships.

12	Alternative arrangements for cooling of essential machinery and systems in the event of a forced cooling system failure shall be provided.	Risk: Essential machinery or system fails due to cooling failure. Consideration of alternative arrangements for forced cooling failure should be provided such as but not limited to : • Alternative ventilation flaps opened on the machinery/equipment; • The use of an alternative cooling system i.e. the use of sea water in lieu of chilled water. Essential machinery and system redundancy with independent forced cooling arrangements or operational constraints (e.g. engine slow down) may be accepted by the Naval Administration in lieu of arrangements for forced cooling failure.
13	Suitable arrangements shall be provided to minimise the effects of radiation hazards to personnel.	Risk: Medical risk to personnel from radiation emanating from electrical systems. Mitigations include but are not limited to: • Shielding; • Exclusion of personnel; • Restricted access.

Solutions

14 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 13 Machinery Control

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	Main and Auxiliary Machinery & Systems essential for propulsion and safety of the ship shall be provided with effective means for its operation and control during all ship operational conditions.	Risk: Loss of control of essential machinery & systems could render the ship out of control.
Performance Requirements		
		CONSTRUCTION GUIDANCE Risk: Components or systems prematurely fail during use, leading to loss of control of essential machinery and systems. Consideration should be given to the behaviour of an alert system during start up and shut down activities (for example: a low lube oil pressure indication on engine shut down, leading to automatic starting of an alternative pump).
2	The design, construction and operation of the control systems shall consider human element requirements in accordance with Regulation 17 Human Element.	ISO standards can be used for system assessment.
3	Provisions shall be made to ensure a continuous electrical supply to the essential machinery/systems control system. An audible and visual alert shall be initiated in the event of the failure of any of the power supplies.	Risk: Non continuous electrical supply will disable remote control and lead to loss of control of the essential machinery & systems.
4	The control system must operate essential machinery & systems in a safe, controlled and stable manner throughout the machinery's/systems defined operational limits and shall recover automatically in a safe manner after a loss of power supply.	Risk: The remote control system could invoke unstable and dangerous modes of machinery or system operation leading to potential failures or inadvertent operation.
5	It must be possible to control machinery/systems from only one location at a time, with clear indication showing the location of the control. Transfer between control stations without altering the control set points shall be provided. Transfer of control location will be indicated with visual and audible indication.	Naval practice does not require authorisation to take control. Risk: Conflicting commands such as Ahead and Astern being commanded simultaneously causing damage/overload to machinery and systems. The control system should be arranged such that mutually exclusive commands cannot be accepted. Interlocks or other control devices are to be provided to prevent commands such as Ahead and Astern being simultaneously applied.

6	Appropriate indication and feedback shall be provided at each control station to confirm that the system has responded to operator demands. The status of automatic control systems shall be indicated.	If the operator can manually control a system parameter, confirmation is required that the equipment has responded as intended. For automated control systems, control system status is to be indicated. E.g. Systems on line in standby mode rather than off or in local control.
7	It must be possible to disable the automatic or remote control operation of essential machinery & systems to allow inspection and maintenance tasks to be safely performed on the machinery and systems.	Usually the use of a local/remote switch located adjacent to the machinery would suffice. Indication of the control status should be provided at the remote control station.
8	Indications of impending slow-down / shut-down of essential machinery and systems shall be provided at applicable locations with provision to take alternative actions if approved	An audible and visual alarm shall be provided for example, impending slow down due to high bearing temperature shall allow enough time to be over-ridden in exceptional circumstances i.e. manoeuvring. A visual indication that the over-ride is in operation shall be provided. Some shut down functions such as Low Lube Oil Pressure may not have an over-ride.
9	Automated control systems which utilise stored energy to start essential machinery shall be configured not to exhaust the stored energy completely and to provide an alert when the stored energy is below a critical limit.	The stored energy should allow three successive start attempts. The stored energy could be Pneumatic, hydraulic or electrical.
10	The monitoring system for system parameters is to have integrity appropriate for its intended purpose.	At least one gauge or indicator for any parameter being measured shall be direct reading and be calibrated periodically or is assured over the lifetime of the gauge or indicator. There is no requirement for every gauge to be calibrated; some may be for indication only.
11	For unattended machinery spaces, a machinery control and alarm position shall be provided.	This is also required for single person operation. It is acceptable for the control and alarm position to be located in the machinery space.
12	Failure of the external control systems for essential safety functions shall initiate an audible and visual alert at the relevant control stations. It shall be possible to override the control system to regain control of the machinery or system.	Risk: Failure of the control system prevents alternative means of safe control. The Ships control centre is considered to be the external control system. Upon failure of this system, it should be possible to operate the machinery manually. For essential systems which are unable to operate without their control system, it may not be possible to operate the machinery manually and in this case consideration should be given to the redundancy arrangements of the essential safety function. For example, the control system for a gas turbine.
13	The control system shall fail safe, and where practicable the essential machinery or system shall maintain the last position or state prior to the failure or to a fail safe condition.	Upon failure the machinery shall not cause harm to other equipment, personnel or the environment.

14	Operators shall have an independent, high integrity method to disconnect all energy sources that shall put machinery for essential safety functions into a known safe state.	Essential machinery and systems should be fitted with a remote independent emergency stop.

Solutions

15	Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.	

Regulation 14 Alerts and Safety Systems

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	The alert system shall inform operators as soon as reasonably practicable of deviations from normal operation of essential machinery and systems during all ship operations.	Risk: Machinery & Systems operate at a level where there is a risk of damage or catastrophic failure. An alert system can form part of a Platform Management System.
2	A safety system shall be installed to ensure that any serious malfunctions of machinery or system which present an immediate danger shall initiate a corrective action where appropriate to remove the risk of danger.	The system does not necessarily need to be shut down, it could be brought to a safe operating condition. Manual intervention may be acceptable for some safety systems. A safety system may be integrated into the control and alert system with the agreement of the Naval Administration.
Performance Requirements		
3	An alert system shall be arranged with necessary panels at key locations as agreed with the Naval Administration.	Risk: The alert system is unintelligible, information is difficult to extract, and important alarms get overlooked. A Hierarchical alert system should be employed and should include both audible and visual indications (hierarchical refers to the sequence of local alerts, followed by group alerts, followed by platform alerts). For unattended machinery spaces and control stations, a duty engineers alarm should be provided.
4	The design, construction and operation of the alert and safety systems shall consider human element requirements.	Risk: The alert system is unintelligible, information is difficult to extract, and important alarms get overlooked.
5	The operational status of the computer based system should be easily recognisable. Alerts should be visually and audibly presented with priority over other information in every operating mode of the system and should be clearly distinguishable from other information. When using general purpose graphical user interfaces, only functions necessary for the respective process should be available.	
6	The alert system and safety system shall be provided with a continuous supply of power.	Risk: Loss of power supply renders alert or safety systems inoperative. Power can be electrical, pneumatic or hydraulic. Transitional arrangements will be required. The failure of the power supplies should be indicated by an alarm.
7	Where parameters of the alert system can be adjusted, the integrity of the system shall be maintained.	When alert systems are provided with a means to adjust their sensitivity or setpoint the arrangements should be such that the final settings can be traceable and readily identified (configuration management).

8	The status of an alert shall be clearly visible and a means to accept it from all appropriate locations as agreed with the Naval Administration. Visual indication of the alarm shall remain until the fault is cleared.	It is acceptable to have a single acceptance and a separate single reset action for multiple independent alarms. The alert system should be able to indicate more than one fault simultaneously and the acceptance of any alert should not inhibit another alarm.
9	Machinery and Systems shut-down by the safety system must be manually reset before allowing a restart.	This can be a remote reset. This relies upon operational procedures.
10	Where the function of a safety system may lead to a greater hazard than the loss of the equipment, the Naval Administration may agree to an override feature.	Provisions to override a safety system should only be fitted when approved and a clear indication should be provided when in operation. Means should be provided to prevent inadvertent operation of the safety system override.
11	The status of standby machinery & systems shall be indicated at appropriate control stations as agreed with the Naval Administration.	
12	As far as practicable the alert and safety systems shall be designed to fail to a safe state.	Risk: Failure of part of the alert or safety system inhibits the other alert and safety functions, or causes the initiation of the uncontrolled actions.

Solutions

13 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 15 Programmable Electronic Systems (PES)

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	Additional hazards shall not be introduced by the application of programmable electronic systems.	
Performance Requirements		
2	These requirements apply in addition to 13 Machinery Control and Regulation 14 Alerts and Safety Systems.	
3	The requirements specified within Regulation 16 Systems Integration shall be met.	
4	Safety requirements for systems shall be derived from a top level risk assessment of all reasonably foreseeable accidents. The safety requirements shall be used to determine safety integrity for each complex electronic component.	Risk: A system that has not been subject to a top level risk assessment may witness data corruption, mal-operation and the potential to raise false alarms. The computer based system should be designed, constructed and installed using ergonomic principles and shall consider the human element and installation requirements such as those specified in ISO 17894:2005.
5	Evidence for the failure modes and failure rates of the complex electronic element shall be provided to the Naval Administration.	Using risk based techniques.
6	The computer based system shall comply with the EMC requirements specified in Regulation 10 Electrical Distribution and Equipment.	
7	The PES shall be arranged such that the configuration is protected against unauthorised or unintended change.	Risk: Unauthorised changes corrupt the computer system and render it inoperable. A means to go back to a safe state should always be accessible.
8	Where applicable, the synchronisation of date and time stamping between separate equipment shall be considered.	Risk: Time errors between different systems makes it difficult to understand the actual sequence of events.
9	There shall be no degradation of the sub-system functionality when integrated into a larger system.	Risk: Inability to integrate the sub-system, connection issues, lack of conformity between sub-systems leading to operator confusion. Computer based sub-systems integrated into larger systems should use standardised or agreed interfaces, and a consistency of the display architecture, indications and messages.
10	Programmable electronic systems shall maintain specified levels of performance in operation, and where necessary, under fault conditions.	

11	Systems shall be readily usable under all intended operating conditions and shall support effective and efficient operation. Adequate safeguards against incorrect operation shall be provided.	Risk: Poor Human Interface leads to an incorrect input function leading to unintended machinery/system control.
12	The system repeatability and accuracy shall be adequate for the proposed use and shall be maintained at their specified value during their expected lifetime and normal use.	Corrupted/unsafe data due to a detected fault condition should be clearly identified.
13	Program and data held in the system shall be protected from corruption by loss of power.	
14	A management of change process shall be applied to safeguard against unexpected consequences of modifications.	Risk: Uncontrolled changes can lead to equipment failure, loss of integration, false alarms and damage to machinery and systems.

Solutions

15 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 16 Systems Integration

CODE REQUIREMENTS	GUIDANCE ONLY
Functional Objective 1 Essential safety functions shall be designed such that risks of harm to personnel, damage to the platform or the environment are reduced to a level acceptable to the Naval Administration, both in normal operation and under fault conditions. Functions shall be designed to fail safe.	
Performance Requirements	<u>**CONSTRUCTION GUIDANCE**</u> Risk: Sub Systems do not function or function optimally when integrated. Integrated sub-systems should operate as efficiently as if they were stand alone systems. Consideration should be given to: • Interfaces; • GUI's / Mimic diagrams, Symbols, Alarms & Indicators etc for PES; • Power supplies; • Operation.
2 The integrity of essential machinery or systems, during normal operation and fault conditions shall be demonstrated.	Risk: Unintended system operation or hazardous consequences to personnel, the vessel or the environment due to a component or sub-system failure. Risk based techniques should be completed to determine that the system will behave in a predictable manner and that individual components and sub-systems are compatible during both normal and fault conditions. This should include both machinery or system operation as well as identify, reduce and/or eliminate hazards to personnel, adjacent equipment, the vessel and the environment. Risk: The fitting of non-identical "equivalent" components leads to the catastrophic failure of the essential safety system due to unintended interaction. The impact of replacing an essential safety system component with a non-identical "equivalent" component should be fully assessed and demonstrated. Replacement of the following should be fully assessed using the same techniques used for the original system installation especially if the new component or machinery has a wider operational envelope which could place undue stresses within the essential safety system during normal and abnormal operating conditions: • A system component; • A sub-system or piece of machinery; • Software; • Control & Safety system settings.

3	Any imposed equipment limitations shall be reflected in system design.	Risk: Individual equipment safety setting not comparable across the entire system. E.g. An engine that can operate to at a higher rpm than the generator, will need to be speed limited. The pressure relief setting should correspond to the weakest link within the system.
4	Systems shall be designed such that they will not unduly affect any other system (even under failure conditions).	Risk: External influences from a system may degrade/destroy an essential system. Equipment that requires cooler ambient conditions should not be located next to a high heat source. Also consideration of other influences such as: • Vibrations; • EMC.
5	Failure of one part of the integrated system shall not affect the functionality of other parts except for those functions directly dependant on the defective part.	Risk: Failure to identify and Test component or sub-system failures renders the essential safety system inoperative. The important issue is that actual physical system testing is completed and documented to confirm that intended operation and actions are completed. Risk: A single point failure disables an essential system or damages another system. A risk analysis of single failure of a system component or another system failure should be completed. A single failure is all that is required to be considered and any degradation of the essential safety system output requires assessment and acceptance by the Naval Administration.

Solutions

6	Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.	

Regulation 17 Human Element

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	Physical arrangements for machinery and equipment shall not pose a risk to personnel.	To ensure the physical ergonomics of the arrangement are suitable.
2	Information relating to the operation of the equipment shall not result in unintended actions.	The cognitive ergonomics of the arrangements provide information to operators without causing confusion or overload.
Performance Requirements		
3	The following areas are to be designed with consideration for the human element:	The Naval Administration may require that the design, construction, operation and maintenance requirements of equipment and systems have considered the human element to prevent failure, over the lifecycle of the platform.
3.1	the Navigation Bridge;	Compliance with ISO/PAS 18152:2003 A specification for the process assessment of human system issues would satisfy the requirements of this regulation.
3.2	the main machinery control position;	
3.3	other conning and control positions as agreed with the Naval Administration.	
Solutions		
4	Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.	

Regulation 18 Hazardous Areas

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	Machinery and systems located in hazardous areas shall not create an additional fire or explosion risk.	
2	The risks to personnel associated with hazardous areas shall be minimised.	This regulation covers a range of hazards to personnel; refer to the definition of Hazardous Areas in Regulation 1 General.
Performance Requirements		
3	The categorisation of hazardous areas with potentially flammable atmospheres shall be in accordance with a national or international standard agreed by the Naval Administration.	Examples of appropriate standards are IEC 60079-10 Electrical apparatus for explosive gas atmospheres: classification of hazardous areas (2002), IEC 60092-502 Electrical installations in ships – Tankers – special features (1999) or IEC 60092-506 Electrical Installations in Ships: Special Features Ships carrying specific dangerous goods and materials hazardous only in bulk (2003). Chapter VI Regulation 8 Containment of Fire categorises spaces but does not specifically specify the hazardous nature of the space.
4	Electrical machinery and systems shall not normally be located in spaces with potentially flammable atmospheres unless required for operational purposes and agreed by the Naval Administration.	Equipment that does not have the potential to ignite a flammable atmosphere may be acceptable.
5	Where machinery or electrical equipment is required to be fitted in a space with a potentially flammable atmosphere, it is to be of a type suitable for the environment for which it will be operated.	For electrical equipment, a safe type will have an arrangement that either prevents the flammable atmosphere coming into contact with conductive elements, will contain an ignition within that piece of apparatus or does not contain sufficient energy to ignite the atmosphere. Where essential for operational purposes, electrical equipment should be of a type providing protection against ignition of the explosive gases or combustible dusts encountered, and compliant with the relevant parts of IEC 60079 – Electrical apparatus for explosive atmospheres, or an acceptable and relevant standard acceptable to the Naval Administration.
6	Where machinery is operated in a potentially flammable atmosphere, a means is to be provided to detect any abnormal parameters which may lead to ignition of the atmosphere.	For example, the fitting of a bearing temperature monitor to a mechanical pump located in the hazardous area.
7	Any failure that can change the categorisation of a hazardous area shall be indicated by an alert.	Where the categorisation of a hazardous area due to its potentially flammable atmosphere is dependant on ventilation arrangements, an alert indicating failure of the ventilation system is to be provided. The alert should be indicated at the relevant control stations. Operational procedures will be required to determine the action that should be taken in the event of the alarm sounding.

8	The integrity of the boundary of the hazardous area shall not compromise the safety of the adjacent space.	Penetrations such as doors, hatches, cable penetrations, vent trunking, piping etc in boundaries of hazardous areas with potentially flammable atmospheres shall not compromise the containment of the hazard within the space. Where an area is dependent on ventilation or over/under pressurisation it is important that the air flow or under/over pressure be monitored rather than just the ventilation fans. The fan motor could still be running but a door may be propped open or a fan drive belt failed that could result in loss of pressurisation.
9	Suitable indication of the nature of the potential hazards shall be provided at the entrance(s) to the space, and on the equipment where applicable.	Risk: Personnel injury resulting from unintentional exposure to noise, moving equipment, flammable atmospheres, oxygen depleted atmospheres, gas leakage, chemicals, electrical and electromagnetic hazards. All electrical equipment shall have clearly displayed notices indicating the electrical and electromagnetic risks. This shall include the maximum exposure time if applicable.
10	Arrangements to prevent unauthorised or inadvertent access to hazardous or potentially hazardous areas or equipment shall be provided in accordance with Naval Administration requirements.	Means to prevent unauthorised or inadvertent access may include but is not limited to: • Locking of compartments; • Signs; • Use of interlocks to isolate electrical supplies; • Access permits; • Location; • Guards on moving machinery.
11	Measures shall be taken to reduce machinery noise in machinery spaces and transmitted noise to adjacent spaces to acceptable levels, as determined by the Naval Administration.	If this noise cannot be sufficiently reduced, the source of excessive noise should be suitably insulated or isolated, or a refuge from noise should be provided if the space is required to be manned. Ear protectors shall be provided for personnel required to enter machinery spaces, if necessary.
12	Personnel equipment and platform are to be protected from the risk of static electricity.	Consideration to equipment damage or personnel injury from risks associated from static electricity shall be given. Consideration should be given to static becoming a source of ignition in a hazardous area.
13	Any hazardous area which has a risk of personnel becoming inadvertently locked in shall have a means to escape.	For example, either open the door from the inside, operate an alarm which alerts a control station or an alternative means of notification.

Solutions

14 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 19 Replenishment at Sea (RAS)

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	Ships shall be allowed, where required, to safely transfer solid stores, munitions, fluids or personnel between two ships whilst underway.	This regulation covers all replenishment operations: abeam, astern or by vertical replenishment (Vertrep). It has been identified that suitable naval standards exist to mitigate risks associated with RAS operations to an acceptable level. This regulation has been included within the Code to ensure that verification against the selected standard is completed.
Performance Requirements		
2	The requirements of a recognised Naval, national or international standard are to be applied in accordance with the functional requirements of the system.	It is assumed that the Naval Administration will mandate a specific technical standard for compliance. The design of the system is to have considered the following aspects in terms of the system functionality required: • Location of stations; • Control and observation positions; • Ships structure; • Storing routes; • Personnel hazards – radhaz and noise; • Machinery redundancy; • Seakeeping and manoeuvrability; • Internal and external communications; • Dynamic stability due to fluid transfers; • Lifting equipment; • RAS equipment – wires hoses etc (plus emergency); • Operational procedures – inc mgt of static charges.
3	Effective means of communications, complying with the requirements of Chapter VIII, Regulation 6, are to be provided between:	This is considered to be an essential electrical service in accordance with Regulation 9 Electrical Generation and power supplies. Two independent means of communication should be provided.
3.1	RAS station and conning position;	
3.2	Ship to ship RAS stations;	
3.3	RAS station to equipment operating positions.	
4	The requirements of Chapter II are applicable for local structural loads.	Risk: Local loads will damage the ship’s structure.
5	The requirements of Chapter IV Regulation 4 Propulsion are applicable for propulsion and machinery redundancy.	Risk: A single propulsion machinery failure endangers both the supply and receiving ship. Risk: Insufficient propulsion capacity to enable safe breakaway.

6	The requirements of Chapter III are applicable for seakeeping, stability and manoeuvrability.	Risk: Vessel is unable to establish position, maintain station and separate after RAS evolution.
7	The requirements of Regulation 22 Lifting Appliances are applicable for the lifting appliances associated with RAS operations.	Risk: The lifting equipment is not designed for the additional loads imposed by relative movement of the two vessels.
8	Means to rapidly stop operations and disconnect are to be provided.	Risk: Ship's unable to separate in emergency situation.

Solutions

9 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 20 Anchoring and Mooring

CODE REQUIREMENTS	GUIDANCE ONLY
Functional Objective	
1 A ship shall be capable of being secured in position without the use of propulsion machinery, either alongside or at sea.	The intended functions of the equipment are to be defined in the ConOps and may include but not limited to mooring, use in event of propulsion failure and beaching operations. For some ships, anchoring systems may be limited to use in sheltered conditions. ConOps to define weather conditions in which anchoring and mooring equipment is to function. Consideration should be given to operational requirements of the anchoring system with regard to: • Prevention of Collision; • Prevention of Grounding; • Structural damage during deployment and recovery; • Movement of the vessel without using propulsion systems.
Performance Requirements	Construction Guidance Installation is to be in accordance with Chapter II Structure. A single anchor/ windlass is acceptable if the machinery redundancy arrangements are acceptable to the Naval Administration. For example, if propulsion machinery fails, an anchor is used as an emergency device therefore if the propulsion is duplicated then a single anchor is likely to be acceptable.
2 The operational use of the anchoring and mooring equipment shall be defined in the CONOPS.	This is included to capture both normal and novel use of the equipment, i.e. Use for beaching operations, emergency turns etc.
3 Means to allow the controlled deployment of the anchor independent of the motive power shall be provided.	Risk: Uncontrolled deployment of the anchor chain leads to injury to personnel, damage to the equipment or damage to the vessel. The brake shall hold the anchor without the use of hydraulic or electrical supply.
4 Means to lock the anchor in the desired position independent of the motive power shall be provided.	The lock shall hold the anchor without the use of hydraulic or electrical supply.
5 Means shall be provided to recover the entire length of anchor and chain.	The windlass should be sized to recover the full length of anchor and chain when hanging free in deep water.
6 Consideration shall be given to Regulation 21 Towing Equipment if the mooring equipment will be used for towing.	This captures the scenario where fixed mooring equipment may be used for towing or being towed.
7 It shall be possible to abandon the anchor and chain in the event of motive power failure or fouling of the anchor.	If whilst moored the windlass fails, the last course of action would be to drop the remainder of the chain and abandon the anchor. It shall be possible to release the chain from a safe position.

8	For certain ship types, novel craft or for operational reasons, the full anchoring and mooring arrangements may not be required subject to justification and acceptance by the Naval Administration.	Not all craft i.e. landing craft would require the full compliance with anchoring and mooring arrangements.

Solutions

9 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 21 Towing Equipment

CODE REQUIREMENTS	GUIDANCE ONLY
Functional Objective	
1 Facilities shall be provided to allow ship to be towed.	The provision of facilities to allow the vessel to be towed should be independent of the vessels power and propulsion systems. Provisions for emergency towing in accordance with SOLAS Ch II-1 Reg 3-4 should be provided as a minimum. See also IMO MSC/Circ.1255 for preparing guidelines on Emergency Towing Procedures.
2 Facilities shall be provided to allow ship to tow another ship if required by the CONOPS.	
3 Facilities shall be provided to allow ship to tow equipment if required by the CONOPS.	Equipment such as towed arrays etc.
Performance Requirements	
	<u>**CONSTRUCTION GUIDANCE**</u> Risk: Components suffer premature failure. The components, fixings and deck must be of suitable strength to cope with the loads during all operation conditions. It is foreseen that some machinery i.e. windlasses/capstans may be used to pull across ropes from another vessel but would not be used during actual towing.
4 The strength of equipment is to be based on the Safe Working Load (SWL) of the weakest element in the respective system.	Risk: System is over-engineered. For example if the load on the rope is the weakest link, then design all other equipment i.e. Bollards at that load. The design shall incorporate the dynamic loads expected during towing operations.
5 The operational use of towing equipment shall be defined in the CONOPS.	CONOPS will specify the operating scenarios for the use of the towing equipment. Guidance should be provided detailing the limitations and operational procedures for towing operations.
6 Winches used for towing shall comply with the requirements of Regulation 22 Lifting Appliances.	Winches used for towing equipment such as Towed Arrays.
Solutions	
7 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.	

Regulation 22 Lifting Appliances

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	Lifting appliances shall be designed, constructed, maintained and operated to minimise danger to embarked personnel, the lifting equipment and the platform in all Foreseeable Operating Conditions.	The lifting appliances should enable the crew to perform lifting operations in a safe manner including those done during the escape and evacuation process. The Naval Administration should advise on the scope of applicability of this regulation (i.e. Minimum SWL to which this regulation applies).
	Note: For windlasses and capstans see Anchoring and Mooring.	
Performance Requirements		
		CONSTRUCTION GUIDANCE Consideration shall be given to additional forces placed on the lifting appliance as a consequence of the ship's motions.
2	Lifting appliances shall be equipped with requisite safety devices.	
3	The operational use of each item of lifting equipment shall be defined.	Some lifting equipment will be designed and installed for a specific purpose e.g. Aircraft lifts, boat hoist etc.
4	The lifting appliance shall remain safe during all modes of operation.	The lifting equipment shall be safe during all modes of operation including start up, shut down and lifting operations. E.g. If software controlled, a controller re-set shall not cause unexpected movement or release of the load.
5	Operation of lifting appliances shall minimise the risk to embarked personnel, the lifting equipment and the platform during lifting operations.	Operating procedures are required to ensure lifting operations are carried out in a safe manner.
6	Necessary instructions for assembly, use and maintenance shall be present. Identification of the Safe Working Load (SWL) and the maximum test load shall be displayed on or adjacent to the equipment.	For lifting equipment which is not designed for the carriage of personnel, this should be clearly displayed.

7	As far as reasonably practicable, the location of the lifting appliance shall be such that the load can be viewed directly by the operator. In the event that the load cannot be viewed directly by the appliance operator, an effective means of communication, complying with the requirements of Chapter VIII, shall be provided between the load area and the operating position.	
8	The lifting appliance shall not be able to be controlled from more than one operating position at the same time.	
9	Additional requirements for lifting appliances used for personnel or munitions must satisfy an applicable naval, national or international standard.	For lifts intended to carry personnel or munitions additional safety / operation functions are required.
10	Lifting equipment required for life saving functions shall be in accordance with the requirements of Chapter VII, in particular Regulation 22 Launching and Embarkation Arrangements.	
11	Upon motive power failure the load shall remain in position.	
12	After motive power failure means shall be provided to safely move the load to a pre-determined location.	For majority of cases it is anticipated that the load will be lowered. However, for personnel lifts there may be requirements to raise the lift to a safe location.

Solutions

13 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 23 Heating Ventilation and Air Conditioning (HVAC)

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	Ambient conditions shall be controlled to suit machinery requirements.	Note: Closed down conditions may require different ventilation requirements as agreed with the Naval Administration. Ambient conditions refers to temperature, humidity and air quality.
2	Ambient conditions shall be controlled for crew habitability.	To allow crew to carry out their duties safely with regard to ambient conditions. There are additional requirements for accommodation and recreational spaces.
3	Ventilation shall be provided for hazardous areas.	
Performance Requirements		**CONSTRUCTION GUIDANCE** Note special requirements may exist for: • Machinery Spaces; • Technical equipment rooms; • Accommodation Spaces; • Crew and embarked personnel spaces; • Medical Facilities; • Galleys; • Magazines and hazardous material stores; • Aircraft hangers; • Stores, including refrigerated spaces. Operational Requirements should consider: • Normal Operation; • Closed Down Conditions; • Operation within chemical, biological, radiological and nuclear environments.
4	Suitable ambient conditions in spaces containing machinery or equipment shall be maintained.	Risk: Ambient conditions are those in which that machinery operation will not be significantly degraded or lead to failure. This may include lift machinery spaces etc.

5	Suitable ambient conditions for all accessible spaces shall be maintained.	Risk: Unfavourable Ambient conditions could endanger personnel. The level of CO_2 will need to be considered. All spaces that require periodic visits by personnel via conventional Hatches/Doors shall be adequately ventilated. No products of combustion or noxious gases i.e. engine exhaust or refrigerant gases shall be admitted into machinery spaces via ventilation. Due care shall be applied to the location of intake and exhaust duct locations. The location of exhaust vents from hazardous areas i.e. battery shops, vents from tanks shall be located appropriately to avoid danger to personnel.
6	The ventilation requirements of Chapter VI Fire Safety shall be met.	Consideration should be given to the extraction of smoke and fire fighting gasses (e.g. CO_2 and equivalents) to an area that will not cause harm to personnel.
7	Watertight Integrity (see Chapter III) and Fire Zone (see Chapter VI) boundaries are not to be compromised by HVAC systems.	Risk: Water ingress via ventilation openings. The location of vent openings or suitable closing arrangements must be provided to ensure water-tight integrity of the vessel.
8	Provisions to "Crash Stop" ventilation in case of fire shall be provided.	Risk: Propagation of Fire. The number and location of the crash stops is dependent upon ship type. In all cases the operation of the ventilation should be outside of the space being ventilated.
9	Hazardous areas are to be provided with appropriate ventilation systems.	To avoid the risks of explosion hazards or oxygen depleted environments, independent ventilation systems may be required for the following types of spaces: • Battery stores; • Paint shops; • Gas storage rooms; • Chemical stores.
10	For remote controlled ventilation machinery & systems, appropriate indication, monitoring, alerts and protection shall be provided.	Indication of status: • Local/remote control; • stopped/running etc. Alerts: • Loss of ventilation; • Abnormal operation of machinery. Protection: • Pressure relief valve; • Bursting discs.
11	Continuity of operation of essential safety functions in the event of a ventilation failure shall be provided. See also Regulation 8 Other Essential Safety Functions.	Risk: Essential Machinery and or Systems fail during ventilation failure. For combustion air provided from within the machinery space, enough air flow shall be provided to maintain combustion in the event of ventilation failure. For essential machinery and systems that require ventilation / air conditioning for component cooling, an alternative means of cooling shall be provided this could include but not limited to: • Additional Flaps / doors to increase ventilation rate; • Redundant ventilation system.

12	The routing of ventilation systems for spaces with hazardous atmospheres shall not pose a risk to other spaces.	Locations of inlets and exhausts for ventilation systems for spaces for hazardous atmospheres (i.e. Flammable, oxygen deficient, gas laden) should be specially considered for potential effects of cross-contamination of compartments. Ventilation from hazardous spaces should not run through accommodation areas.

Solutions

13 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Regulation 24 Tanks

CODE REQUIREMENTS	GUIDANCE ONLY
Functional Objective	
1 Bulk fluids required for machinery systems and crew habitability shall be safely stored.	
Performance Requirements	**CONSTRUCTION GUIDANCE** Consider cross-contamination of fluids from common venting and filling arrangements and due to tank boundaries.
2 Suitable arrangements to safely determine the level of fluid in a tank are to be provided.	Risk: Running out of fluid, overflow of fluid due to overfilling, impact on stability. Consideration should be given to the location of the sounding position with regards to vapour discharge and accidental spillage. Sounding pipes terminating within a compartment are to be fitted with a self closing cock and a test cock to determine if tank is over-pressurised (SOLAS requirement).
3 Tanks are to be provided with suitable venting arrangements to prevent overpressure and underpressure during all operational evolutions.	Consideration of maximum filling and emptying flow rates including: • Ship's own pumps; • Shore supply; • RAS. Consideration should be given to the location of the venting arrangements with regards to vapour discharge and accidental spillage.
4 Location and arrangement of vent pipes for oil fuel service, settling and lube oil tanks shall be such that in the event of a broken vent pipe this shall not directly lead to the risk of ingress of seawater or rainwater.	
5 Suitable arrangements to prevent the ignition of vapours in a tank shall be provided.	
Solutions	
6 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.	

Regulation 25 Novel Arrangements

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	The use of Novel Arrangements shall be allowed whilst maintaining the overall safety of the ship and protection of personnel.	Refer to the definition of Novel Arrangements in Regulation 1 General.
Performance Requirements		
2	All novel arrangements shall be considered by the Naval Administration and accepted on the basis of a submission.	Risk: A novel arrangement does not provide the same level of safety as an equivalent conventional system or equipment during its entire lifecycle.
3	The submission shall include but not be limited to the following aspects:	Compliance with ISO/IEC 15288:2008 Systems Engineering – System Life Cycle Processes or an acceptable equivalent National Standard may be accepted by the Naval Administration as meeting the requirements of this regulation.
3.1	Operational requirements: A description of the agreed functionality of the arrangement including normal, failure and emergency modes.	
3.2	Project management: A description of the process that the designer will adopt to address the design, construction, installation, commissioning and acceptance process.	
3.3	Quality assurance: The internal quality management system shall be in accordance a recognised national or international standard.	
3.4	Engineering safety assessment: Documentation of the hazard identification and mitigation processes required to demonstrate equivalency to conventional arrangements with respect to safety function and protection of personnel.	
3.5	Configuration management: Documentation of the process that enables the traceability of changes throughout the life of the system or equipment to be demonstrated.	
3.6	Integration: Demonstration that the requirements of Regulation 16 Systems Integration are complied with.	

3.7	Maintenance: Identification of any specific through life requirements to maintain the overall safety of the arrangement.	Any component or system with a finite life should be identified.
4	The requirements of other applicable regulations are to be complied with.	

Solutions

5 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

6 CHAPTER V – NOT USED

7 GUIDANCE ON NSC CHAPTER VI FIRE SAFETY

Background

THE STUDY GROUP

7.1 This Chapter was developed by a Study Group between 2005 and 2008. Principal contributors included Lloyd's Register, RINA and the Defence Departments of Sweden, France, the Netherlands and the United Kingdom.

7.2 The authority for the Study Group came from the Specialist Team constituted under NATO NG/6 to which all NATO Navies, Partners for Peace Navies, and Naval Classification Societies that were members of the Naval Ship Classification Association were invited.

7.3 A brief history of the Study Group and the principal agreements:

Date	**Principle agreements/comments**
October 2005	Formal Hazard Identification
November 2005	Initial meeting: • Fire process map • Chapter structure • Identification of Standards
February 2006	Development of Goal and Functional objectives
April 2006	Development of Definitions and Ship types
June 2006	Review of Detection and alarm section
August 2006	Initial review of Risk of Ignition Strategy for development of rule sections
November 2006	Work to develop the following sections: • Detection and Alarm • Control of Smoke Spread • Fire Growth Potential • Risk of Ignition • Special Requirements
February 2007	Circulation of draft regulations within Study Group
May 2007	Review and comment on available draft sections
September 2007	Review and comment on all draft sections
March 2008	Finalise and agree all sections
June 2008	Format and release Chapter VI

7.4 Comments on the principal agreements noted above:

7.4.1 All members of the Specialist Team were invited to participate; those that did are noted above. Collectively, the navies represented on the Study Group operated a wide range of ship types, size, style of construction, and operational areas.

7.4.2 The following standards were used in the development of Chapter VI:

7.4.3 SOLAS Chapter II-1

7.4.4 SOLAS Chapter II-2

7.4.5 2000 HSC Code

7.4.6 French modified SOLAS

7.4.7 Swedish adapted HSC Code

7.4.8 Italian RINA Naval Rules

7.4.9 Lloyd's Naval Ship Rules

7.4.10 UK MoD Defence Standards

7.5 An overview of the scope of the Fire Safety chapter is provided in the basic fire safety map below:

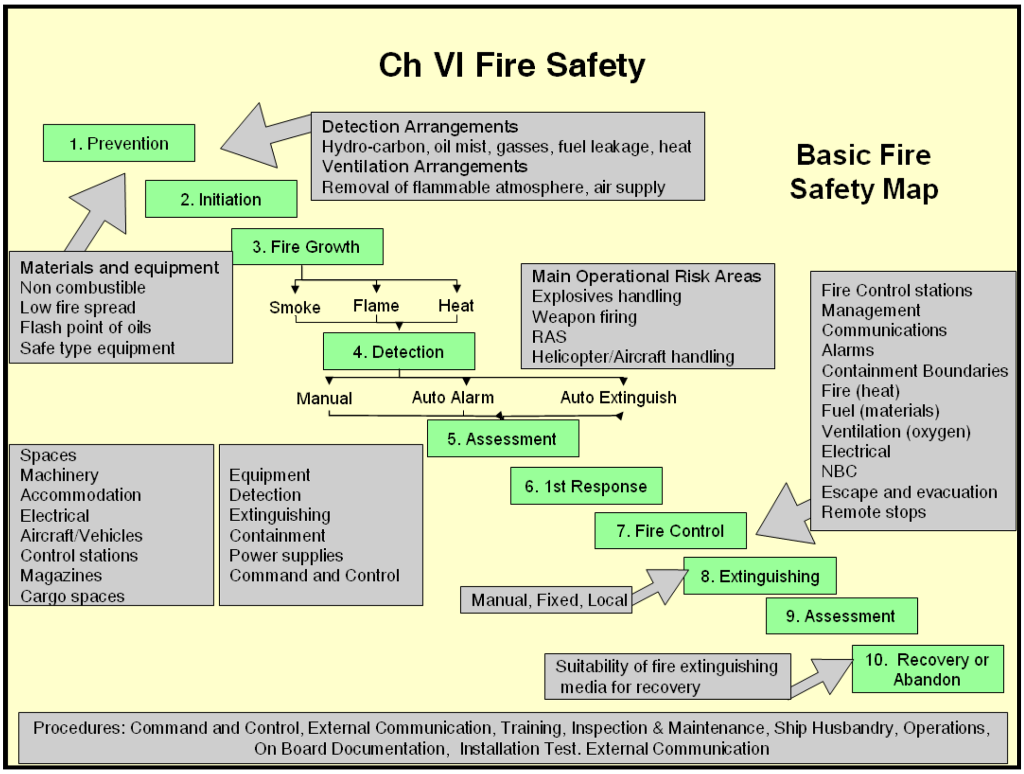

Figure 15: Fire Safety Map

Default Concept of Operations Statement

Fire Safety	**Cargo/Payload** (Ch VI, Reg. 13)	
	Aircraft	Manned Helicopters and Fixed wing aircraft AVCAT Fuel FP above 60°C Insensitive munitions
	Landing craft (Dock)	Manned vessels DIESO Fuel FP above 60°C Insensitive munitions
	Boats (Davit)	Manned vessels Small Quantities Fuel FP above 35°C Insensitive munitions
	Vehicles	Manned vehicles DIESO Fuel FP above 60°C Insensitive munitions
	Munitions	Not addressed by Chapter VI
	Fluids in tanks	Ships own use DIESO and AVCAT FP above 60°C Fluid stored or transferred on board FP above 60°C
	Weapon systems	Not addressed by Chapter VI
	Fuels for recreational use	None assumed
	Operating Activities (Ch VI, Reg. 3)	
	RAS	In accordance with ATP 16D *Replenishment At Sea, Edition D.*
	Anchoring mooring	In accordance with National standards
	Towing	No impact on fire fighting arrangements by towing another vessel. Arrangements if being towed not addressed.
	CBRN (Ch VI, Reg 6, Para 14.6)	None assumed
	Aircraft Refuelling	Not addressed by Chapter VI
	Other	To be defined
	Area of operation	
	Type A, B or C	World Wide
	Alongside (Ch VI, Reg. 12, Para. 6.1)	Addressed assuming fully manned and not in refit
	Docked	Not addressed by Chapter VI
	Environment	
	External Air temperature	-25°C to +70°C
	Internal Air temperature	+5°C to +55°C

Sea temperature	-2°C to + 35°C
Ship motions	Max inclination 22.5°
Electromagnetic	EMC Directive (2004/108/EC), IEC 61000-4 (latest version) and IEC60945 (2002)
Shock	Not addressed by Chapter VI
Vibration	5-13.5Hz +/-1.0mm and 13.5-100Hz+/-0.7g
Embarked persons	
Type A	Min 1 fire party per fire zone
Type B	Min 2 fire parties Max 240 non crew
Type C	Min 2 Fire parties Max 60 non crew
Persons carried in emergency	None assumed
Fire parties	Min 4 people per party (3 fire fighters, one leader) plus one person in overall control
Survivability	
Scenario (Ch VI, Reg 9, Para 15 and 16)	Single fire or two small fires contained within one compartment
Situational awareness	
Fire detection equipment (Ch VI, Reg. 7)	Automatic addressable detectors; heat, smoke, flame, matched to characteristics of the fire. Local and ship wide alarm system alarm system tested to FTP Code
CCTV monitoring	None fitted
Management	
Communication	Not addressed by Chapter VI see Ch VII Reg 10, Reg 11, Reg 12
Number of Safety Zones	One
Damage control organisation	One Central Control station (all ships) Fire station (to be defined by Naval Administration) Damage control centre (Type A)
Training (Ch VI, Reg. 12, Para. 1)	
Non crew	Ship awareness, local fire fighting and evacuation
Crew	Fire fighting training STCW or equivalent
Fire fighting team	Fire fighting training STCW or equivalent plus specific role training
Survey and Maintenance	
Fire fighting Equipment	OEM instructions
Fire fighting system	Ship board operations manual
Maintenance regime	Maintained in accordance with OEM instructions
Survey regime	Annual, Five yearly and following modification

Containment	
Fire containment	Approved insulation and hull structure Approved fire doors with indication and automatic release Approved penetrations to the same standard as the division
Smoke containment (Ch VI, Reg. 6)	Restriction of smoke spread to control stations, machinery spaces and concealed spaces. Smoke containment zones up to $150m^2$.
Main vertical zones (Ch VI, Reg. 1)	Generally minimum of 2 for type A and B ships
Boundary cooling	As alternative to insulation
Structural integrity (Ch VI, Reg. 2, Para. 1)	Multiple redundant conventional ships structure, multiple decks, bulkheads and shell with no single point of failure Steel, composite or aluminium construction Structural fire protection time: 60 minutes for steel ships For ships not constructed of steel 30 minutes for areas of moderate fire hazard and 60 minutes for areas of significant and major fire hazard.
Fire containment equipment	Insulation doors penetrations prototype tested to FTP Code or national requirements
Control of smoke and toxic products (Ch VI, Reg. 5, Para. 1)	Cables, Paint, deck coverings, veneers, plastic piping, insulation etc. to FTP Code or national requirements.
Prosecution	
Fire extinguishing equipment	Fire main Fixed fire fighting systems for high risk equipment and compartments Time delay for operation of gaseous systems in accordance with FTP Code Accommodation fixed fire fighting system Portable appliances To FSS Code or national requirements
Fire main and pumps (Ch VI, Reg. 9, Para. 16.4.2)	Sized for fire fighting only, no default allowance for non-fire fighting consumers or fixed boundary cooling.
Fire hoses (Ch VI, Reg 9, Para. 18)	At least 2 hoses per compartment
Control of flooding	Not addressed by Chapter VI, WT Integrity addressed in Ch III, De watering in Ch IV
Restore access and structure	No provision
Search and rescue	No provision
Damage control equipment	No provision
Re entry (Ch VI, Reg. 8, Para. 34.6)	Limited, water wall capability for hose nozzles.

	Recovery (Ch VI, Reg. 10, Paras 1 and 2)	
	Damage extent (Fire)	Single compartment or contiguous group of compartments
	Re configuration and redundancy (Ch VI, Reg. 9, Para. 16)	Fire pump redundancy included Fixed systems with single shot
	Battle damage repair and override	No provision
	Post damage capability	No provision
	Smoke clearance (Ch VI, Reg. 6, Paras. 8-11, Para 14.6)	Machinery space only
	Smoke clearance equipment	Natural Ventilation and forced ventilation system
	External Assistance	
	Safe Areas	Type A and B only
	Shore connection	One (international type)
	Ship to Ship connection	No provision
	Escape and evacuation	
	Escape routes to be protected (Ch VI, Reg. 8, Para. 9)	Limited protection is provided from the default solution unless escape routes are defined.
	Evacuation stations (Ch VI, Reg. 8)	Protection provided for all ships
	LSA equipment stations (Ch VI, Reg. 8)	Protection provided for all ships

Table 7.1: Default Concept of Operations Statement

Concept of Operations Statement Assumptions

7.6 The Default Concept of Operations Statement has been developed for Chapter VI to define the minimum level of safety provided by the fire safety chapter. The primary aim of the default assumptions in the Concept of Operations Statement fire section is to ensure that all users of the code are clear about the level of safety and protection provided by the default solution. The document can be used by the Naval Administration, Owner or Builder to define additional requirements for fire safety in a clear and specific manner.

7.7 The document can be added to the Ships Concept of Operations Statement defined in Chapter I Annex A or exist as a separate document.

7.8 Where the minimum level of safety is enhanced or the assumptions are changed, the solution presented in Chapter VI will need to be reviewed and additional requirements specified, these additional requirements can be added to the Default Concept of Operations Statement and/or ships specification. Some Code cross references are included but an enhancement of the requirement may have consequences for several regulations in Chapter VI.

7.9 The Default Concept of Operations Statement is based on the ship's Concept of Operations Statement in Chapter I Annex A and has some common elements which define what has been assumed when the solution for Ch VI was written. E.g. Cargoes of a certain type, operating environment. The content has been formulated to take account of the recoverability characteristics and pillars presented in ANEP 43 *Ship Combat Survivability, Edition 2* from which additional requirements may be derived.

CARGO/PAYLOAD

7.10 Operation of UAV, UUV and USV is to be addressed in a future update to the code.

OPERATING ACTIVITIES

7.11 CBRN aspects are to be addressed in a future update to the code

7.12 Aircraft refuelling is covered by national standards and relevant STANAGs: STANAG 3632 *Aircraft and Ground Support Equipment Electrical Connections for Static Grounding, Edition 5,* STANAG, 3681 *Criteria for Pressure Fuelling /Defuelling of Aircraft, Edition 3* and STANAG 3756 *Facilities and Equipment for Receipt and Delivery of Aviation Kerosene and Diesel Fuels, Edition 4.*.

AREA OF OPERATION

7.13 World wide operation is assumed for ship types B and C as the fire fighting requirements are enhanced above basic HSC code requirements.

CONTAINMENT

7.14 Control of smoke and toxic products, a limited range of products require approval to FTP code through the marine equipment directive, MED. Navies may have additional national requirements.

PROSECUTION

7.15 Fire extinguishing equipment requires certification to the FTP code through the marine equipment directive, MED. Navies may have additional national requirements.

EXTERNAL ASSISTANCE

7.16 Ship to ship connection STANAG 1169 *Firefighting Equipment and Principles for Harmonization of Present and Future Equipment and Materials, Edition 1* can be specified.

Baseline standard cross-reference for Chapter VI Fire Safety

7.17 The basis of each of the requirements outlined in this chapter for each Ship Type is shown in the following table (Table 7.2).

Functional Objective	Applicability to Ship Type	Code/Rules Baseline
Structural integrity	Type A Type B	SOLAS
	Type C	Steel or equiv – SOLAS Aluminium or Fibre Reinforced Plastic – Adapted HSC
Fire growth potential	Type A Type B	SOLAS
	Type C	Adapted HSC
Smoke generation and toxicity	Type A Type B	SOLAS
	Type C	Adapted HSC
Control of smoke spread	Type A Type B	Risk based method with SOLAS basis
	Type C	Risk based method with SOLAS basis
Containment of fire	Type A	Risk based method based on SOLAS Passenger ship with more than 36 passengers
	Type B	Risk based method based on SOLAS Passenger ship with not more than 36 passengers
	Type C	Risk based method based on SOLAS Cargo ship method IC
Risk of ignition	Type A	SOLAS Passenger ship
	Type B and Type C	SOLAS Cargo Ship
Detection and alarm	Type A	SOLAS Passenger ship with more than 36 passengers
	Type B	SOLAS Passenger ship with not more than 36 passengers
	Type C	SOLAS Cargo ship method IC Aluminium or Fibre Reinforced Plastic – Adapted HSC
Fire fighting	Type A	SOLAS Passenger ship with more than 36 passengers
	Type B	SOLAS Passenger ship with not more than 36 passengers
	Type C	SOLAS Cargo ship method IC Aluminium or Fibre Reinforced Plastic – Adapted HSC
Maintain capability	All Ship Types	SOLAS
Operational Info	All Ship Types	SOLAS
Special Requirements	All Ship Types	SOLAS
Low Flash Point Fuels in Bulk	All Ship Types	Large Commercial Yacht Code

Table 7.2: Code/Rule Baseline for each Ship Type against each Functional Objective

7.18 When defining a Tier 4 Solution for the Naval Ship Code Tier 3 performance requirements, there are three options for a Naval Ship:

7.18.1 Statutory: Safety of life at sea and protection of the environment are paramount.

7.18.2 Simple Naval: Offers a level of safety to which embarked persons are exposed that is no less than the level of safety to which persons embarked on a merchant ship are exposed. It is based upon foreseeable operations on which a naval ship is or may be engaged and intact, degraded, aged and/or damaged state scenarios that would be considered if that ship were regulated under international conventions or regulations applicable to merchant shipping. These foreseeable operations exclude extreme threat conditions.

7.18.3 Complex Naval: The safety of the Naval ship and embarked personnel may be secondary to the safety of those under the protection of the Naval ship. The ship could foreseeably experience abnormal operating conditions resulting from the deliberate exposure of a naval ship to extreme hostile acts deliberately created by other persons.

7.18.4 For each of these, the number of people on board will affect the Tier 4 Solution applied in accordance with the following table (Table 7.3)

Complement **ConOps Basis**	**Type A** **n>240**	**Type B** **60>n<240**	**Type C** **N<60**
Statutory	Use SOLAS/HSC/SPS Code (more than 36 passengers)	Use SOLAS/HSC/SPS Code (more than 36 passengers)	Use SOLAS/HSC/SPS Code (Less than 12 passengers)
Simple Naval (Constabulary Duties)	Use NSC Tier 4 Solution (n>240)	Use NSC Tier 4 Solution (60>n<240)	Use NSC Tier 4 Solution (n<60)
Complex Naval (National Defence)	For complex naval ships, the Naval Administration will advise on the applicability of the Tier 4 solution and may require an enhancement of some of the Solutions in this chapter		

Table 7.3: Code/Rule Baseline for Tier 4 Solutions

7.18.5 The following table is included to assist in the identification of the source of much of the Naval Ship Code Chapter VI regulation text.

NSC Regulation	NSC Paragraph	Reference Doc / Comment	Ref Doc Paragraph
Regulation 0 Goal			
Regulation 1 General	Definitions Table, Enclosed Space	International Tonnage Convention 1969	Reg 2 (4)
	Definitions Table, Safe area	IMO Resolution	MSC.216(82)
	Definitions Table, Steel or other equivalent material	FTP Annex1	Pt. 11 MSC.45(65)
	Definitions Table, Structural Fire Protection Time (SFP)	2000 HSC Code	Reg. 7.4.1.3
Regulation 2 Structural Integrity	2-6	Developed from SOLAS	Ch II-2 Reg. 11 HSC Ch3 modified
	8	SOLAS	Ch. II-2 Reg. 11.2 Modified

NSC Regulation	NSC Paragraph	Reference Doc / Comment	Ref Doc Paragraph
		2000 HSC Code	Reg. 7.4.1.3
	9	BS476	Pt. 20-22
	12	2000 HSC Code	Reg. 7.4.2.1
	13	RINA	c4,7,2.1.1c2
	15	RINA SOLAS MCA	C4,7,1.1.1 ChII-2 Reg.11.3. Modified to cover Aluminium and GRP. Yacht Code Min of 20mm A Class Insulation
	22, first sentence	SOLAS	Ch. II-2 Reg. 11.5
	23	SOLAS	Ch. II-2 Reg. 11.4.2 modified
	24	Naval Ship Specific	
Regulation 3 Risk of Ignition	2-5	SOLAS	Ch II-2 Reg. 4 modified
	3.0	Naval Ship specific, addresses SG6 Action 8	
	7	SOLAS	Ch. II-2 Reg. 4.2.1
	7.4	Adapted 2000 HSC Code	
	7.5	Naval Ship Specific	
	12	SOLAS	Ch. II-2 Reg. 4.2.2.3.3
	13	SOLAS	Ch. II-2 Reg. 4.2.2.3.4
	15	SOLAS Modified	Ch. II-2 Reg. 4 para 2.2.3.5.1
	17	SOLAS	Ch. II-2 Reg. 4.2.2.3.2
	19	SOLAS	Ch. II-2 Reg. 4.2.2.4
	20	SOLAS	Ch. II-2 Reg. 4.2.2.5
	25	Naval Ship specific	
	27, 28	SOLAS	Ch. II-2 Reg. 4.2.2.6
	29, 30	SOLAS	Ch II-2 Reg. 4.2.3
	31	SOLAS modified	Ch. II-2 Reg. 4.2.4
	32	SOLAS	Ch. II-2 Reg. 4.2.5
	33	SOLAS	Ch. II-2 Reg. 4.3
	34-37.1	SOLAS	Ch. II-2 Reg. 4.4
	38-39	Naval Ship specific	
Regulation 4 Fire Growth Potential	2	SOLAS	SOLAS II-2 Reg. 5
	7-11.1	SOLAS	Ch. II-2 Reg. 5.2.2

NSC Regulation	NSC Paragraph	Reference Doc / Comment	Ref Doc Paragraph
	12	SOLAS	Ch. II-2 Reg. 5.2.3
	13.1	SOLAS	Ch. II-2 Reg. 5.3.1.1
	13.1	2000 HSC Code	Ch. 7 Reg. 7.4.3
	13.2	Naval Ship specific	
	Note after para 14.1.1	Naval Ship specific	
	14.2	SOLAS	Ch. II-2 Reg. 5.3.1.2 modified
	14.2	2000 HSC Code	Ch. 7 Reg. 7.4.3.1
	15-18	SOLAS	Ch. II-2 Reg. 5.3.2
	17.1	SOLAS Modified	Ch. II-2 Reg. 5.3.2.3 IMO MSC/Circ.1003
	18.1	SOLAS	Ch. II-2 Reg. 5.3.2.4
	19	SOLAS	Ch. II-2 Reg. 5.3.3
	20	Naval Ship Specific	
	21	Naval Ship Specific	
	22-24	Naval Ship Specific	
Regulation 5 Smoke Generation and Toxicity	2	Developed from SOLAS & HSC	Ch II-2 Reg. 6 modified, HSC Ch. 7 7.4.3.6
	7	SOLAS Ch. II-2 Reg. 6.2	Ch. II-2 Reg. 6.2
	8	SOLAS	Ch. II-2 Reg. 6.3
	9.1	Naval Ship specific	
	11	Def Stan	02-165 (obsolete)
	12	Def Stan	02-165 (obsolete)
	13	Naval Ship specific	
Regulation 6 Control of Smoke Spread	2, 3, 4	Developed from SOLAS	Ch II-2 Reg. 8 modified
	7	SOLAS	Ch. II-2 Reg. 8 2
	8-11	SOLAS	Ch. II-2 Reg. 8 3
	12	SOLAS	Ch. II-2 Reg. 8 4
	14.1	From extended HSC code	
Regulation 7 Detection and Alarm	2-6	SOLAS	Ch II-2 Reg. 7
	8-10	SOLAS	Ch II-2 Reg. 7.2
	12	Naval Ship specific	
	13	SOLAS	Ch. II-2 Reg. 7.4.1
	14	Naval Ship specific	
	15-17	SOLAS	Ch. II-2 Reg. 7.4.2

NSC Regulation	NSC Paragraph	Reference Doc / Comment	Ref Doc Paragraph
	18-20	SOLAS	Ch. II-2 Reg. 7.5
	22	SOLAS	Ch. II-2 Reg. 7.6
	23-24	SOLAS	Ch. II-2 Reg. 7.7
	25-27	SOLAS	Ch. II-2 Reg. 7.8
	28-33	SOLAS	Ch. II-2 Reg. 7.9
	34.1	SOLAS	Ch. II-2 Reg. 7.9.3
	36	FSS Code	Ch. 9 Reg. 2.2 modified
	37.2	FSS Code	Ch. 9 Reg. 2.4.1.2 modified
	37.3	Naval Ship specific	
	37.4	FSS Code	Ch. 9 Reg. 2.4.1.3
	37.5	FSS Code	Ch. 9 Reg. 2.4.1.3 modified
	37.6	FSS Code	Ch. 9 Reg. 2.4.2.2
	37.7	Naval Ship specific	
	37.8	FSS Code	Ch. 9 Reg. 2.5.1.3
	37.9	Naval Ship specific	
	37.10	Naval Ship specific	
	38	Naval Ship specific	
	39	Adapted HSC	Ch 7 7.7
	42-49	Naval Ship specific	
Regulation 8 Containment of Fire	2, 3	SOLAS	Ch II-2 Reg. 9
	5	SOLAS	Ch II-2 Reg. 9.2.2.1
	6	SOLAS	Ch. II-2 Reg. 9.2.2.2
	7.1	SOLAS	Ch. II-2 Reg. 9.2.2.3
	7.3.2 (1)	SOLAS	Ch. II-2 Reg. 9.2.2.3.2.2 (1) modified
	7.3.2 (2)	SOLAS	Ch. II-2 Reg. 9.2.2.3.2.2 (2)
	7.3.2 (3)	SOLAS	Ch. II-2 Reg. 9.2.2.3.2.2 (3)
	7.3.2 (4)	SOLAS	Ch. II-2 Reg. 9.2.2.3.2.2 (4) modified
	7.3.2 (5)	SOLAS	Ch. II-2 Reg. 9.2.2.3.2.2 (5)
	7.3.2 (6)	SOLAS	Ch. II-2 Reg. 9.2.2.3.2.2 (6)
	7.3.2 (7)	SOLAS	Ch. II-2 Reg.

NSC Regulation	NSC Paragraph	Reference Doc / Comment	Ref Doc Paragraph
			9.2.2.3.2.2 (7) and (8)
	7.3.2 (8)	SOLAS	Ch. II-2 Reg. 9.2.2.3.2.2 (9)
	7.3.2 (9)	SOLAS	Ch. II-2 Reg. 9.2.2.3.2.2 (10)
	7.3.2 (10)	SOLAS	Ch. II-2 Reg. 9.2.2.3.2.2 (11)
	7.3.2 (11)	SOLAS	Ch. II-2 Reg. 9.2.2.3.2.2 (12)
	7.3.2 (11) 'galleys'	SOLAS modified	
	7.3.2 (12)	SOLAS	Ch. II-2 Reg. 9.2.2.3.2.2 (13)
	7.3.2 (13)	SOLAS	Ch. II-2 Reg. 9.2.2.3.2.2 (14)
	7.3.2 (14)	Naval Ship specific	
	7.3.2 (15)	Naval Ship specific	
	8	SOLAS	Ch. II-2 Reg. 9.2.2.5
	Note [a] to Table 8-2	Naval Ship specific	
	Note [a] to Table 8-3	Naval Ship specific	
	10	SOLAS	Ch. II-2 Reg. 9.2.2.3.4
	11.1	SOLAS	Ch. II-2 Reg. 9.2.2.1.1.2
	12	SOLAS	Ch. II-2 Reg. 9.2.3.2 IC modified
	13	SOLAS	Ch. II-2 Reg. 9.2.3.3
	13.3.2 (1)	SOLAS	Ch. II-2 Reg. 9.2.3.3.2.2 (1) modified
	13.3.2 (10)	SOLAS	Ch. II-2 Reg. 9.2.3.3.2 (11) modified
	13.3.2 (11)	Naval Ship specific	
	Note [a] to tables 8-5 and 8-6	Naval Ship specific	
	15	SOLAS	Ch. II-2 Reg. 9.2.2.5
	16	SOLAS	Ch. II-2 Reg. 9.2.3.4
	17	2000 HSC Code	Ch. 7 Reg. 7.4.1
	19	2000 HSC Code	Ch. 7 Reg. 7.4.2
	Table 8-7	2000 HSC Code	Ch. 7 Reg. 7.4, Table 7.4-2
	24-27	SOLAS	Ch. II-2 Reg. 9.3
	28	2000 HSC Code requirement	

NSC Regulation	NSC Paragraph	Reference Doc / Comment	Ref Doc Paragraph
	29.1	SOLAS ChII-2 reg 9 para 4.1.1.1	
	29.2	HSC 7.4.2.6 SOLAS Reg 9 para 4.1.1.2 Passenger 4.2.1 cargo HSC 7.4.2.6	Naval administration requirements for water and gas tight integrity or door operation following fire recognised in guidance note. For a Naval Ship all A class fire divisions are to be smoke tight, the FTP test does not explicitly require this to be the case. Suitable smoke tight standards include ISO 5925/1 (1981) NFPA 105 (2007) UBC 7-2/2 (1997) DIN 18095/2 (1991) BS 476-31.1 (1983) EN 1634/2 (2001)
	29.3	SOLAS Reg 9 para 4.1.1.2 Passenger 4.2.1 cargo	Changed to make applicable to hatches throughout. Passage of smoke and flame deleted door to be the same as the boundary. Gap for sill deleted to reflect Naval requirement for A class Doors to be smoke tight Guidance note added to reflect SOLAS relaxation for large WT steel doors
	29.4	SOLAS Reg 9 para 4.1.2.1 Passenger	Cargo ship requirements applied specifically to cabins, public spaces and B divisions in office pantries, lockers and store rooms, distinction deleted now applied to all B class divisions
	29.5	SOLAS Reg 9 para 4.1.16 and 4.1.2.1Pass	Combined and now applied to all ships. Restriction applied for windows on RoRo and Flight decks
	29.6	SOLAS Reg 9 para 4.1.2.3 Passenger 4.2.1 Cargo	
	29.7	SOLAS Reg 9 para 4.1.2.3 Passenger HSC 7.9.3.2	Now applied to cargo ships.
	29.8		Additional requirement

NSC Regulation	NSC Paragraph	Reference Doc / Comment	Ref Doc Paragraph
			identified by WG.
	30.1		Additional requirement identified by WG as SOLAS does not specifically address these types of door Guidance note added to allow fire resistant doors rather then full A60 where there is a conflict with watertight integrity requirements. SOLAS Reg 9 para 4.1.1.2 and HSC 7.4.6.2 allowance for WT doors not to be insulated deleted
	30.2	SOLAS Reg 9 para 4.1.1.4.1 Passenger HSC 7.9.3.3.1	Now applied to cargo ship Doors.
	30.3	SOLAS Reg 9 para 4.1.2.2 Passenger 4.2.2 Cargo SOLAS Reg 9 para 5.2.3 SOLAS Reg 9 para 4.1.2.3 Passenger	local release and reset requirements Now applied to cargo ships
	30.4		Naval requirement to use hold backs for cabins though use and operating procedure to be agreed with naval administration.
	30.5	SOLAS Reg 9 para 5.2.5 Passenger	emergency escape requirements applied to all ships
	30.6		Additional requirement identified by WG
	30.7	SOLAS Reg 9 para 4.1.1.4 Passenger	relevant part now applied to all ships
	31.1	SOLAS Reg 9 para 4.1.1.4 Passenger	Now applied to cargo ship powered doors too. SOLAS exempts powered WT doors and doors normally locked from the requirements. This has been deleted. Para 36.1.5 DNV 5.14.11B400 requirements covered para 36.1.11 Cross reference removed. Guidance note added to reflect SOLAS

NSC Regulation	NSC Paragraph	Reference Doc / Comment	Ref Doc Paragraph
			relaxation for large WT steel doors
	32.1	SOLAS Reg 9 para 5.1.1, 4.2.1 All	Part of SOLAS Reg 9 para 5.2.5 Passenger Extracted requirements for machinery space boundaries.
	32.2	SOLAS Reg para 9 6.4	Now applied to all ships
	32.3	SOLAS Reg 9 para 5.2.1	
	32.4	SOLAS Reg 9 para 5.2.2	
	32.5	SOLAS Reg 9 para 5.2.6	modified to allow view ports in Machinery space boundaries
	32.6		View ports to be tested noting naval requirements for blast and shock
	33.1	SOLAS Reg 9 para 4.1.3.1	Now applied to all ships
	33.2	SOLAS Reg 9 para 4.1.3.1	Now applied to all ships
	33.3	SOLAS Reg 9 para 4.1.3.1	Now applied to all ships
	34.1	SOLAS Reg 9 para 4.1.1.4 Passenger	
	34.2	SOLAS Reg 9 para 4.1.2.2 Passenger	
	34.3	SOLAS Reg 9 para 5.2.4 Passenger	Modified to cover only release
	34.4	SOLAS Reg 9 para 4.1.1.5 Passenger	
	34.5	SOLAS Reg 9 para 4.1.1.7 Passenger	Removed reasonably gas tight. Guidance note added to indicate that naval administration needs to agree requirement for hose ports and bulkhead through connectors currently applied to passenger type ships only
	34.6		Addition at the request of WG members, currently applied to passenger type ships only.
	34.7	SOLAS Reg 9 para 5.2.2	DNV 5.14.11B400 requirements covered

NSC Regulation	NSC Paragraph	Reference Doc / Comment	Ref Doc Paragraph
		Passenger	
	36	SOLAS	Ch. II-2 Reg. 9.7.1
	37	SOLAS	Ch. II-2 Reg. 9.7.2
	38	SOLAS	Ch. II-2 Reg. 9.7.3
	39-44	SOLAS	Ch. II-2 Reg. 9.7.4
	44	SOLAS Reg 9 para 7.4.6 Passenger	
	45	SOLAS	Ch. II-2 Reg. 9.7.5.1
	47	SOLAS	MSC.216(82)
	48	SOLAS	Ch. II-2 Reg.9 4.1.8 Pass
	49	SOLAS	Ch. II-2 Reg. 9.7.5.2
	60-62	Naval Ship specific	
Regulation 9 Fire Fighting	3,4,6-8	Developed from SOLAS	Ch II-2 Reg. 10 modified
	13	SOLAS	Ch. II-2 Reg. 10.2
	14	Naval Ship Specific	WG12Ch06-01
	15.1	SOLAS	Ch. II-2 Reg. 10.2.1.1 modified
	15.2.1	SOLAS	Ch. II-2 Reg. 10.2.1.3 modified
	15.2.2.1	DNV Rules for Ships/High Speed, Light Craft and Naval Surface Craft	Pt. 5 Ch. 14 Sec. 11 F101
	15.3	SOLAS	Ch. II-2 Reg. 10.2.1.4
	15.3.3	Naval Ship specific	
	15.4	SOLAS	Ch. II-2 Reg. 10.2.1.5 modified
	15.4.2	DNV Rules for Ships/High Speed, Light Craft and Naval Surface Craft	Pt. 5 Ch. 14 Sec. 11 F104
	15.5.1	SOLAS	Ch. II-2 Reg. 10.2.1.6
	15.6	SOLAS	Ch. II-2 Reg. 10.2.1.7
	16.1.1	SOLAS	Ch. II-2 Reg. 10.2.2.1
	16.2.1	SOLAS	Ch. II-2 Reg. 10.2.2.2 modified
	16.2.2	2000 HSC Code	Reg. 7.7.5.1
	16.3	SOLAS	Ch. II-2 Reg. 10.2.2.3.1
	16.3.1	SOLAS French	Ch. II-2/10
	16.3.3	SOLAS	Ch. II-2 Reg.

NSC Regulation	NSC Paragraph	Reference Doc / Comment	Ref Doc Paragraph
			10.2.2.3.3
	16.4	SOLAS Modified	Ch. II-2 Reg. 10.2.2.4.1.1
	16.4.2	Naval Ship specific to replace SOLAS II-2 10.2.2.4.1.2	
	16.5	SOLAS	Ch. II-2 Reg. 10.2.2.3.2.1
	16.5	SOLAS	Ch. II-2 Reg. 10.2.2.3.2.2
	16.5.3	SOLAS	Ch. II-2 Reg. 10.2.2.3.2.3
	17.1	SOLAS	Ch. II-2 Reg. 10.2.3.1.1
	17.2	SOLAS	Ch. II-2 Reg. 10.2.3.1.2
	18	SOLAS	Ch. II-2 Reg. 10.2.3.2 modified
	19	SOLAS	Ch. II-2 Reg. 10.2.3.3 modified
	19.1.1.4	SOLAS	Ch. II-2 Reg. 10.2.3.3.4
	21.2	SOLAS	Ch. II-2 Reg. 10.3.1 modified
	22	SOLAS	Ch. II-2 Reg. 10.3.2 modified
	23	SOLAS HSC	Ch. II-2 Reg. 10.3.3 modified HSC Ch 7 para 7.7.7
	24	SOLAS	Ch. II-2 Reg. 10.4 modified
	24.7 & 26.2	DNV Rules for Ships/High Speed, Light Craft and Naval Surface Craft	Pt. 5 Ch. 14 Sec. 11 G104
	25.1	SOLAS	Ch. II-2 Reg. 10.4.2 modified
	26.1	SOLAS	Ch. II-2 Reg. 10.4.4
	27	Developed from 2000 HSC code & MCS.44(65)	HSC 7.13 & 7.16
	28	SOLAS	Ch, II-2 Reg. 10.5.6
	29.1.1	SOLAS	Ch. II-2 Reg. 10.5.1.1
	29.2.1	SOLAS	Ch. II-2 Reg. 10.5.1.2.1
	29.2.2	SOLAS	Ch. II-2 Reg. 10.5.1.2.2
	30.1.1	SOLAS	Ch. II-2 Reg. 10.5.2.1

NSC Regulation	NSC Paragraph	Reference Doc / Comment	Ref Doc Paragraph
	30.2	SOLAS	Ch. II-2 Reg. 10.5.2.2
	31.1	SOLAS	Ch. II-2 Reg. 10.5.3.1
	31.2	SOLAS	Ch. II-2 Reg. 10.5.3.2
	33.1	SOLAS	Ch. II-2 Reg. 10.5.4 modified
	34.3.1	DNV Rules for Ships/High Speed, Light Craft and Naval Surface Craft	Pt. 5 Ch. 14 Sec. 11 G101
	34.3.3	DNV Rules for Ships/High Speed, Light Craft and Naval Surface Craft	Pt. 5 Ch. 14 Sec. 11 G103
	35	SOLAS	Ch. II-2 Reg. 10.6.3
	35.5	DNV Rules for Ships/High Speed, Light Craft and Naval Surface Craft	Pt. 5 Ch. 14 Sec. 11 E203
	35.6	DNV Rules for Ships/High Speed, Light Craft and Naval Surface Craft	Pt. 5 Ch. 14 Sec. 11 E204
	36	SOLAS	Ch. II-2 Reg. 10.6.4
	37.1.1	SOLAS	Ch. II-2 Reg. 10.7.1.1
	37.3.1	SOLAS	Ch. II-2 Reg. 10.7.2
	39	Adapted HSC	Ch 7 7.7
	39.1	DNV Rules for Ships/High Speed, Light Craft and Naval Surface Craft	Pt. 5 Ch. 14 Sec. 11 E207
	40-44	SOLAS	Ch. II-2 Reg. 10.10 modified
	41	DNV Rules for Ships/High Speed, Light Craft and Naval Surface Craft	Pt. 5 Ch. 14 Sec. 11 H105
	42.1	DNV Rules for Ships/High Speed, Light Craft and Naval Surface Craft	Pt. 5 Ch. 14 Sec. 11 H104
	42.2	DNV Rules for Ships/High Speed, Light Craft and Naval Surface Craft	Pt. 5 Ch. 14 Sec. 11 H106
	43.2.1	DNV Rules for Ships/High Speed, Light Craft and Naval Surface Craft	Pt. 5 Ch. 14 Sec. 11 H102
	44.5	DNV Rules for Ships/High Speed, Light Craft and Naval Surface Craft	Pt. 5 Ch. 14 Sec. 11 H103
	46	Naval Ship specific	
	49-51	Naval Ship specific	
Regulation 10 Maintain Capability	2, 3	Developed from SOLAS	IMO Res. MSC.216(82) Ch.II-2

NSC Regulation	NSC Paragraph	Reference Doc / Comment	Ref Doc Paragraph
			Reg. 21 modified
	8-11	ISO Resolution	MSC.216(82) Reg. 21
	12-13	IMO Resolution	MSC.216(82) Reg. 22
	17-20	Naval Ship specific	
Regulation 12 Provision of Operational Information	2, 3, 4	Developed from SOLAS	Ch.II-2 Reg. 14 and 15 modified
	6	SOLAS Ch. II-2 Reg. 14	Ch. II-2 Reg. 14
	8.3	SOLAS Reg. 14.3 is covered by items 8.3.12 to 8.3.14	
		SOLAS Reg. 14.4 for tankers covered by items 8.3.6 to 8.3.8.	
	9-11	SOLAS	Ch. II-2 Reg. 15
	11.1.1	SOLAS	Ch. II-2 Reg. 15.3 and III Reg. 30
	12-14	SOLAS	Ch. II-2 Reg. 16 modified
	14	SOLAS	Ch. II-2 Reg. 16.3
Regulation 13 Special Requirements	2-6	Developed from SOLAS	Ch.II-2 Reg. 19 and 20 modified
	8-10	SOLAS	Ch. II-2 Reg. 19
	10.1	SOLAS	Ch. II-2 Reg. 19.4 modified
	11-16	SOLAS	Ch. II-2 Reg. 20
	13.1.4.2	SOLAS	Ch. II-2 Reg. 20 3.1.4.2
	13.6	SOLAS	Ch. II-2 Reg. 19.3.10
	14.1.2	Naval Ship Specific	
	16.1.4.1.5, second sentence	Replaces bilge pump requirements in SOLAS II-1 Reg. 21	
	16.1.4.2.1	SOLAS	Ch. II-1 Reg. 22
	17-24	SOLAS modified	Ch. II-2 Reg. 18
	24.4	Naval Ship Specific	
	27-49	SPS Code - Code of Safety for Special Purpose Ships Resolution	A.534(13) Ch. 7 – Explosives Stowage
	52-55	Naval Ship specific	

NSC Regulation	NSC Paragraph	Reference Doc / Comment	Ref Doc Paragraph
Regulation 14 Carriage of Low Flash Point Fuels in Bulk		Large Commercial Yacht Code	Para 14.1.4 modified
	18-21	Naval Ship specific	

Table 7.4: Baseline Standard for Chapter VI Fire Safety

General Guidance

GUIDANCE ON DETECTORS

7.19 Tables 10.5 and 10.6 provide guidance on the detector types and locations that should be considered when selecting equipment for fire detection.

Ship Type **Room**	**A** **Detector Type**	**B** **More than 50 non-crew** **Detector Type**	**B** **Less than 50 non-crew** **Detector Type**	**C** **Detector Type**
Machinery space **+ when there are flammable liquids**	s + f	s + f	s + f	s + f
Central control station	s	s	s	s
Control stations	s	s	s	s
Accommodation spaces	s	s	s	s
Service spaces	s	s	s as HSC	s as HSC
Drying rooms and laundries.	s	s	s	s
Galleys	h + f (variable set)	h + f (variable set)	h + f (variable set)	h + f (variable set)
Corridors, stairways and escape routes within accommodation spaces	s	s	s	s
Totally enclosed emergency escape trunks	s	s	s	not applicable
Cables tunnels and Technical passageway	s	s	not applicable	not applicable
Store-rooms, workshops, **pantries, etc.**	s	s	s	s
Rooms containing section switchboards greater than 800kw or for essential services	s	s	s	s
Magazine	x	x	x	x

Ammunition spaces	x	x	x	x
Closed vehicle spaces, closed ro–ro spaces and special category spaces	x	x	x	not applicable

Note:
s : smoke detector
f : flame detector
h : heat detector
x : as requested by the Naval Administration

Table 7.5: Detector type for Ship Types A, B and C

Room	**Detector type**
Machinery space **+ when there is** **Fuel oil or flammable hydraulic fluids**	s + f
Special category spaces	x
Central control station	
Control stations	
Accommodation spaces	s
Service spaces	s as HSC
Drying rooms and laundries.	s
Galleys	h +f (variable set)
Corridors, stairways and escape routes within accommodation spaces	NC
Totally enclosed emergency escape trunks	NC
Cables tunnels and Technical passageway	NC
Store-rooms, workshops, **Pantries, etc.**	s
Rooms containing section switchboards	s
Magazine	x
Ammunition spaces	x

Note:
s : smoke detector
f : flame detector
h : heat detector
x : as requested by the Naval Administration

Table 7.6: Detector type for Ship Type D

GUIDANCE ON PENETRATION SYSTEMS

7.20 Passing an A60 test does not automatically mean a penetration is safe to be installed in A0 without any additional insulation. This is due to the additional conducted and radiated heat on the non fire side if there is no insulation on bulkhead or cables & pipes penetrating. A certificated drawing should be provided detailing tested arrangement for A0.

GUIDANCE ON THERMAL AND STRUCTURAL BOUNDARIES FOR TYPE A, B, C AND D SHIPS

7.21 The aim of omitting the SOLAS exception for category 5, 8 or 9 spaces (sanitary spaces etc.) within the regulations concerning thermal and structural boundaries (Chapter VI, Reg. 8, Para. 5-10 for Type A ships / Chapter VI, Reg. 8, Para. 11-14 for type B, C and D ships) is to maintain the integrity of the main vertical fire zones and is not intended to deal with effects of military attack.

GUIDANCE ON THE DEFINITION "OPEN DECK SPACE"

7.22 Reference is made to the definition "open deck space" (see Chapter VI Reg. 1) and the use of "open deck space" within Chapter VI (Chapter VI Reg. 8 and 13). An open deck space is a specific definition relating to Chapter VI because it refers to whether a space is internal or external to the ship, based on the extent to which it is enclosed. This is different from a weather or exposed deck which could be enclosed on 5 sides.

GUIDANCE ON THE FIRE DETECTION AND ALARM FOR HV SPACES

7.23 Reference Chapter VI Reg. 7 Para. 13 (Protection of Machinery Spaces) – it is not a requirement of the Code that a fixed fire detection and fire alarm system be fitted for HV spaces. HV spaces do not contain machinery that is operated locally (e.g. switchboards, transformers). The fire risk in such spaces is lower than spaces with flammable fuel. This requirement is to be considered as a minimum, the Naval Administration may consider HV spaces as high fire risk spaces, based on the Concept of Operations Statement (survivability).

Guidance on Application of Alternative arrangements

INTRODUCTION

7.24 The purpose of this guidance is to interpret and simplify the methodology for alternative design as prescribed in NSC Chapter I Regulation 5 (and in IMO MSC/Circ.1002). The objective is to produce guidelines that can be applied in relation to both reporting and inspecting projects that utilise alternative design methodology.

7.25 IMO MSC/Circ.1002 describes general prerequisites surrounding alternative design, and also defines a number of fire engineering terms. The most important points in IMO MSC/Circ.1002 are summarised below:

7.25.1 A project team shall be established, with participants who have specific tasks/skills.

7.25.2 Sections of regulations that are of interest for alternative design shall be identified.

7.25.3 Fire risks, fire load and design fire scenarios shall be established.

7.25.4 A qualitative, preliminary analysis shall be conducted.

7.25.5 A preliminary analysis report shall be compiled.

7.25.6 A quantitative analysis shall be conducted.

7.25.7 The analysis work shall be recorded in a final report.

7.26 The guidelines for assessment of alternative designs are presented below. The presentation below is in the chronological sequence that is appropriate for implementation. If appropriate, some parts can be executed in parallel.

COMPOSITION OF THE PROJECT ORGANISATION

7.27 A project team should be assembled with all the appropriate disciplines. As a minimum, the project organisation shall have the following representation:

7.27.1 Project manager with overall expertise with respect to ship design.

7.27.2 A specialist in fire prevention (fire protection engineer or equivalent).

7.27.3 Specialist/s with respect to ship systems (electrics, hydraulics, operation, battle capability, etc.)

7.27.4 Representative of the purchaser, familiar with requirement scenario.

7.27.5 Representative of the users, familiar with organisational prerequisites (crew etc).

7.27.6 Representative of the Naval Administration.

THE PROJECT ORGANISATION'S ROLES

7.28 The expert in fire prevention is usually the best person for co-ordinating the project. The fire prevention expert would draw up the technical and organisational design prerequisites for the analysis together with the project manager, specialists within ship systems and the crew's organisation.

7.29 A preliminary analysis can normally be implemented without the participation of purchaser, users and project manager. These roles can inspect the results after the preliminary analysis has been conducted and review the final documentation that summarises the analysis work.

PROJECT PLANNING METHOD

7.30 Alternative design assessment can be implemented by means of two fundamentally different methods; absolute analysis and comparative analysis.

7.31 Alternative design with absolute analysis means that the design selected is evaluated in relation to preset criteria in the regulations and associated standards, e.g. a maximum permitted temperature in conjunction with fire.

7.32 Alternative design by means of comparative analysis entails evaluating the design against the performance requirements in relation to a variety of scenarios. Comparative analysis is a more robust and accurate method, as it considers aspects such as operational reliability. For example, the method can take into account the fact that an active system such as sprinklers might have a higher operational reliability than manual extinguishing initiatives. Comparative analysis shall be used when comparing prevention systems with varying reliability.

DEFINITION OF ASSESSMENT METHOD

7.33 The assessment method shall be drawn up and presented as a detailed project plan. The plan should cover the whole of chapter VI and identify with a justification which regulations are and are not affected by the alternative design. It should also set out whether an absolute or comparative analysis is being proposed. Code requirements that are judged irrelevant for fire engineering should be dismissed with a note to that effect.

PRELIMINARY QUALITATIVE ANALYSIS

7.34 The qualitative preliminary analysis is the first stage and is to be drawn up to inform the Naval Administration about the approach being adopted. This is so that any shortcomings or mistakes can be identified before the more resource-intensive analysis or testing commences. The preliminary qualitative analysis shall comprise as a minimum the following elements:

7.34.1 Definition of systems that are subject to analysis with alternative design.

7.34.2 List of regulations and functional objectives that are relevant for analysis. Identification of any applicable Code requirements that are not met by the design.

7.34.3 Review and analysis of Code requirements and functional objectives that are subject to analysis with alternative design. The review should establish whether these functional objectives are aimed at protecting people or property

7.34.4 Specification of what is to be protected from fire incidents, with respect to people and vital components.

7.34.5 Identification of ignition sources/risks and fire load in spaces that are subject to alternative design arrangements. The work should start with an established, systematic qualitative method, e.g. HAZOP. Relevant statistics should be used to determine the level of risk.

7.34.6 Identification and classification of fire risks. Classification shall take place in four categories; small, medium-sized, large and catastrophic fires. Catastrophic fires primarily refer to the fact that the fire has an impact on the surroundings, e.g. quay or berth

7.34.7 Design information for each space that is subject to analysis with alternative design. The compilation shall contain a minimum of room designation, fire separation within the room, fire separation between rooms, ventilation system, automatic and manual extinguishing systems, detection systems, fire load (fittings and fixtures/systems), ignition sources, presence of personnel, presence of systems vital to the vessel.

7.34.8 Where testing is proposed: full details of test method, criteria and test organisations.

7.34.9 For comparative analysis: Production of preliminary event tree with branches for different design fire scenarios and outcomes with respect to function and malfunction in fire fighting organisation, equipment, systems and passive protection.

CONDUCT QUANTITATIVE ANALYSIS

7.35 After the preliminary qualitative analysis has been reviewed and approved by the Naval Administration the quantitative analysis shall be implemented. The quantitative analysis constitutes the most labour-intensive element, as both input data and output data for the analysis shall be quantified and justified. All quantification shall be based on the ship's service life as a whole, and consider all conceivable future changes in design.

7.36 The qualitative analysis shall comprise as a minimum the following elements:

7.36.1 Quantification of functional objectives and performance requirements into measurable requirements. If functional objectives and performance requirements are non-quantifiable, quantification shall be carried out on the basis of an assessment of a similar solution executed in accordance with the performance requirements.

7.36.2 Calculation and estimation of the effects of the fire fighting organisation.

7.36.3 Quantify the fire load density that exists and that also constitutes input data for fire scenarios. Quantify amount and type of interior fittings, furnishings, construction materials and flammable liquids.

7.36.4 Quantify fire scenario and related effects of fire as a time line, where account is taken of the fire fighting organisation and fire prevention systems.

7.36.5 Establish requirements and acceptance criteria for crew and personnel with and without protective equipment and for equipment, systems and structural components. Quantify amount of and establish criteria for visibility, temperature, incident thermal radiation, smoke and toxicity.

7.36.6 Where testing is proposed: full details of test method, test results and applicability to the alternative design and fire scenarios.

7.36.7 For comparative analysis: Quantification of different design fire scenarios and outcomes with respect to function or malfunction in fire fighting organisation, equipment, systems and passive protection. Production of risk graphs and/or average risks that define the relative risk levels of the solutions proposed.

DOCUMENTATION

7.37 As alternative designs can entail substantial departures from Code requirements it is important that the process of alternative design is thoroughly documented. The assessment undertaken for the alternative design shall be scientifically traceable and transparent so that future changes in the design can be easily assessed. The documentation shall be accessible to the Naval Administration, purchaser, maintenance organisation and in a suitable format to the ship operator. The documentation of the alternative design shall as a minimum comprise the following:

7.37.1 Scope and description of the alternative design.

7.37.2 Composition of the project organisation.

7.37.3 Results from work on preliminary qualitative analysis.

7.37.4 Results from work on quantitative analysis.

7.37.5 Reports of engineering assessments covering;

7.37.5.1 sphere of application for calculation models used;

7.37.5.2 models' shortcomings;

7.37.5.3 attendant need for safety margins and/or sensitivity analyses;

7.37.5.4 critical engineering assumptions.

7.37.6 Requirements for tests, inspections and maintenance.

7.37.7 References.

8 GUIDANCE ON NSC CHAPTER VII ESCAPE, EVACUATION AND RESCUE

Overview

8.1 Chapter VII Escape, Evacuation and Rescue (EER) is structured in the following manner: Firstly, general procedures are given, followed by onboard procedures and general systems. Then the EER event stream is reproduced. An overview is shown in the Figure below.

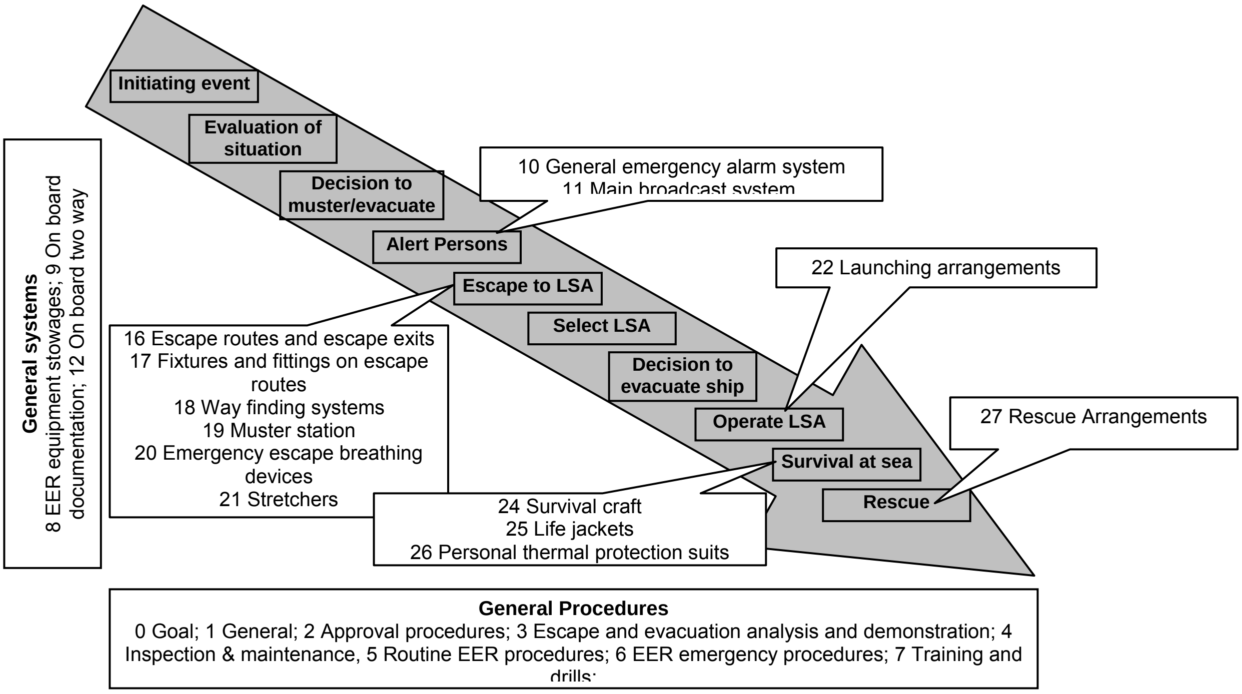

Figure 16: Structure of Chapter VII Escape, Evacuation and Rescue

8.2 In NSC Chapter VII, only the minimum safety requirements are given. It provides adequate safety for peacetime operations, like exercises (including helicopter operations, RAS and the use of own arms), SAR and surveillance of territorial waters. Hazards that come from act of war or terrorism are not incorporated, i.e., shock and vulnerability requirements to safeguard life from such acts are not covered. A clear example is the number of survival craft on board, the NSC covers the only the ‘merchant’ risks (source: HSC-code), whereas vulnerability requirements will most probably lead to a higher capacity of survival craft on board.

8.3 The regulations of NSC Chapter VII are typically applicable to ships engaged in worldwide service, capable of independent operation, having an anticipated number of persons on board which is larger than 50. The Naval Administration might consider to exempt specific small ships, such as tugs, LCU’s, from certain requirements (Refer to Regulation 1, Para 5).

8.4 The requirements of NSC Chapter VII are mainly based on SOLAS cargo vessels, SOLAS passenger vessels and SOLAS HSC, where appropriate. Explicit consideration is given to the assumption that embarked forces, special personnel and passengers are not familiarized with the vessel, and can therefore be considered as passengers (Regulation 18 “Way finding systems”, 19 “Muster Station”). The number of persons on board is often the argument to prefer the SOLAS regulations for passenger vessels, e.g., the number of life buoys provided in Regulation 27 “Rescue Arrangements” and the maximum time to evacuation in Regulation 2 “Approval Procedures”. The number of survival craft has been determined by the High Speed Craft – Code, and is a direct copy of those requirements (Regulation 24 “Survival Craft”).

8.5 Generally, persons on board merchant vessels will be mustered following an emergency. NSC Chapter VII accommodates a different philosophy. After the outbreak of a fire or another damage scenario, persons on board may be required to safeguard the ship's essential safety functions (fire fighting, damage control, power repair, navigation, etc.). Those persons who are not, and most probably will not soon, be requested to participate in such activities, shall be provided with designated muster stations. The escape routes and way finding systems shall lead to any muster or evacuation stations.

8.6 Another philosophy on board merchant vessels is that the safety of the embarked persons is paramount. The decision to remaining on board (safe haven concept) or evacuation is based on the judgment of the Commanding Officer, will decide between the two options based on a risk assessment. The NSC does not provide guidance on the priority between escape and evacuation on the one hand and fire fighting and damage control on the other hand. However, it is stated that a decision support system should be provided to the Commanding Officer (Regulation 6 "EER emergency procedures"). Secondly, the vessel's layout should accommodate the effect of the attained procedures, which can be verified by Regulation 3 "Escape and Evacuation Analysis and Demonstration".

8.7 If the DC & FF has a high priority on board, provision is made in the NSC for three envisaged consequences:

8.7.1 higher probability of having smoke present during escape;

8.7.2 casualties; and

8.7.3 an increased list/trim before evacuation takes place.

8.8 Enhanced requirements with respect to the protection from smoke are given in Regulation 20 "Emergency Escape Breathing Devices". Enhanced requirements with respect to casualties are found in Regulation 21 "Stretchers", as it is considered a foreseeable risk. Enhanced requirements with respect to increased levels of trim/list can be found throughout NSC Chapter VII, but mainly in Regulations 22 "Launching and Embarkation Arrangements" and 24 "Survival craft". Typically, in merchant shipping, EER equipment should be demonstrated to be operable at 10 degrees of trim and 20 degrees of list. This is also the basic requirement of the LSA-Code However, if the damage stability calculations of NSC Chapter III "Buoyancy and stability" show that the anticipated list or trim during foreseeable damage conditions is worse than 10 and 20 degrees respectively, then all necessary equipment should be demonstrated to be operable at the calculated conditions. Compliance with the LSA-Code or having a 'Wheelmark' (Marine Equipment Directive) is not sufficient in these cases.

8.9 Some navies prefer to use the whole upper deck as an evacuation station and this is accepted within the NSC (as long as the evacuation deck is not higher than 6 m or an evacuation system is provided). Refer to Regulation 22 "Launching and Embarkation Arrangements".

8.10 Another preference of some navies is to use small craft on board as survival craft. Examples are landing craft utility (LCU), landing craft vehicle & personnel (LCVP), sea boats and rigid hull inflatable boats (RHIB) etc, that can perform various operational roles including rescue. NSC Chapter VII accepts these craft as survival craft, however to ensure that they are available when required, they would have to be designed, equipped, stowed and ready to be used and launched compliant with the requirements for conventional rescue or survival craft at all times. For example if the landing craft were in use operationally and the ship had to be evacuated, there may not be sufficient survival craft for the persons onboard.

8.11 In merchant shipping it is generally accepted that persons will survive a 4.5 m jump during evacuation. It is considered that the skills of the embarked persons on board naval vessels allow them to jump from 6.0 m. However, if the Naval Administration allows this, both the life jacket and the personal thermal protection suit should be specifically designed to withstand the impact. Sole compliance with the LSA-Code or having a 'Wheelmark' (Marine Equipment Directive) is not sufficient in these cases. Refer to Regulations 25 "Life Jackets" and 26 "Personal Thermal Protection Suits".

8.12 Some risks on board naval vessels are generally not found on board merchant vessels, such as risks associated with the deployment of the vessel's weapons; aircraft operations; and the combination commonly found on board replenishment vessels, i.e., large numbers of persons on board and large quantities of fuel. These risks are covered by regulations throughout NSC Chapter VII.

8.13 Regulation 3 “Escape and Evacuation Analysis and Demonstration” is, amongst other reasons, incorporated to address the risks associated with deriving regulation for a variety of vessel arrangements.

8.14 Regulation 8 “EER Equipment Stowages” gives specific attention to float-free stowages, to prevent that e.g. signature reduction measures might jeopardize availability of survival craft in case the naval vessel sinks.

8.15 Regulation 24 “Survival Craft” introduces the concept of marshalling craft which are used to marshal survival craft. All rescue craft can be used as marshalling craft, but not all marshalling craft can be used as rescue craft because the Code does not require compliance with the LSA Code (and therefore they do not have a full SOLAS rescue boat specification). As most naval ships have more boats onboard than required solely for escape and rescue, boats which are non-compliant as rescue craft can be used to marshal survival craft providing that a sufficient number are retained onboard at all times for use in an emergency.

8.16 Regulation 27 “Rescue Arrangements” covers the concept of the ‘Swimmer of the Watch’ as a method of recovery of a man-overboard which could be the preferred method when the weather is too bad to launch the rescue boat. It gives the command greater flexibility in the recovery of personnel.

Other Issues

8.17 NSC Chapter VII does not include docking, harbour, etc., only voyages at sea are included.

Relations with other chapters:

Chapter	Regulations in Chapter VII	Motivation/comments
II Structure		Although there is a relationship with structural degradation from fire, this is not explicitly mentioned
III Buoyancy, Stability and Controllability	1.5.4, 9.19.3, 9.22, 16.2.4, 16.8.4, 17.2.4, 17.7, 19.8, 19.11.3, 22.2.2, 22.8.2, 22.12.5, 22.12.8, 22.13.2	The vessel’s trim or list influences the effectiveness of the escape and evacuation measures.
IV Engineering Systems	n.a.	Reference is made to NSC Chapter IV.
V NOT USED		
VI Fire Safety	1.5.4, 9.10, 16.6.3, 16.7, 16.8.2, 16.11.1, 16.13.2.1, 19.7, 20.9, 22.9, 24.8	NSC Chapter VII covers escape, which is covered by the SOLAS Chapter II on Fire Safety. NSC Chapter VII does make reference to NSC Chapter VI.
VIII Communications	11, 12, 13	Text from Regulations 11, 12 and 13 was incorporated into Chapter VIII.
IX Navigation	n.a.	
X Dangerous Goods	All	EER arrangements should in normal operating conditions be protected from explosion, fire, or impact from its own weapons.
	1.4.2, 9.2.2, 9.13.2, 19.11.1, 22.2.8	Weapon and sensor system
	(See also relationship with NSC Chapter VI.)	General fire hazards

Comparison between SOLAS and Naval Ship Code

8.18 The following table is included to assist in cross-referencing between IMO SOLAS and Chapter VII of the Naval Ship Code.

SOLAS Chapter and Part	SOLAS Paragraph	NSC Regulation
CHAPTER II-2 PART D		
Notification of crew and passengers	12.1	10.1
	12.1	11.1
	12.2	10.1
	12.3	11.2
Means of escape	13.1	1.2
	13.1.1	16
	13.1.2	5.5.6
	13.1.3	17
	13.1.3	18
	13.1.3	20
	13.1.3	21
	13.2.1	16.4.1
	13.2.2	16.4.4
	13.3.1.1	16
	13.3.1.2	16.5.5
	13.3.1.2	16.4
	13.3.1.3	17.4
	13.3.1.4	n.a.
	13.3.1.5	17.8
	13.3.1.5.1	17.8
	13.3.1.5.2	17.8
	13.3.2.1.1	16.4.3
	13.3.2.1.1	16.6.2
	13.3.2.1.2	16.11.5
	13.3.2.1.2	17.7
	13.3.2.2	16.4.3
	13.3.2.3	16.7
	13.3.2.4.1	15.4.1
	13.3.2.4.1	15.4.2

SOLAS Chapter and Part	SOLAS Paragraph	NSC Regulation
	13.3.2.4.1	16.10.2
	13.3.2.4.1	16.11.1
	13.3.2.4.2	16.11.1
	13.3.2.4.3	n.a.
	13.3.2.4.4	n.a.
	13.3.2.4.5	16.11.5
	13.3.2.4.5	17.7
	13.3.2.4.5	17.13
	13.3.2.4.5	17.14
	13.3.2.4.5	17.15
	13.3.2.5.1	18.8
	13.3.2.5.1	18.7
	13.3.2.5.1	18.13
	13.3.2.5.1	18.4
	13.3.2.5.2	n.a.
	13.3.2.6.1	16.13.1
	13.3.2.6.1	16.8.9
	13.3.2.6.2	n.a.
	13.3.3.1	16.4.1
	13.3.3.2	16.4.5
	13.3.3.3	16.12.1
	13.3.3.4	16.5.4
	13.3.3.5	16.11.5
	13.3.3.5	17.7
	13.3.3.5	17.13
	13.3.3.5	17.14
	13.3.3.5	17.15
	13.3.3.6	16.6
	13.3.4.1	20.2
	13.3.4.2	20
	13.3.4.3	20
	13.3.4.4	20

SOLAS Chapter and Part	SOLAS Paragraph	NSC Regulation
	13.3.4.5	20
	13.4.1.1	16.12.2
	13.4.1.2	16.4.1
	13.4.1.2	17.4
	13.4.1.3	16.5
	13.4.1.4	16.4.1
	13.4.1.4	16.5
	13.4.2.1	16.13.2
	13.4.2.2	16.4.1
	13.4.2.3	16.5
	13.4.3.1	20.6
	13.4.3.1	20.7
	13.4.3.2	20.9
	13.4.3.3	20.4
	13.5.1	16.8.6
	13.5.2	16.11.2
	13.6	16.4.1
	13.7.1.1	16.13.4
	13.7.1.1	18
	13.7.1.1	16.4.1
	13.7.1.2	16.11.3
	13.7.1.2	16.11.4
	13.7.1.3	16.4.1
	13.7.1.4	16.4.5
	13.7.1.5	5.6.1
	13.7.1.5	5.5.7
	13.7.1.5	5.5.6
	13.7.2.1	n.a.
	13.7.2.2	8.8
	13.7.3.1	17.7
	13.7.3.2	16.11.8
Evacuation analysis	13.7.4	3
CHAPTER III		
Application	1	n.a.
Exemptions	2.1	n.a.
	2.2.1	n.a.

SOLAS Chapter and Part	SOLAS Paragraph	NSC Regulation
	2.2.2	n.a.
Definitions	3	Definitions
Evaluation, testing …	4.1	n.a.
	4.2	2.6
	4.3	2.6
	4.4	2.9
	4.5	n.a.
	4.6	2.8
Communications	6.1	n.a.
	6.2.1	ChVIII 8.6
	6.2.1	ChVIII 8.8
	6.2.2	ChVIII 8.6
	6.2.2	ChVIII 8.8
	6.3	ChVIII 9.7
	6.4.1	ChVIII 8.6
	6.4.1	ChVIII 8.8
	6.4.2	ChVIII 7
	6.4.3	10.6
	6.4.4	ChVIII 6.4.7
	6.5.1	ChVIII 7
	6.5.2	ChVIII 7
	6.5.2	ChVIII 7
	6.5.3	ChVIII 7
	6.5.4	ChVIII 7
	6.5.5	ChVIII 7
Personal LSA	7.1.1.1	27.19
	7.1.1.2	27.20
	7.1.2	27.21
	7.1.3	27.22
	7.1.4	27.23
	7.2.1	25.3
	7.2.1.1	n.a.
	7.2.1.2	n.a.
	7.2.1.3	n.a.

SOLAS Chapter and Part	SOLAS Paragraph	NSC Regulation
	7.2.1.4	25.11
	7.2.1.5	n.a.
	7.2.2	25.9
	7.2.2	25.10
	7.2.2	9.8
	7.2.3	25.6
	7.2.4	25.6
	7.3	26
Muster list & Em. instr.	8.1	n.a.
	8.2	8
	8.3	8.7
	8.4	8.8
Operating instr.	9	8.5
Manning of surv. craft & supervision	10.1	n.a.
	10.2	5.5.4
	10.3	5.5.4
	10.4	5.5.4
	10.5	n.a.
	10.6	7.10.5
	10.7	5.5.4
Surv. craft muster & emb. Arr	11.1	24.9
	11.2	19.5
	11.2	19.6
	11.3	19.9
	11.4	15.4
	11.5	15.4
	11.5	18.8
	11.6	22.8.10
	11.7	22.12
	11.7	22.8
	11.8	22.12.4
Launching stations	12	22.8.6
	12	22.10.4
Stowage of survival craft	13.1	9.19
	13.2	9.20.1
	13.3	9.20.2

SOLAS Chapter and Part	SOLAS Paragraph	NSC Regulation
	13.4	9.21
	13.5	9.22
	13.6	9.23
Stowage of rescue boats	14	9.24
Stowage of MES	15.1	22.8.7
	15.2	9.20
	15.3	9.25
	15.4	9.13.1
Surv.craft launching & recovery arr	16.1	22.5
	16.1	22.12.7
	16.1	22.13.1
	16.1	23.13.4
	16.2	22.4.2
	16.3	22.10
	16.4	22.12.3
	16.5	22.8.3
	16.6	22.12.5
	16.7	15.4.3
	16.8	22.8.4
	16.9	22.18.5
	16.10	22.12.2
Resc. boat launching & recovery arr	17.1	22.12.4
	17.2	24.1
	17.3	27.6
	17.4	22.12.4.3
	17.5	27.9
	17.5	22.8.14
Line-throwing appliances	18	27.15
Emergency training and drills (familiarity) (fire drills)	19.1	n.a.
	19.2.1	5.4.3
	19.2.1	5.5.4
	19.2.2	5.5.3
	19.2.3	7.9
	19.2.3	7.6
	19.3.1	7.5

SOLAS Chapter and Part	**SOLAS Paragraph**	**NSC Regulation**
	19.3.2	7.15.1
	19.3.3.1	7.9.5
	19.3.3.2	n.a.
	19.3.3.3	7.15.1
	19.3.3.4	7.15.2
	19.3.3.5	n.a.
	19.3.3.6	7.14.2
	19.3.3.7	7.14.3
	19.3.3.7	7.15.3
	19.3.3.8	7.16
	19.3.3.9	7.10.2
	19.3.4.1	n.a.
	19.3.4.2	n.a.
	19.3.4.3	7.8
	19.4.1	7
	19.4.2.1	7.10.3
	19.4.2.2	7.11.3
	19.4.2.3	7.12.2
	19.4.2.4	n.a.
	19.4.3	7.17.1
	19.5	7.7
Operat. readiness, maint. & insp.	20.1	n.a.
	20.2	5.4
	20.3	4.6
	20.3	4.7
	20.3	4.8
	20.4	4.18
	20.5	4.9
	20.6	4.11.1
	20.7	4.11.2
	20.7	4.10
	20.8.1	4.20
	20.8.2	4.21
	20.8.3	4.22
	20.8.4	4.23
	20.8.5	n.a.

SOLAS Chapter and Part	**SOLAS Paragraph**	**NSC Regulation**
	20.9	4.20
	20.10	9.8
	20.11.1.1	4.16.1
	20.11.1.2	4.24.1
	20.11.1.3	4.24.2
	20.11.2.1	4.17.1
	20.11.2.2	4.25.1
	20.11.2.3	4.25.2
Survival craft and rescue boats	21.1.1	24.6
	21.1.2	24.6
	21.1.3	24.4
	21.1.4	2.4.6
	21.1.5	24.4
	21.2	24.6.4
	21.2	24.12.1
	21.2	24.12.2
	21.2	27.4
	21.3.1	24.12.1
	21.3.2	n.a.
Personal LSA	22.1.1	27.16
	22.1.2	27.22
	22.2	25.9
	22.2	25.10
	22.3.1	25.4
	22.3.2	n.a.
	22.4	26
Surv. craft muster & emb. arr	23.1.1	22.12.2
	23.1.2	22.8.13
	23.2	22.12.4
Stowage of survival craft	24	22.12.6
	24	9.19.1
Muster stations	25.1	19.9
	25.2	19.6
Additional requirements for roro	26.1.1	n.a.
	26.2.1	22.13
	26.2.2	9.15

SOLAS Chapter and Part	**SOLAS Paragraph**	**NSC Regulation**
	26.2.3	24.4.1
	26.2.3	24.4.3
	26.2.4	24.4.1
	26.2.4	24.4.3
	26.2.5	ChVIII 9.4
	26.3	27.4
	26.4	27.14
	26.5.1	25.9
	26.5.1	25.10
	26.5.2	25.4
Information on passengers	27.1	5.4.5
	27.2	n.a.
	27.3	n.a.
	27.4	5.5.5
	27.5	n.a.
Heli landing and pick up areas	28.1	n.a.
	28.2	n.a.
Decision support system for masters	29	6.9
Drills	30.1	n.a.
	30.2	7.11
	30.2	7.9
	30.2	CVI 11.1.1
	31.1.1	24.6
	31.1.2	24.6
	31.1.3	24.6
	31.1.4	24.6
	31.1.5	2.4

SOLAS Chapter and Part	**SOLAS Paragraph**	**NSC Regulation**
	31.1.6	n.a.
	31.1.7	24.13
	31.2	27.4
	31.2	27.7
	31.3	n.a.
	32.1	27.16
	32.1	27.17
	32.2	25.2.5
	32.3	26
	33.1	22.8.13
	33.1	22.12.2
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	33.2	n.a.
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	37.2	n.a.
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	37.8	n.a.

9 GUIDANCE ON NSC CHAPTER VIII COMMUNICATIONS

Background

9.1 Chapter VIII Communications has been developed by a collaboration of two external organisations, under contract to INSA.

9.2 It has been developed on the basis that Chapter VIII should be the focus of all communications requirements in the Code and the Chapter should therefore include Internal communications, Portable communications and External communications. The chapter was renamed Communications (from Radiocommunications) to reflect this wider scope.

9.3 To achieve this new focus, it was agreed that the existing internal and portable communications sections in Chapter VII (Escape, Evacuation and Rescue) should be moved into Chapter VIII and referenced from Chapter VII. Chapter's IV (Engineering Systems) and VI (Fire Safety) were reviewed for references to communications requirements and cross-references added as necessary.

Regulation 0 Goal

CODE REQUIREMENTS		GUIDANCE ONLY
1	The communications equipment shall be designed, installed and maintained so that the ship, while at sea, is capable of:	These requirements from SOLAS, chapter 4.
1.1	transmitting ship-to-shore distress alerts by at least two separate and independent means, each using a different radiocommunication service;	
1.2	transmitting ship-to-air distress alerts;	
1.3	receiving shore-to-ship distress alerts;	
1.4	transmitting and receiving ship-to-ship distress alerts;	
1.5	transmitting and receiving search and rescue coordinating communications;	
1.6	transmitting and receiving on-scene communications;	
1.7	transmitting and receiving signals for locating ships, aircraft or units in distress;	The Naval Administration may also require a Marine Survivor Locating System to transmit or receive signals for locating persons lost overboard. Procedures would govern the use of MSLS; typically persons working on deck at night or in hazardous conditions (i.e. rough weather) would be equipped with it. There is concern in the UK MCA about the proliferation of non type-approved, non GMDSS personal locator devices which operate using various means of location and alarm. Until an IMO Performance Standard is available, MSLS will not be a requirement of the Code. Where a MSLS is required it should operate using VHF DSC and AIS, and should: • provide an audible alert to bridge staff that a person has fallen overboard; and • provide in-water tracking of the casualty through the use of an imbedded Global Satellite Navigation System receiver in the beacon.
1.8	transmitting and receiving maritime safety information;	
1.9	transmitting and receiving general radiocommunications to and from shore-based radio systems or networks;	
1.10	transmitting and receiving bridge-bridge communications from the position where the ship is normally navigated; and	

1.11	transmitting and receiving internal communications.	
2	The communications equipment shall:	
2.1	provide high reliability and minimise the risk of mal-operation in all Foreseeable Operating Conditions, accidents and emergencies; and	
2.2	maintain essential safety functions after a minimum of one single operational error and/or system/equipment fault.	

Regulation 1 General

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	The purpose of this Regulation is to outline the principles and framework of Chapter VIII Communications systems and their applications.	SOLAS Regulations, Chapter IV, GMDSS Life Saving Appliances (LSA) Code, 2010
Definitions		SOLAS Regulations, Chapter IV, GMDSS
Definitions table not reproduced		
2	All other terms and abbreviations which are used in this chapter and which are defined in the Radio Regulations and in the International Convention on Maritime Search and Rescue (SAR), 1979, shall have the meanings as defined in those Regulations and the SAR Convention.	SOLAS Regulations, Chapter IV, GMDSS ITU-R Radio Regulations, 2008 International Code of Signals, 2005 (INTERCO)
IMO Documents table not reproduced		
Performance Requirements		
3	The Concept of Operations Statement document is the Owner's vision of how the communications systems of the ship are to be operated and maintained throughout the life of the ship and is to be shared by the Naval Administration and, where appointed, it's Recognised Organisation.	The CONOPS for Radio allows Member Nations to decide on issues such as: Procurement and through life support (In House, Contract or hybrid of the two); Emergency Communications to be either part of the Military fit or as a standalone (in accordance with GMDSS philosophy); how much equipment and placement depending on the type of ship, and what the radio outfit was to be used for (Distress, commercial, disaster relief, support to civilian operations etc.). This chapter follows GMDSS principles with military guidelines if required.
4	The ability to be deployed to any area of interest to the Navy defined in the Concept of Operations Statement shall be maintained and the communications fit and on-board personnel shall provide:	
4.1	the capability to send and transmit all information as required by the Global Maritime Distress and safety System (GMDSS).	Whilst IMO GMDSS requires that GMDSS equipment is capable of use as a separate entity this is not a Code requirement. However, a standalone system may be preferable to achieve the highest level of availability in the event that military communications are lost.

4.2	on-board safety communications including internal communications, main broadcast, portable and survival craft equipment;	Life Saving Appliances (LSA) Code, 2010
4.3	qualified personnel certified to operate and, if required, maintain the GMDSS equipment to ITU Radio Regulations.	ITU-R Radio Regulations, 2008 (latest version under development by the ITU (Oct 2011)) will provide a bulk of the technical requirements for chapter VIII
	Note: The requirements of Chapter VI, Regulation 10 which relate to communications equipment shall be met.	
Solutions		
7	Verification that the ship complies with this chapter shall be by the Naval Administration. Provision of evidence to support verification shall be by the owner. All decisions that affect compliance with the requirements of this chapter shall be recorded at all stages from Concept to Disposal and these records be maintained throughout the life of the ship.	SOLAS Regulations, Chapter IV, GMDSS ITU-R Radio Regulations, 2008 National Standards e.g. Department for Transport (UK)

Regulation 2 GMDSS Equipment

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	GMDSS communications equipment shall be fitted onboard.	
Performance Requirements		
2	The GMDSS equipment to be fitted shall be determined by the naval ship's sea area of operation with reference to the Concept of Operations Statement.	
3	Every naval ship subject to this Chapter shall be provided with:	These requirements from SOLAS, chapter 4
3.1	a VHF radio installation capable of transmitting and receiving:	
3.1.1	DSC on the frequency 156.525 MHz (channel 70). It shall be possible to initiate the transmission of distress alerts on channel 70 from the position from which the naval vessel is normally navigated; and	GMDSS equipment must be installed on the bridge, however, the Naval Administration may consider installing remote monitoring/control equipment in the Comcen for situational awareness purposes.
3.1.2	general radiocommunications using radiotelephony on the frequencies 156.300 MHz (channel 6), 156.650 MHz (channel 13) and 156.800 MHz (channel 16);	
3.2	a radio installation capable of maintaining a continuous DSC watch on VHF channel 70 which may be separate from, or combined with, that required by subparagraph 3.1.1;	
3.3	a search and rescue locating device capable of operating either in the 9 GHz band or on frequencies dedicated for AIS, which shall be so stowed that it can be easily utilised;	
3.4	a receiver capable of receiving international NAVTEX service broadcasts if the naval ship is engaged on voyages in any area in which an international NAVTEX service is provided;	

3.5	a radio facility for reception of maritime safety information by the Inmarsat enhanced group calling system if the naval ship is engaged on voyages in any area of Inmarsat coverage but in which an international NAVTEX service is not provided. However, the Naval Administration may permit naval ships engaged exclusively on voyages in areas where a HF direct-printing telegraphy maritime safety information service is provided and fitted with equipment capable of receiving such service, to be exempted from the requirement to carry an Inmarsat EGC receiver.	Inmarsat C is required if the ship is operating in an area where MSI is broadcast via the Inmarsat C EGC system. Inmarsat C systems are inexpensive, use a very small antenna system and are simple to install. In practice, Inmarsat C is required for all ships operating in GMDSS Sea Area A3.
3.6	a satellite emergency position-indicating radio beacon (satellite EPIRB) which shall be:	
3.6.1	capable of transmitting a distress alert through the polar orbiting satellite service operating in the 406 MHz band;	
3.6.2	installed in an easily accessible position;	406 EPIRBs are normally mounted near the bridge in a float free bracket.
3.6.3	ready to be manually released and capable of being carried by one person into a survival craft;	
3.6.4	capable of floating free if the ship sinks and of being automatically activated when afloat; and	The float-free function should be prioritised when selecting a location for the EPIRB..
3.6.5	capable of being activated manually.	
	Note: The satellite EPIRB shall be located such as to give the float-free function (sub-paragraph 3.6.4) priority. If it is not possible to comply with the sub-paragraphs 3.6,2, 3.6.3 and 3.6.5 from the chosen position, an additional satellite EPIRB (need not to be of a float-free type) may be required, preferably located on the bridge.	

	Sea Area A1	These requirements from SOLAS, chapter 4
4	In addition to meeting the requirements of Regulation 2, paragraph 3, every naval ship engaged on voyages exclusively in sea area A1 shall be provided with a radio installation capable of initiating the transmission of ship-to-shore distress alerts from the position from which the ship is normally navigated, operating either:	
4.1	on VHF using DSC; or	
4.2	through the polar orbiting satellite service on 406 MHz; this requirement may be fulfilled by the satellite EPIRB required by Regulation 2 paragraph 3.6, either by installing the satellite EPIRB close to, or by remote activation from, the position from which the ship is normally navigated; or	
4.3	if the naval ship is engaged on voyages within coverage of MF coast stations equipped with DSC, on MF using DSC; or	
4.4	on HF using DSC; or	
4.5	through the Inmarsat geostationary satellite service.	
	Sea Areas A1 and A2	These requirements from SOLAS, chapter 4
5	In addition to meeting the requirements of Regulation 2, paragraph 3, every naval ship engaged on voyages beyond sea area A1, but remaining within sea area A2, shall be provided with:	
5.1	an MF radio installation capable of transmitting and receiving, for distress and safety purposes, on the frequencies 2187.5 kHz using DSC and 2182 kHz using radiotelephony; and	
5.2	a radio installation capable of maintaining a continuous DSC watch on the frequency 2187.5 kHz which may be separate from, or combined with, that required by sub-paragraph 5.1; and	

5.3	means of initiating the transmission of ship-to-shore distress alerts by a radio service other than MF operating either through the polar orbiting satellite service on 406 MHz; this requirement may be fulfilled by the satellite EPIRB, required by Regulation 2 paragraph 3.6, either by installing the satellite EPIRB close to, or by remote activation from, the position from which the ship is normally navigated; or on HF using DSC or through the Inmarsat satellite service using a ship earth station.	
6	It shall be possible to initiate transmission of distress alerts by the radio installations specified in paragraphs 5.1 and 5.1from the position from which the ship is normally navigated.	
7	The naval ship shall, in addition, be capable of transmitting and receiving general radiocommunications using radiotelephony or direct-printing telegraphy by either:	All GMDSS MF/HF transceivers cover 1.6-30 MHz as standard. There are no *MF only* GMDSS transceivers.
7.1	a radio installation operating on working frequencies in the bands between 1,605 kHz and 4,000 kHz or between 4,000 kHz and 27,500 kHz. This requirement may be fulfilled by the addition of this capability in the equipment required by paragraph 5.1; or	
7.2	an Inmarsat earth station.	
	<u>Sea Areas A1, A2 and A3</u>	These requirements from SOLAS, chapter 4
8	In addition to meeting the requirements of Regulation 2, paragraph 3, every ship engaged on voyages beyond sea areas A1 and A2, but remaining within sea area A3, shall, if it does not comply with the requirements of paragraph, be provided with:	
8.1	an Inmarsat ship earth station capable of:	
8.1.1	transmitting and receiving distress and safety communications using direct-printing telegraphy;	
8.1.2	initiating and receiving distress priority calls;	

8.1.3	maintaining watch for shore-to-ship distress alerts, including those directed to specifically defined geographical areas; and	
8.1.4	transmitting and receiving general radiocommunications, using either radiotelephony or direct-printing telegraphy.	
8.2	an MF radio installation capable of transmitting and receiving, for distress and safety purposes, on the frequencies 2187.5 kHz using DSC and 2182 kHz using radiotelephony; and	
8.3	a radio installation capable of maintaining a continuous DSC watch on the frequency 2187.5 kHz which may be separate from, or combined with, that required by sub-paragraph 8.2; and	
8.4	means of initiating the transmission of ship-to-shore distress alerts by a radio service other than MF operating either through the polar orbiting satellite service on 406 MHz; this requirement may be fulfilled by the satellite EPIRB, required by Regulation 2 paragraph 3.6, either by installing the satellite EPIRB close to, or by remote activation from, the position from which the ship is normally navigated; or on HF using DSC or through the Inmarsat satellite service using a ship earth station.	
9	In addition to meeting the requirements of Regulation 2, paragraph 3, every naval vessel engaged on voyages beyond sea areas A1 and A2, but remaining within sea area A3, shall, if it does not comply with the requirements of paragraph 8, be provided with:	
9.1	an MF/HF radio installation capable of transmitting and receiving, for distress and safety purposes, on all distress and safety frequencies in the bands between 1,605 kHz and 4,000 kHz and between 4,000 kHz and 27,500 kHz using DSC, radiotelephony and narrow band direct printing:	Narrow Band Direct Printing (NBDP) is very rarely used by GMDSS ships, as the equipment is difficult to operate for non-technical users. There is thus little point in using the option defined by 6.2.1

9.2	equipment capable of maintaining DSC watch on 2,187.5 kHz, 8,414.5 kHz and on at least one of the distress and safety DSC frequencies 4,207.5 kHz, 6,312 kHz, 12,577 kHz or 16,804.5 kHz; at any time, it shall be possible to select any of these DSC distress and safety frequencies. This equipment may be separate from, or combined with, the equipment required by subparagraph 9.1; and	
9.3	means of initiating the transmission of ship-to-shore distress alerts by a radio service other than MF operating either through the polar orbiting satellite service on 406 MHz; this requirement may be fulfilled by the satellite EPIRB, required by Regulation 2 paragraph 3.6, either by installing the satellite EPIRB close to, or by remote activation from, the position from which the ship is normally navigated; or through the Inmarsat satellite service using a ship earth station.	
9.4	in addition, naval ships shall be capable of transmitting and receiving general radiocommunications using radiotelephony or direct-printing telegraphy by an MF/HF radio installation operating on working frequencies in the bands between 1,605 kHz and 4,000 kHz and between 4,000 kHz and 27,500 kHz. This requirement may be fulfilled by the addition of this capability in the equipment required by subparagraph 9.1.	Always fitted to GMDSS MF/HF equipment as standard.
10	It shall be possible to initiate transmission of distress alerts by the radio installations specified in paragraphs 8 and 9 from the position from which the ship is normally navigated.	

	Sea Areas A1, A2, A3 and A4	These requirements from SOLAS, chapter 4
11	In addition to meeting the requirements of Regulation 2, paragraph 3, naval ships engaged on voyages in all sea areas shall be provided with the radio installations and equipment required by Regulation 2, paragraph 9, except that the Inmarsat earth station required by Regulation 2, paragraph 9.3 shall not be accepted as an alternative to that required by Regulation 2, paragraph 9.1, which shall always be provided. In addition, naval ships engaged on voyages in all sea areas shall comply with the requirements of Regulation 2, paragraph 10.	
	Note: This means that Sea Area A4 naval ships must always be fitted with a MF/HF installation, as Inmarsat does not cover Sea Area A4	
Solutions		
12	The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	
13	GMDSS equipment shall comply with the following standards:	The latest version of the standard must always be used. Refer IEC website http://www.iec.ch
13.1	International Electrotechnical Commission (IEC) IEC60945:2002 Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results.	

13.2	International Electrotechnical Commission (IEC) IEC61097 series Global Maritime Distress and Safety System, (latest versions):	
13.2.1	Part 1: Radar transponder - Marine search and rescue (SART) - Operational and performance requirements, methods of testing and required test results	
13.2.2	Part 2: COSPAS-SARSAT EPIRB - Satellite emergency position indicating radio beacon operating on 406 MHz - Operational and performance requirements, methods of testing and required test results	
13.2.3	Part 3: Digital selective calling (DSC) equipment - Operational and performance requirements, methods of testing and required testing results	
13.2.4	Part 4: INMARSAT-C ship earth station and INMARSAT enhanced group call (EGC) equipment - Operational and performance requirements, methods of testing and required test results	
13.2.5	Part 6: Narrowband direct-printing telegraph equipment for the reception of navigational and meteorological warnings and urgent information to ships (NAVTEX)	
13.2.6	Part 7: Shipborne VHF radiotelephone transmitter and receiver - Operational and performance requirements, methods of testing and required test results	
13.2.7	Part 8: Shipborne watchkeeping receivers for the reception of digital selective calling (DSC) in the maritime MF, MF/HF and VHF bands - Operational and performance requirements, methods of testing and required test results	

13.2.8	Part 9: Shipborne transmitters and receivers for use in the MF and HF bands suitable for telephony, digital selective calling (DSC) and narrow band direct printing (NBDP) - Operational and performance requirements, methods of testing and required test results	
13.2.9	Part 13: Inmarsat F77 ship earth station equipment - Operational and performance requirements, methods of testing and required test results	
13.2.10	Part 14: AIS search and rescue transmitter (AIS-SART) - Operational and performance requirements, methods of testing and required test results.	
14	Marine survivor locating systems shall comply with Radio Technical Commission for Maritime (RTCM) Standard 11901.0 Maritime Survivor Locating Devices.	The latest version of the standard must always be used. Refer RTCM website http://www.rtcm.org

Regulation 3 Ensuring Availability of GMDSS Equipment

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	GMDSS equipment shall be continuously available at sea.	These requirements from SOLAS, chapter 4
Performance Requirements		
2	The GMDSS radio equipment required by this chapter shall be maintained to provide the availability of the functional requirements specified in Regulation 1 General and to meet the recommended performance standards of such equipment.	
3	On naval ships engaged on voyages in sea areas A1 and A2, the availability shall be ensured by using such methods as duplication of equipment, shore-based maintenance or at-sea electronic maintenance capability, or a combination of these, as may be approved by the Naval Authority.	
4	On naval ships engaged on voyages in sea areas A3 and A4, the availability shall be ensured by using a combination of at least two methods such as duplication of equipment, shore-based maintenance or at-sea electronic maintenance capability, as may be approved by the Naval Administration, taking into account the recommendations of the IMO.	
Solutions		
5	The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	

6	If availability is ensured by using a combination of methods which includes duplication of equipment, in addition to the equipment required by Regulation 2, the following radio installations should be available on board naval ships engaged on voyages in:	
6.1	Sea area A3 - A VHF radio installation complying with the requirements of Regulation 2, paragraph 3.1 and either an MF/HF installation complying with the requirements of Regulation 2, paragraphs 9.1 and 9.2 or an Inmarsat ship earth station complying with Regulation 2, paragraph 8.1.	
	Note: In practice A3 ships must fit two complete VHF systems and either 2 complete Inmarsat ship earth stations, or an Inmarsat ship earth station and a MF/HF installation. The MF/HF installation may be combined with an existing MF installation fitted under Regulation 2.	
6.2	Sea areas A3 and A4 - A VHF radio installation complying with the requirements of Regulation 2, paragraph 3.1 and an MF/HF installation complying with the requirements of Regulation 2, paragraphs 9.1 and 9.2. Naval ships operating only occasionally in A4 may fit an additional Inmarsat ship earth station in lieu of a second MF/HF installation	
6.3	The additional radio installations specified in paragraphs 5.1 and 5.2 should each be connected to a separate antenna and be installed and ready for immediate operation.	In practice, each item of GMDSS VHF, HF/HF and satcom equipment is connected to a dedicated antenna.

7	If availability is ensured by using a combination of methods which includes shore-based maintenance, an arrangement acceptable to the Naval Administration should be established to ensure adequate support of the naval ship for the maintenance and repair of its radio installation. For example an agreement with a company providing GMDSS maintenance services known to cover the operating area of the ship.	
8	If availability is ensured by using a combination of methods which includes at sea electronic maintenance capability, adequate technical documentation, tools, test equipment and spare parts must be carried on board in order to enable the maintainer to perform tests and localise and repair faults in the radio equipment.	
8.1	The person(s) designated as the GMDSS equipment maintainer should either hold a GMDSS 1st or 2nd Class Radio-Electronic Certificate or qualifications recognised as equivalent by the Naval Administration.	
	Note: In practice, the option of at sea electronic maintenance is rarely used by GMDSS ships, as equipment is generally very reliable, repair of equipment requires specialised equipment and few, if any, training institutions offer courses for the 1st and 2nd Class Radio Electronic Certificates. GMDSS A1/2 ships use duplication or shore based maintenance, and the great majority of GMDSS A3/4 ships use duplication and shore based maintenance.	

Regulation 4 GMDSS Sources of Energy

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	GMDSS equipment shall be provided with main, emergency and reserve sources of energy.	These requirements from SOLAS, chapter 4
Performance Requirements		
2	There shall be available at all times, while the naval ship is at sea, a supply of electrical energy sufficient to operate the radio installations and to charge any batteries used as part of a reserve source or sources of energy for the radio installations.	The batteries used for the reserve source must be maintained regularly. This includes: • physically checking the security of the batteries in their stowage; • physically inspecting the batteries for cracks in the case, corrosion on the terminals, and terminal tightness; • conducting a check of the specific gravity with a hydrometer; and • checking that the electrolyte is at the proper level. A person or persons must be designated as having responsibility for these functions.
3	A reserve source or sources of energy shall be provided on every naval ship, to supply GMDSS radio installations, for the purpose of conducting distress and safety radiocommunications, in the event of failure of the ship's main and emergency sources of electrical power. The reserve source or sources of energy shall be capable of simultaneously operating the main and duplicated GMDSS equipment for a period of at least:	These requirements from SOLAS, chapter 4
3.1	1 hour on naval ships provided with an emergency source of electrical power, if such source of power complies fully with all relevant provisions of Chapter IV, Regulation 9, including the supply of such power to the radio installations; and	
3.2	6 hours on naval ships not provided with an emergency source of electrical power complying fully with all relevant provisions of Chapter IV, Regulation 9, including the supply of such power to the radio installations.	

4	The reserve source or sources of energy shall be independent of the propelling power of the ship and the ship's electrical system.	These requirements from SOLAS, chapter 4
5	The reserve source or sources of energy may be used to supply the electrical lighting required by Regulation 14.	These requirements from SOLAS, chapter 4
6	If an uninterrupted input of information from the ship's navigational or other equipment to a radio installation required by this chapter, including the navigation receiver referred to in Regulation 5, is needed to ensure its proper performance, it shall be powered from the main, emergency and reserve sources of energy.	These requirements from SOLAS, chapter 4
Solutions		
7	The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	
8	The reserve source is only to be used for the GMDSS equipment, the navigation receiver referred to in paragraph 6 and the emergency radio lighting referred to in Regulation 14.	These requirements from SOLAS, chapter 4
9	Where a reserve source of energy consists of a rechargeable accumulator battery or batteries:	
9.1	a means of automatically charging such batteries shall be provided which shall be capable of recharging them to minimum capacity requirements within 10 hours; and	Some administrations require battery charger failure alarms.
9.2	the capacity of the battery or batteries shall be checked, using an appropriate method, at intervals not exceeding 12 months, when the ship is not at sea.	

	Note: The battery capacity is normally checked at the annual survey of the GMDSS equipment.	
9.3	The siting and installation of accumulator batteries which provide a reserve source of energy shall be such as to ensure:	
9.3.1	the highest degree of service;	
9.3.2	a reasonable lifetime, agreed by the Naval Administration;	The Naval Administration should agree a minimum lifetime, for example 5 years, and may require them to be labelled with the installation date and a table for annual discharge tests.
9.3.3	Reasonable safety;	
9.3.4	that battery temperatures remain within the manufacturer's specifications whether under charge or idle; and	
9.3.5	that when fully charged, the batteries will provide at least the minimum required hours of operation under all weather conditions.	
	Note: GMDSS batteries are normally mounted at the same level or higher than the GMDSS equipment, in a vented insulated locker or container.	
9.4	For more information on GMDSS reserve supplies, see IMO COMSAR Circular 16, dated March 4, 1998.	

Regulation 5 Position Updates

	CODE REQUIREMENTS	GUIDANCE ONLY
Functional Objective		
1	Electronic position information shall be available to the GMDSS equipment.	These requirements from SOLAS, chapter 4
Performance Requirements		
2	All GMDSS equipment carried on board a naval ship to which this Chapter applies which is capable of automatically including the ship's position in the distress alert shall be automatically provided with this information from an internal or external navigation receiver, if either is installed.	
Solutions		
3	The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	
4	Electronic navigation receivers used for position input to GMDSS equipment shall comply with IEC 61108-1:2003 - Maritime navigation and radio communication equipment and systems – Global navigation satellite systems (GNSS) – Part 1: Global positioning system (GPS) – Receiver equipment – Performance standards, methods of testing and required test results (2003-07).	The latest version of the standard must always be used. Refer IEC website http://www.iec.ch

Regulation 6 Internal Communications

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	Internal communications equipment shall be provided to:	
1.1	enable safe operation of the ship;	
1.2	alert persons onboard of emergency or hazardous situations; and	
1.3	facilitate appropriate emergency response and recovery.	
Performance Requirements		
2	The main internal communications system shall provide effective two-way verbal communication between crew members.	
3	A back-up internal communications system shall also be provided in the event that the main system is unavailable. The back-up system shall:	
3.1	be effective and continuously available;	
3.2	be protected from hazards such as fire, vibration, electrical interference, flooding;	
3.3	be independent of the ships power supply;	
3.4	be operable from positions defined by the Naval Administration.	
Solutions		
4	The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	

5	The main internal communications system shall:	
5.1	be operable from all positions used for Escape, Evacuation and Rescue, damage control and command and control;	
5.2	be operable from positions used for operational activities related to the ship's role;	
5.3	be operable from locations identified in Chapter IV Engineering Systems to support machinery control and RAS operations;	
5.4	be operable from other locations defined by the Naval Administration.	
6	An emergency means comprised of either fixed or portable equipment or both shall be provided for two-way communications between strategic positions for Escape, Evacuation and Rescue.	
7	Additionally, on ships fitted with a MES, two-way communication shall be provided between the MES embarkation point and the platform or survival craft.	
8	The power supply to the internal communication system shall comply with the requirements of Chapter IV. Alternatively a redundant system not requiring a power supply shall be provided such as sound powered telephones or battery powered portable equipment.	
	Note: For portable communications, see Regulation 8	
9	System redundancy shall be demonstrated through functional testing of the installed systems.	The Naval Administration may also require an FMEA to demonstrate system redundancy.
10	Cables for internal communication systems shall be routed clear of galleys, machinery spaces and their casings and other high fire risk areas, except for supplying equipment in those spaces.	
11	Communication equipment located or used in areas where flammable gases may be present shall be certified intrinsically safe.	

12	Performance Requirements at paragraphs 2 and 3.1 above shall be verified by a risk assessment and/or a demonstration.	

Regulation 7 Main Broadcast System

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	A main broadcast system shall enable verbal communication to Persons Onboard of an emergency incident and the actions to be taken.	
Performance Requirements		
2	The main broadcast system shall:	
2.1	allow one-way verbal communication to Persons Onboard;	
2.2	be clearly noticeable by all embarked persons;	
2.3	be easily distinguishable and recognisable;	
2.4	be continuously available;	
2.5	be protected from hazards such as fire, vibration, electrical interference or flooding;	
2.6	be provided such that any incident which may cause alarm failure shall be guarded against by system or equipment redundancy;	
2.7	be operable from strategic Escape, Evacuation and Rescue positions and locations used for command and control.	
Solutions		
3	The ship, systems and equipment are to comply with, and be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	
4	Unless provided otherwise in this Code, the main broadcast system shall comply with:	
4.1	LSA Code Paragraph 7.2.2 "Public address system";	

4.2	IMO Resolution A.1021(26) "Code on alerts and indicators", 2009;	
	Note: Where possible, the main broadcast system should also comply with IMO MSC/Circ.808: "Recommendation on performance standards for public address systems on passenger ships, including cabling".	
5	Where in any referenced IMO documents the term "public address system" is used, it should be read to mean "main broadcast system" for the purpose of this Naval Ship Code.	
6	The main broadcast system shall be clearly distinguishable across the upper deck and within the ship with all doors and accesses closed, unless stated otherwise by the Naval Administration. A trial shall demonstrate that the main broadcast system is clearly audible and/or visible.	
7	When the main broadcast system is integrated with systems other than the general alarm system, the broadcast system shall have automatic priority over any other system input, so that all announcements will be broadcast even if any loudspeaker in the spaces concerned has been switched off, its volume turned down or the main broadcast system is used for other purposes.	
8	A number of operating positions shall be available for the main broadcast system. As a minimum this shall include the bridge, operations room and the damage control headquarters. At least one operating position is to be continuously manned when at sea. During periods of increased risk, at least two of these positions are to be continuously manned (e.g. RAS, constricted navigational situations).	
9	The power supply to the main broadcast system shall comply with the requirements of Chapter VII Regulation 14 Power Supply to Escape, Evacuation and Rescue Systems.	

10	Functional testing of the installed system shall demonstrate that any incident that may cause main broadcast system failure is guarded against by system or equipment redundancy.	The Naval Administration may also an FMEA showing any incident that may cause main broadcast system failure is guarded against by system or equipment redundancy.
11	Loudspeaker installations shall comply with the requirements of Section 7.2 of the LSA Code.	
12	Communication equipment located or used in areas where flammable gases may be present shall be certified intrinsically safe.	

Regulation 8 Portable Radiocommunications

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	Portable Radiocommunications systems shall enable effective two-way communication between crew members.	
Performance Requirements		
2	Portable Radiocommunications systems shall:	
2.1	Allow clear and distinguishable two-way verbal communication;	
2.2	Be suitably rated for the environment under which it will operate;	
2.3	Have complete system redundancy.	
Solutions		
3	The ship, systems and equipment are to comply with, and be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	Consideration may be given to using a commercial form of encryption on top of a digital modulation scheme, such as APCO25 with DES (Data Encryption Standard).
4	Portable radiocommunications shall be provided to enable Escape, Evacuation and Rescue evolutions in accordance with Regulation 6.	
5	Portable radiocommunications shall be operable from all positions used for Escape, Evacuation and Rescue, damage control and command and control. The equipment may also be required by shore parties and boat parties as defined in the Concept of Operations Statement.	UHF systems may offer better penetration of ships compartments than VHF systems.
6	Complete system redundancy shall be demonstrated through functional testing.	The Naval Administration may also require an FMEA to demonstrate complete system redundancy.

7	Communication equipment located or used in areas where flammable gases may be present shall be certified intrinsically safe.	
8	Performance Requirements at paragraph 2 above shall be verified by demonstration.	

Regulation 9 Survival Craft Radio Equipment

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	External communication equipment used in survival craft shall enable communication to other ships or to shore during emergencies.	
Performance Requirements		
2	External communication equipment to be used in survival craft shall:	
2.1	be easy to operate including by those wearing fire fighting or other individual protective equipment;	
2.2	incorporate redundancy;	
2.3	be located at strategic Escape, Evacuation and Rescue positions as agreed with the Naval Administration;	
2.4	be installed in such a way as to avoid harmful electromagnetic interference arising from, or being given to other equipment on board; and	
2.5	not cause injuries to persons using the equipment.	
Solutions		
3	The ship, systems and equipment are to comply with, and be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	

4	Unless expressly provided otherwise in this Code, survival craft radio equipment shall comply with	
4.1	International Electrotechnical Commission (IEC) IEC61097 series Global Maritime Distress and Safety System, (latest versions):	The latest version of the standard must always be used. Refer IEC website http://www.iec.ch
4.1.1	Part 1: Radar transponder - Marine search and rescue (SART) - Operational and performance requirements, methods of testing and required test results.	
4.1.2	Part 2: COSPAS-SARSAT EPIRB - Satellite emergency position indicating radio beacon operating on 406 MHz - Operational and performance requirements, methods of testing and required test results	
4.1.3	Part 12: Survival craft portable two-way VHF radiotelephone apparatus - Operational and performance requirements, methods of testing and required test results	
4.1.4	Part 14: AIS search and rescue transmitter (AIS-SART) - Operational and performance requirements, methods of testing and required test results.	
4.2	LSA Code, Chapter 3 "Visual Signals";	
4.3	SOLAS Chapter IV "Radio communications".	
5	At least three waterproof portable two-way VHF radiotelephone apparatus shall be provided on every naval ship over 500 GRT. Ships below 500 GRT shall carry two. The location shall be approved by the Naval Administration.	Portable VHF radios are often stored on the bridge or the Damage Control Headquarters.
6	At least one search and rescue transponder (SART) shall be carried on each side of a naval ship over 500 GRT. Ships below 500 GRT shall carry one. SARTs shall be stowed in such locations that they can be rapidly placed in any one of the survival craft.	SART can be used to refer to both AIS-SART and radar-SART. SARTs are normally mounted on a bracket just inside the bridge wing doors.

7	Not less than 12 rocket parachute distress flares shall be carried and be stowed directly available on or near the navigation bridge. Flares shall comply with the LSA Code Chapter 3.1 "Rocket parachute flares".	
8	All ships shall be provided with a portable daylight signalling lamp which is available at all times and which is not dependent on the ship’s main source of electrical power.	
9	Communication equipment located or used in areas where flammable gases may be present shall be certified intrinsically safe.	

Regulation 10 Sea-Air Radiocommunications

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	A sea-to-air two-way radiocommunications system shall enable communication with overflying aircraft during emergencies.	
Performance Requirements		
2	Every naval ship shall be provided with means for two-way on-scene radio communications for search and rescue purposes using civil aeronautical VHF frequencies.	These requirements from SOLAS, chapter 4
Solutions		
3	The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	
4	The equipment shall provide operation on the aeronautical frequencies of 121.5 MHz and 123.1 MHz from the position from which the ship is normally navigated. Additional civil aeronautical VHF frequencies may be provided if required.	
5	Equipment shall comply with the following performance standard:	
5.1	ETSI EN 301 688 V1.1.1 Electromagnetic compatibility and Radio spectrum Matters (ERM) Technical characteristics and methods of measurement for fixed and portable VHF equipment operating on 121,5 MHz and 123,1 MHz.	The latest version of the standard must always be used. Refer ETSI website http://www.etsi.org

Regulation 11 Radio Personnel

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	Radio operators shall be qualified to operate GMDSS equipment.	As defined by the Naval Administration, taking due account of SOLAS Regulations, Chapter IV, GMDSS. ITU Radio Regulations
Performance Requirements		
2	The communications qualifications shall include:	
2.1	GMDSS certificates specified in ITU Radio Regulations;	ITU Radio Regulations Standards of Training, Certification and Watch-keeping for Mariners (STCW)
2.2	Military qualifications as required by the operational installation.	As defined by the Naval Administration
Solutions		
3	The operator qualification is to be approved by the Naval Administration as being compliant with the above Performance Requirements.	As defined by the Naval Administration

Regulation 12 Radio Watches

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	GMDSS equipment shall be monitored at sea as determined by operational requirements.	As defined by the Naval Administration, taking due account of SOLAS Regulations, Chapter IV, GMDSS.
Performance Requirements		
2	Every naval ship shall, while at sea, maintain a continuous radio watch:	All based on SOLAS Regulations, Chapter IV, GMDSS.
2.1	on VHF DSC channel 70;	
2.2	on the distress and safety DSC frequency 2,187.5 kHz, if the ship is fitted with an MF radio installation;	
2.3	on the distress and safety DSC frequencies 2,187.5 kHz and 8,414.5 kHz and also on at least one of the distress and safety DSC frequencies 4,207.5 kHz, 6,312 kHz, 12,577 kHz or 16,804.5 kHz, appropriate to the time of day and the geographical position of the ship, if the ship is fitted with an MF/HF radio installation. This watch may be kept by means of a scanning receiver; and	
2.4	for satellite shore-to-ship distress alerts, if the ship is fitted with a GMDSS ship earth station system.	
3	While at sea, and when practicable, a continuous listening watch should be maintained on VHF channel 16. This watch shall be kept at the position from which the ship is normally navigated.	
4	Every naval ship, while at sea, shall maintain a radio watch for broadcasts of maritime safety information on the appropriate frequency or frequencies on which such information is broadcast for the area in which the ship is navigating.	

Solutions		
5	The operating procedures are to be approved by the Naval Administration as being compliant with the above Performance Requirements.	

Regulation 13 Radio Records

	CODE REQUIREMENTS	GUIDANCE ONLY
Functional Objective		
1	Radio records shall be maintained.	This will allow official investigations to be conducted if the Naval Administration is willing to release such documents to Civil Authorities.
Performance Requirements		
2	Radio records shall be maintained by transcript, magnetic media or any other method as agreed by the Naval Administration.	SOLAS Regulations, Chapter IV, GMDSS Means of keeping records as required by the Naval Administration.
3	A record shall be kept, to the satisfaction of the Naval Administration and as required by the Radio Regulations, of all incidents connected with the radio communication service which appear to be of importance to safety of life at sea.	ITU Radio Regulations
4	The relevant distress, emergency or safety records shall be released to the relevant Investigation Authority if operational conditions and circumstances allow.	As determined by the Naval Administration and depending upon the operational circumstances.
Solutions		
5	The operating procedures are to be approved by the Naval Administration as being compliant with the above Performance Requirements.	

Regulation 14 Installation, Maintenance, Testing and Repairs

	CODE REQUIREMENTS	GUIDANCE ONLY
Functional Objective		
1	The location and ship installation of GMDSS equipment shall enable it's operation, maintenance, testing and repair.	SOLAS Regulations, Chapter IV, GMDSS In accordance with the naval Administrations engineering standards and practice
Performance Requirements		
2	Every GMDSS radio installation shall;	All SOLAS Regulations, Chapter IV, GMDSS and in accordance with the Naval Administrations engineering standards and practice
2.1	be so located that no harmful interference of mechanical, electrical or other origin affects its proper use, and so as to ensure electromagnetic compatibility and avoidance of harmful interaction with other equipment and systems;	
2.2	be so located as to ensure the greatest possible degree of safety and operational availability;	
2.3	be protected against harmful effects of water, extremes of temperature and other adverse environmental conditions;	
2.4	be provided with reliable, permanently arranged electrical lighting, independent of the main and emergency sources of electrical power, for the adequate illumination of the radio controls for operating the radio installation; and	Normally powered from GMDSS batteries.
2.5	be clearly marked with the call sign, the ship station identity and other codes as applicable for the use of the radio installation.	
3	Control of the VHF radiotelephone channels, required for navigational safety, shall be immediately available on the navigation bridge convenient to the conning position and, where necessary, facilities should be available to permit radiocommunications from the wings of the navigation bridge. Portable VHF equipment may be used to meet the latter requirement.	

4	Where applicable, equipment shall be so constructed and installed that it is readily accessible for inspection and on-board maintenance purposes.	SOLAS Regulations, Chapter IV, GMDSS
4.1	Adequate information shall be provided to enable the equipment to be properly operated and maintained, taking into account the recommendations of the IMO.	
4.2	Adequate tools and spares shall be provided to enable the equipment to be maintained;	
4.3	Satellite EPIRBs shall be annually tested for all aspects of operational efficiency, with special emphasis on checking the emission on operational frequencies, coding and registration. The test may be conducted on board the ship or at an approved testing station, and subject to maintenance at intervals not exceeding five years, to be performed at an approved shore-based maintenance facility;	
4.4	Radio communication equipment shall be so designed that the main units can be replaced readily, without elaborate recalibration or readjustment; and	
4.5	change over switches shall be tested in accordance with SOLAS Regulations as approved by the Naval Administration.	
5	Where required by the Naval Administration, GMDSS equipment shall be provided with facilities to inhibit transmission for EMCON/RADHAZ purposes.	The ability to lockout RF transmissions may be required for use when personnel are aloft or working in close proximity. Naval Administrations Standing Orders for the ship type should define the procedures.
Solutions		
6	Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.	

7	The maintenance information and maintenance procedures are to be approved by the Naval Administration as being compliant with the above Performance Requirements.	

Regulation 15 Operational Audit and Compliance Validation

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	GMDSS equipment shall be surveyed at regular intervals.	
Performance Requirements		
2	The GMDSS equipment shall be surveyed annually in accordance with the requirements of Chapter I, Part B.	
	Note: Annual survey of GMDSS equipment is required for full SOLAS compliance. The Naval Administration may require alternative arrangements for the periodicity of surveys.	
Solutions		
3	The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	
4	Surveys shall be conducted in accordance with Annex 1 to IMO Resolution A.997(25) , as amended by IMO Resolution A.1020(26) – *Survey Guidelines under The Harmonised System of Survey and Certification.*	

10 GUIDANCE ON NSC CHAPTER IX NAVIGATION

Background

10.1 Chapter IX Navigation has been developed by a naval navigation specialist, under contract to INSA. The Chapter IX Working Group have guided the development and reviewed the Chapter.

10.2 It has been developed on the basis that Chapter IX should be the focus of all requirements concerning the conduct of safe navigation, including manoeuvring, in the Code and the Chapter should therefore include Internal communications, propulsion and steering as it affects collision avoidance and manoeuvring and External communications where these are directly relevant to navigation. The chapter does not include Seamanship aspects addressed in SOLAS V as it was deemed that the management of navigation and seamanship issues are generally separated in most Navies. Shipboard access aspects are included at Regulation 11 and will be moved to the Seamanship Chapter when it is developed.

10.3 To achieve this new focus, it was agreed that relevant Regulations in Chapters IV and VIII in particular as they relate to navigation would be referenced from Chapter IX.

Regulation 0 Goal

CODE REQUIREMENTS		GUIDANCE ONLY
1	The navigation related spaces, systems and equipment shall be designed, constructed, installed and maintained so that the ship, while at sea, may:	Requirement origin: SOLAS Chapter V
1.1	be capable of independent navigation;	
1.2	be aware of all navigation hazards, fixed or mobile;	
1.3	minimise risk of grounding, collision and negative environmental impact;	
1.4	measure and interpret environmental data;	
1.5	assist other ships, aircraft, units or persons in distress.	
2	The navigation spaces, workstations, systems and equipment shall:	
2.1	provide high reliability and minimise the risk of mal-operation in all Foreseeable Operating Conditions, accidents and emergencies;	

2.2	maintain uninterrupted essential safety functions after a minimum of one single operational error and/or system/equipment fault.	
3	The navigation systems and equipment providing essential safety functions shall not be dependent upon the ship's combat functions being available.	Conduct of safe navigation should not be reliant upon sensors or processing functions installed in support of war fighting capability.

Regulation 1 General

Functional Objective		
1	The purpose of this Regulation is to outline the principles and framework of Chapter IX Navigation and its application.	
Definitions		
	Note: Definitions which are applicable to all Chapters are located in Chapter I, Regulation 2.	
Definitions table not reproduced		
2	All other terms and abbreviations which are used in this chapter and which are defined in the Regulations for the Prevention of Collision at Sea (COLREGs), 1972 shall have the meanings as defined in those Regulations.	
International Maritime Organization (IMO) Documents		
IMO Documents table not reproduced		
Purpose		
3	The ability to be deployed to any area of interest to the Navy defined in the Concept of Operations Statement shall be maintained and the navigation equipment and sensors fit and on-board personnel shall provide:	
3.1	the capability to conduct safe navigation as required by SOLAS, the COLREGS and, where applicable, the HSC Code. This capability must be entirely independent from the military combat systems functionality;	
	Note: The requirements of Chapter IV and Chapter VI, Regulation 10 which relate to navigation equipment and systems shall be met.	
3.2	on-board safety communications including internal communications, main broadcast, Bridge Navigation Watch Alarm System (if fitted) and portable communications equipment;	

3.3	qualified personnel certified to operate and, if required, maintain the NAVTEX equipment to ITU Radio Regulations.	

General Performance Requirements

4	The vessel's Concept of Operations Statement document defines how the navigation systems of the ship are to be operated and maintained throughout the life of the ship and is to be shared by the Naval Administration and, where appointed, its Recognised Organisation.	The CONOPS for Navigation allows Member Nations to decide on issues such as: Procurement and through life support (In House, Contract or hybrid of the two); the ability to conduct safe navigation MUST be independent of any functionality provided by the combat system, or any other part of the Military fit; how much navigation equipment and its placement will depend upon the type of ship, and what the navigation outfit is to be used for (safe departure and entry to harbour, duty of care to other mariners, support to the military operations called for by the role of the vessel, Distress, disaster relief, support to civilian operations, etc.).

Solutions

5	Verification that the ship complies with this chapter shall be by the Naval Administration. Provision of evidence to support verification shall be by the owner. All decisions that affect compliance with the requirements of this chapter shall be recorded at all stages from concept to disposal and these records be maintained throughout the life of the ship.	

Regulation 2 Working Environment in Navigation Related Spaces

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	The design of compartments, their equipment and supporting services, related to the navigation of the ship, shall provide a working environment which facilitates the sustained maintenance of an effective lookout and conduct of safe navigation.	Operators should be provided with a comfortable working environment, free from physical hazards, light pollution and noise pollution. See also NSC Chapter IV Regulation 17
Performance Requirements		
2	The bridge shall be provided with a Heating, Ventilation and Air Conditioning (HVAC) system, or equivalent, that maintains the ventilation, temperature and humidity of the navigation Bridge and associated compartments within a comfortable range.	Requirement origin: • Class Rules
	Note: The HVAC system shall also comply with Chapter IV Regulation 23 of the Code.	
2.1	Control of the HVAC as it affects the Bridge shall be available on the Bridge.	
3	The Bridge, associated compartments, and systems installed on the Bridge, shall be provided with lighting and illumination systems that enable Bridge personnel to perform all Bridge tasks, including maintenance and chartwork, by day and night.	This covers all types of illumination and lightning: ordinary or red light, of the bridge, instruments, keyboards and controls.
3.1	Lighting systems required outside of the Bridge shall be designed such that they do not impair safe navigation. Alternatively where a lighting system is required which could have such an impact, facilities are to be provided to ensure that their use does not impair safe navigation.	See NSC Regulation 5 Those facilities should include controls for individual lights or sets of lights. These controls are to be separate from the controls for the navigation light arrangements

4	Noise levels within the enclosed bridge during good weather are to be sufficiently low as to enable operators carrying out navigation duties to concentrate for long periods of time and comfortably hold conversations with Bridge personnel for the sustained conduct of safe navigation.	The following can be used to define the solutions: • IEC 60839 series Audio alarms; • MSC.Circ/982 Guidelines on ergonomic criteria for Bridge Design; • IMO Resolution A.468(X) and A.343(IX). The ability to hear audio alarm annunciations should be considered. The location of sound signalling whistles is significant (see Regulation 9).
5	The effects of direct and indirect glare are to be reduced to a minimum.	Requirement origin: • Class Rules
6	Where multiple consoles or workstations are to be installed in the navigation Bridge they shall be of a common design.	
7	The arrangement of workstations remote from the Bridge, but having the same functionality as those used by Bridge operators, shall be the same to prevent mal-operation.	E.g. – Steering controls on the Bridge and at the Secondary Steering Position. In many instances different manufacturers will supply these workstations. Such co-operation will require early intervention by the Naval Administration
8	A system shall be installed is to monitor bridge activity and detect operator disability which could lead to marine accidents.	Requirement origin: • SOLAS V/19.
9	The wheelhouse passageways, entrances and areas around workstations, windows and doors are to be so arranged as to enable personnel to move or stand safely in bad weather.	Requirement origin: • Class Rules
10	Personnel safety equipment stored on the Bridge shall be readily accessible.	Requirement origin: • Class Rules
11	Facilities to promote the efficiency and alertness of the Bridge operators are to be provided on the Bridge or adjacent to the Bridge on the Bridge deck.	Requirement origin: • Class Rules

Solutions		
12	The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	
13	The Bridge and associated compartments shall be provided with HVAC that complies ISO 8468: 2007, Ships and marine technology – Ships bridge layout and associated equipment – Requirements and guidelines.	Control of the Bridge ventilation is to be available on the Bridge. Where the HVAC is part of a ship wide system, the Bridge HVAC output should not be overridden by settings applied elsewhere especially where those settings are optimised for the benefit of mechanical or electrical systems.
14	The ship shall be provided with lighting arrangements in the navigation Bridge and associated compartments that comply with ISO 8468: 2007, Ships and marine technology – Ships bridge layout and associated equipment – Requirements and guidelines.	The Naval Administration may direct that other national defence requirements are also met. Use of temporary grey screens, red filter screens, cowls, etc. shall be avoided.
15	The design and fitting out of the navigation Bridge shall be such that noise levels comply with the requirements of ISO 8468: 2007, Ships and marine technology – Ships bridge layout and associated equipment – Requirements and guidelines.	Acoustic lagging, noise dampening deck materials, remote location of HVAC fans and adequate control of speaker system volumes will all contribute.
16	In accordance with ISO 8468: 2007, Ships and marine technology – Ships bridge layout and associated equipment – Requirements and guidelines, utilization of dark coloured, non-reflective or matt surfaces shall be made for bulkheads, deckheads, consoles, chart tables and other major fittings in order to reduce indirect glare so that the information presented on visual display units and instruments shall not be obscured in any lighting conditions.	Arrangements shall be provided to prevent the obscuration of information presented on visual display units and instruments that are fitted with transparent covers. Use of temporary grey screens, red filter screens, cowls, etc. shall be avoided. The Naval Administration may apply additional national requirements or specific Class Rules.

17	The design of workstations or consoles shall be common throughout the ship so as to avoid confusion and mal-operation.	Combat System and Navigation System workstations will be used by the same operators so common design aids operator efficiency. Systems derived from different suppliers are more challenging: especially where the Bridge operator may find themselves in the secondary steering position and facing a different console layout.
18	The ship shall be provided with a Navigation Watch Alarm System that complies with the latest version of IEC 62616 - Bridge navigational watch alarm system (BNWAS):	As agreed by the Naval Administration during the design stage. If not so fitted the authority should be satisfied that the proposed bridge manning levels will be sufficient to facilitate equivalent levels of operator redundancy. The Naval Administration should support non-installation with a certificate of exemption and a justification, perhaps as part of the platform Safety Case.
	Note: The system shall also comply with Chapter VIII Regulation 7 Paragraph 11 of this Code	
19	The navigation Bridge and associated compartments shall be provided with non-slip deck surfaces free of trip hazards, and handrails, hand grabs or other means in accordance with ISO 8468: 2007, Ships and marine technology – Ships bridge layout and associated equipment – Requirements and guidelines.	
20	All doors shall be operable with one hand and shall have ‘holdbacks’ in the open position. External doors shall not be self-closing.	External doors to the enclosed Bridge are usually watertight (and gastight) doors. They are likely to be heavy, may not be hung vertically and must have easy to use holdbacks, or an equivalent means, to prevent them closing on personnel passing through.
21	The Bridge design shall include appropriate stowages for prescribed personnel safety equipment.	
	Note: They shall also comply with Chapter VII Regulation 9 of the Code.	
22	Design of the Bridge deck shall include toilet facilities, and the means of making warm or cold drinks, on the Bridge or immediately adjacent to it in accordance with ISO 8468: 2007, Ships and marine technology – Ships bridge layout and associated equipment – Requirements and guidelines.	

Regulation 3 Bridge Design and Arrangement

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	The design and arrangement of a ship's navigation Bridge, related control positions and spaces, navigational systems and equipment shall ensure that the operators are enabled to perform expeditious, continuous and effective information processing and decision making for maintaining a proper lookout and the conduct of safe navigation without fatigue.	Requirement origin: • SOLAS V/15 • COLREGs Rule • NSC Chapter IV/16 • ISO 8468: 2007, Ships and marine technology – Ships bridge layout and associated equipment – Requirements and guidelines • Class Rules
Performance Requirements		
2	The design of the ship's Bridge, navigational systems and equipment, and the arrangement of those systems and equipment within the Bridge shall:	Requirement origin: • SOLAS V/15 • IMO Resolution A.575(14) • IMO Resolution A.1024(26) • SN.1/Circ.288 • HSC Code Ch 13 • MSC.222(82)
2.1	facilitate the tasks to be performed by the Bridge team and pilot in making full appraisal of the situation and in navigating the ship safely under all operational conditions;	Requirement origin: • ISO 8468: 2007, Ships and marine technology – Ships bridge layout and associated equipment – Requirements and guidelines • ISO/IEC 17894: 2005, Ships and marine technology – Computer applications – General principles for the development and use of programmable electronic systems in marine applications. • ISO 17899: 2004, Ships and marine technology – Marine electric window wipers • The latest version of IEC 60447, Man-machine interface – Actuating principles
2.2	promote effective and safe Bridge Resource Management;	

2.3	enable the Bridge team and pilot to have convenient and continuous access to essential information which is presented in a clear, unambiguous manner, using standard symbols and coding systems for controls and displays;	Requirement origin: • The latest version of IEC 62288, Maritime navigation and radiocommunication equipment and systems – Presentation of navigation-related information on shipborne navigational displays – General requirements, methods of testing and required test results • The latest version of IEC 61209, Maritime navigation and radiocommunication equipment and systems – Integrated bridge systems (IBS) – Operational and performance requirements, methods of testing and required test results • The latest version of IEC 61924, Maritime navigation and radiocommunication equipment and systems – Integrated Navigation Systems
2.4	indicate the operational status of automated functions and integrated components, systems and/or sub-systems;	Requirement origin: • The latest version of IEC 61209, Maritime navigation and radiocommunication equipment and systems – Integrated bridge systems (IBS) – Operational and performance requirements, methods of testing and required test results • Resolution MSC.302(87)
2.5	allow for expeditious, continuous and effective information processing and decision making by the Bridge team and pilot;	Requirement origin: • The latest version of IEC 62288, Maritime navigation and radiocommunication equipment and systems – Presentation of navigation-related information on shipborne navigational displays – General requirements, methods of testing and required test results • ISO/IEC 17894: 2005, Ships and marine technology – Computer applications – General principles for the development and use of programmable electronic systems in marine applications.
2.6	prevent, or minimise, excessive or unnecessary work and any conditions or distractions on the Bridge which may cause fatigue or interfere with the vigilance of the Bridge team and the pilot (especially light pollution which compromises the ocular dark adaptation of the Bridge team or is incompatible with the use of Night Vision devices);	Requirement origin: • ISO 16273:2003, Ships and marine technology - Night vision equipment for high-speed craft - Operational and performance requirements, methods of testing and required test results • The latest version of IEC 61174, Maritime navigation and radiocommunication equipment and systems - Electronic chart display and information system (ECDIS) - Operational and performance requirements, methods of testing and required test results
2.7	minimise the risk of human error and detect such error, if it occurs, through monitoring and alarm systems, in time for the Bridge team and pilot to take appropriate action;	Requirement origin: • The latest version of IEC 62616 - Bridge navigational watch alarm system (BNWAS) • ISO 2412: 1982, Shipbuilding – Colours of indicator lights

3	The ship's navigation Bridge should (and in vessels over 55 metres in length, shall) provide a 360 degree view of the horizon to a standing operator with a maximum of one change of position within the enclosed area.	Requirement origin: • SOLAS V/22 • ISO 8468: 2007, Ships and marine technology – Ships bridge layout and associated equipment – Requirements and guidelines • Class Rules Framing between navigation Bridge windows shall be kept to a minimum and not be installed immediately forward of any work station, especially the central conning position
	Note: External doors shall not impede this visibility requirement.	
4	A means of viewing the ship's side at the waterline shall be provided on the Bridge.	This may be by means of a window set in the deck and/or bulkhead of the Bridge wing. The view may be provided within the enclosed Bridge as part of a near field surveillance camera system
5	There shall be a method of observing the launch positions (davits) of boats from the Bridge and Bridge wing by day and night.	
6	There shall be a method of observing the flight deck by day and night.	
7	Where a rescue station from which the Swimmer of the Watch will operate is provided in accordance with Chapter VII, Regulation 27, Paragraph 10, this position shall be visible from the Bridge or Bridge wings.	
8	Windows shall meet the following requirements:	
8.1	there should be provision of 'look up' windows, inclined from the vertical plane, top in, at an angle of not less than 10 deg and not more than 40 deg, around the covered wheelhouse, especially in Destroyer and Frigate sized vessels and smaller vessels;	In the style of tug wheelhouse windows.
8.2	there shall be a clear view through at least two of the navigation Bridge front windows and depending on the Bridge configuration, an additional number of clear view windows shall be provided at all times, regardless of weather conditions.	Requirement origin: • SOLAS V/22.9.4 This may be achieved either by a system for heating, washing and wiping some or all of the windows, or by the use of ‘Kent’ screens, or equivalent, in appropriate windows.

9	Ships of unconventional design which, in the opinion of the Naval Administration, cannot comply fully with this Code shall be provided with a level of visibility that is as near as practicable to that prescribed in this Code.	
10	Electrical and electronic equipment, including portable electrical and electronic equipment, provided for use on, or near, the Bridge shall:	Requirement origin: • IMO Resolution A.813(19)
10.1	have been tested for electromagnetic compatibility;	Requirement origin: • The latest version of IEC 60945, Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results. • The latest version of IEC 61000, Electromagnetic compatibility • Class Rules e.g. DNV Rules for Naval surface Craft Pt 6 Ch 17 Section 4
10.2	be so installed or operated that electromagnetic interference does not affect the proper function of navigational systems and equipment;	Requirement origin: • The latest version of IEC 60945, Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results. • The latest version of IEC 60533, Electrical and electronic installations in ships – Electromagnetic compatibility.
10.3	in the case of passive electronic equipment, be provided with an exemption statement in place of evidence of electromagnetic compatibility (e.g. cables, purely resistive loads and batteries).	To be agreed with the Naval Administration
11	The ship's navigation bridge shall be arranged such that access to it and the bridge wings, movement around and escape from it is unobstructed and hazard free.	Requirement origin: • Class Rules
	Note: Access shall also comply with Chapter VII Regulation 16 of this Code.	
12	Workstations for navigation are to be arranged to facilitate the conduct of safe navigation, manoeuvring and other functions allocated to the Bridge from any normal working position.	Requirement origin: • IMO Resolution MSC.191(79) • Class Rules Other functions may include Platform Management and Warfare.

13	It shall be possible to control the steering and propulsion from the navigation Bridge in accordance with the requirements of Regulation 5.	The Naval Administration may direct that steering and propulsion can, in addition, be controlled from the Bridge wings.
14	At least one of the screens for presentation of WECDIS or radar shall be mounted near the conning position in 'portrait' orientation in order to optimise the functionality of the WECDIS Anti-Grounding Cone (AGC) and promote 'head up' working.	
15	Where a chair is installed at a workstation, operations shall be capable of being conducted in both the standing and seated positions by operators of any size.	Requirement origin: • Class Rules
16	Bridge seating shall meet the shock and vibration criteria required of seats provided in the Operations, and other Control Rooms.	
17	Sufficient provision for the temporary, secure stowage and immediate access to equipment such as AGR bags, Action overalls, Anti-flash, etc. shall be made.	
18	The navigation Bridge and its external extensions shall be arranged such that an operator has immediate access to the vessel's internal communications network.	Inclusion of system control panels at the principal workstations on the Bridge and its extensions as agreed with the Naval Administration.
	Note: Access shall also comply with Chapter VIII Regulation 6 of this Code.	
19	The navigation Bridge and its external extensions shall be arranged such that an operator has immediate access to the vessel's external communications network.	Inclusion of communication system control panels at the principal workstations on the Bridge and its extensions as agreed with the Naval Administration. Siting of external communications equipment (IMM VHF, MF, HF [IMM and Aero]) within the Bridge Alarms are such that they may be efficiently monitored and operated by either dedicated communications operators or the navigation watch operators.
	Note: Access shall also comply with Chapter VIII Regulation 2 of this Code.	

20	At least two independent methods shall be provided for communicating orders from the navigation Bridge to the position in the machinery space or control room from which the speed and direction of thrust of the propellers are normally controlled; one of these shall be an engine-room telegraph which provides visual indication of the orders and responses both in the machinery spaces and on the navigation Bridge. Appropriate means of communication shall be provided from the navigation Bridge to any other position from which the speed or direction of the thrust of the propellers may be controlled.	Requirement origin: • SOLAS II-1/ 37 • Class Rules
	Note: Communications shall also comply with Chapter IV Regulations 5 and 13 of this Code	
21	At least two independent methods of communication shall be provided between the navigation Bridge and the steering gear compartment. Appropriate means of communication shall be provided from the navigation Bridge to any other position from which the steering gear may be controlled.	Requirement origin: • SOLAS II-1/29 • Class Rules
	Note: Communications shall also comply with Chapter IV Regulations 5 and 13 of this Code	
22	Alarms associated with navigation equipment are to be both audible and visual and are to be centralised for efficient identification and management. Repeater displays may be fitted on the Bridge wings and at other appropriate positions on the Bridge where necessary. At least the following alarms are to be provided:	Requirement origin: • IMO Resolution A.830(19) as amended by A.1021(26) • IMO Resolution MSC.302(87) • SN.1/Circ.265 • Class Rules
22.1	Closest Point of Approach;	
22.2	Shallow Depth;	
22.3	Waypoint approaching (where automatic track follow is provided);	

22.4	Off-course;	
22.5	Off-track (where automatic track following is provided);	
22.6	Steering alarms;	
22.7	Navigation light failure;	
22.8	Gyro failure;	
22.9	Watch safety system failure (where provided);	
22.10	Power supply failure.	
	Note: Alarm systems shall also comply with Regulation 2 and Chapter IV Regulation 14 of this Code.	
23	In addition to any displays presented as part of an integrated navigation or control system the following indicators are to be provided directly from the relevant machinery or equipment installation:	Requirement origin: • SOLAS II-1/31 • IMO Resolution A.830(19) as amended by A.1021(26) • IMO Resolution MSC.302(87) • SN.1/Circ.265
23.1	for controllable pitch propellers, the propeller pitch applied;	
23.2	Speed and direction of shaft rotation;	
23.3	where lateral or directionally controllable thrusters are installed, the proportion of full thrust being generated;	
23.4	where, lateral or directionally controllable thrusters are installed, the direction of thrust;	
23.5	for each rudder, the rudder angle demanded and achieved;	
23.6	rate of turn;	Requirement origin: • IMO Resolution A.526(13) • IMO Resolution A.694(17)
23.7	heading;	
23.8	the status of electrical motors of electric and electrohydraulic steering gear.	
24	An emergency source of power capable of supporting for up to 36 hours navigation equipment and systems shall be available to the navigation Bridge and extensions.	Requirement origin: • SOLAS II-1/42. The Naval Administration may accept that the power supply lasts for a lesser period and, if they do so, shall ensure that suitable justification is in place.

	Note: Power supplies shall also comply with Chapter VIII Regulation 4 and IV Regulation 9 of this Code	
25	Local uninterruptable power supplies capable of supporting for up to 30 minutes navigation and safety equipment and systems susceptible to discontinuities in power supply shall be provided.	
26	Provision shall be made for temporary stowage in the Bridge of not less than 12 hand launched, red para-illuminant flares.	
27	The navigation Bridge and extensions and other navigation related spaces shall be protected against the ingress of solids, liquids and gases. The Naval Administration may also require these spaces to be protected against Chemical, Biological, Radiological and Nuclear (CBRN) hazards.	
	Note: Ingress protection shall also comply with Chapter II, Chapter III Regulations 2 and 7 and Chapter IV Regulation 23 of this Code.	
28	Equipment and systems provided for the safety of navigation shall be protected against the of ingress of solids, liquids and gases appropriate to their location. The Naval Administration may also require these equipments and systems to be protected against CBRN hazards.	A wholly enclosed Bridge extending the width of the ship facilitates the use of instrumentation and controls which might be difficult, or impossible, to adequately protect if installed in exposed locations such as open Bridge wings
Solutions		
29	The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	

30	The Bridge and Bridge wings shall be designed so as to comply with ISO 8468: 2007, Ships and marine technology – Ships bridge layout and associated equipment – Requirements and guidelines, the latest version of IEC 62616 - Bridge navigational watch alarm system (BNWAS), ISO 22555: 2007 – Ships and marine technology – Propeller pitch indicators, ISO 22554: 2007 – Ships and marine technology – Propeller shaft revolution indicators – Electric type and electronic type, ISO 20673: 2007 – Ships and marine technology – Electric rudder angle indicators, ISO 20672: 2007 – Ships and marine technology – Rate of turn indicators, latest version of IEC 60945, Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results and latest version of IEC 61162 Maritime navigation and radiocommunication equipment and systems – Digital interfaces series, SN.1/Circ.288 (Bridge Equipment and Systems) and MSC.302(87) (Bridge Alert Management) paying particular attention to:	The Naval Administration may consider revising the height of eye subject to its own anthropometric requirements. The Naval Administration may accept non Type Approved equipment with appropriate justification.
30.1	The design shall include space for the temporary stowage of portable equipment, instruments, foul weather clothing, hooks, cupboards, seat backs, etc;	
30.2	There shall be a clear passage from bridge wing to bridge wing that is at least 1200 mm wide that is clear of the main conning workstation;	
30.3	There shall be a direct access to the front of the Bridge from the main conning position of not less than 800 mm width;	

30.4	Irrespective of other performance criteria, all navigation related equipment installed shall be Type Approved against the appropriate International Standard and shown also to comply when part of an integrated system;	
30.5	Where the Bridge has open Bridge wings, access to the Bridge from the upper deck shall be possible via both wings;	
30.6	The provision of a centralized alarm management panel adjacent to the Officer Of the Watch's (OOW's) or primary conning position.	
31	There shall be direct line of view of boat launch positions from the Bridge and Bridge wing. Where direct line of view is not possible a near field surveillance camera system shall be installed.	Boat launch positions includes davits, falls and water level. Where a view of boat launch position is not available by direct sight or surveillance camera system then the Naval Administration should ensure procedures are in place to ensure safe launch and recovery of boats. The Naval Administration may also require a method of viewing other locations such as RAS positions, anchoring/mooring positions etc.
32	There shall be direct line of view of the flight deck from the Bridge and Bridge wing. Where direct line of view is not possible a near field surveillance camera system shall be installed.	Where a view of the flight deck is not available by direct sight or surveillance camera system then the Naval Administration should ensure procedures are in place to ensure safe launch and recovery of aircraft.
33	Where the design includes an Integrated Navigational Bridge System (INBS) it shall be built in accordance with IEC 61209: 1999 Maritime navigation and radiocommunication equipment and systems – Integrated bridge systems (IBS) – Operational and performance requirements, methods of testing and required test results.	The Naval Administration may direct that identical multifunction consoles be used at all workstations. *Recommendation for Application of SOLAS Regulation V/15 - Bridge Design, Equipment Arrangement and Procedure (BDEAP),* IACS REC No. 95 may be used as guidance.
34	Means of communicating between the navigation Bridge, its outstations and positions from which control of steering and machinery can be exercised shall be considered as part of the whole ship internal communications matrix.	

35	Utilisation of the same type of seating, and the method of securing it, as used in the Operations Room and other Control Rooms.	As agreed with the Naval Administration.
36	The vessel's power generation and distribution system shall be so designed that there are at least two sources of supply from the primary system to all equipment and that there is also an emergency source, independent of the primary system. Equipment susceptible to fluctuation or discontinuity in supply shall be provided with a dedicated UPS.	Some equipment may have UPS as an integral component.
37	An open basket type stowage, or equivalent, with sufficient capacity for a box of flares in their primary packaging shall be provided.	The Naval Administration may waive this requirement if Bridge operators have immediate access to an explosives Ready Use locker on the Upper Deck adjacent to the Bridge.
38	The Bridge structure and its equipment shall be constructed in compliance with the Ingress Protection Code appropriate to their location.	

Regulation 4 Navigation Safety - Geospatial, Temporal & Environmental Awareness

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	The ship shall be provided with sufficient sensors and systems to continuously and accurately determine, display and record its present time, position, orientation and movement in relation to the Earth and the rate of change of the parameters measured to ensure safe, independent navigation.	Requirement origin: • MSC Circ.982 • IMO Resolution A.529(13) • IMO Resolution MSC 64(67), Annex 1 • Class Rules e.g. DNV Class Rules for Ships/High Speed, Light Craft and Naval Surface Craft Recording may be by Voyage Data Recorder (VDR).
2	The ship shall be provided with appropriate sensors and processing equipment to adequately measure, analyse, assess, display and record its physical environment for the conduct of safe navigation.	Recording may be by VDR
Performance Requirements		
3	The ship shall have one, or more, precise time generator(s), or other means, suitable for maintaining and displaying platform time continuously throughout the intended voyage, which automatically synchronises ship's time with UTC and may be interfaced with the GNSS or terrestrial navigation receivers installed.	
4	The ship, shall have the means to transmit heading information for input to, at least, a display at the main steering position, the navigational radar, an electronic plotting aid, or equivalent, the WECDIS, (W)AIS equipment and a recording facility. The heading shall be correctable to True at all times	Requirement origin: • IMO Resolution MSC.86(70) • IMO Resolution MSC.116(73) • IMO Resolution MSC 166(78) Recording may be by VDR. The Naval Administration may require minor vessels to be fitted with a THD where their intended operations dictate.

5	The ship shall be able to determine, at all times, its heading and display the reading at the main, secondary and emergency steering positions. The equipment shall be capable of correcting headings to True at all times.	Requirement origin: • IMO Resolution A.382(X) • IMO Resolution A.694(17) The Naval Administration should determine what type, or combination of types, of compass is fitted according to the size of the vessel and its intended operational activity (CONOPS).
6	The ship shall be provided with one, or more, speed and distance measuring equipment (SDME), or other means, to be able to determine, display and record its speed and distance travelled through the water in both the fore and aft and athwartships axes and transmit speed information for input to, at least, the navigational radar, an electronic plotting aid, or equivalent, and the WECDIS, (W)AIS and recording equipment.	Recording may be by VDR Requirement origin: • IMO Resolution A.478(XII) • IMO Resolution A.824(19) as amended by MSC.96(72)
7	The ship shall have at least one echo sounder, or other device, for measuring, displaying and recording the available depth of water. Vessels operating in Polar waters shall have two. The equipment shall be capable of transmitting depth information to the ship's WECDIS and Voyage Data Recorder (VDR).	Recording may be by VDR Requirement origin: • IMO Resolution A.224(VII) as amended by MSC.74(69) Annex 4.
8	The ship shall have a method of measuring, displaying and recording its rate of turn and transmit rate of turn information for input to, at least, the navigational radar, automatic radar plotting aid, or equivalent, and the (W)AIS and VDR equipment.	Recording may be by VDR Requirement origin: • IMO Resolution A.526(13)

9	The ship shall have one, or more, receivers for one, or more, global navigation satellite systems (GNSS), suitable for use at all times throughout the intended voyage, including the capability to utilise 'differential' data, which automatically establishes and updates the ship's position and transmits positional information for input to, at least, the navigational radar, an electronic plotting aid, or equivalent, and the WECDIS, (W)AIS, appropriate GMDSS transmitters and VDR equipment. The equipment may be combined with the receiver(s) for civil terrestrial radionavigation installed.	Requirement origin: • IMO Resolution A.819(19) as amended by IMO Resolution MSC.112(73) • IMO Resolution MS.74(69) Annex 1 as amended by IMO Resolution MSC.115(73) • IMO Resolution MSC.64(67) as amended by IMO Resolution MSC.114(73) Antennae are to be so positioned as not to be subjected to EM fields likely to interfere with their efficient operation. It is probable that the GNSS receivers (other than the military ones) and the GMDSS equipment procured will be COTS and Type Approved and therefore able to comply.
	Note: The receiver(s) shall also comply with Chapter VIII Regulation 5 Paragraph 2 of this Code. Note: The Naval Administration shall determine whether the connection is left to stand, is capable of being interrupted as dictated by naval operations, or is permanently disabled upon the justification that, in case of distress, ship's position will be passed by military means.	
10	Where required by the Concept of Operations Statement, ships shall have two, or more, inertial navigation systems, suitable for use at all times throughout the intended voyage, including the capability to navigate at Latitudes higher than 75 degrees, which automatically establishes and updates the ship's position and transmits positional information for input to, at least, the navigational radar, an automatic radar plotting aid, or equivalent, and the WECDIS, (W)AIS and VDR equipment.	

11	The ship shall have one, or more, receivers for one, or more, terrestrial navigation systems, suitable for use during the intended voyage, including the capability to utilise 'differential' data, which automatically establishes and updates the ship's position and transmits positional information for input to, at least, the navigational radar, an electronic plotting aid, or equivalent, and the WECDIS, (W)AIS, appropriate GMDSS transmitters and VDR equipment. The equipment may be combined with the receiver(s) for civil GNSS installed.	Requirement origin: • IMO Resolution A.818(19) • IMO Resolution A.815(19) • IMO Resolution A.694(17) • IMO Resolution A.529(13) Antennae are to be so positioned as not to be subjected to EM fields likely to interfere with their efficient operation. It is likely that the terrestrial receiver and the GMDSS equipment procured will be COTS and Type Approved and therefore able to comply. The Naval Administration shall determine whether the connection is left to stand, is capable of being interrupted as dictated by naval operations, or is permanently disabled upon the justification that, in case of distress, ship's position will be passed by military means.
	Note: The receiver(s) shall also comply with Chapter VIII Regulation 5 Paragraph 2 of this Code.	
12	The ship shall have one, or more, receivers for one, or more, global navigation satellite systems suitable for use at all times throughout the intended voyage, including the capability to utilise 'limited access signals' (such as PPS GPS), which automatically establishes and updates the ship's position and transmits positional information for input to, at least, the navigational radar, an electronic plotting aid, or equivalent, and the WECDIS, (W)AIS and VDR equipment.	Antennae are to be so positioned as not to be subjected to EM fields likely to interfere with their efficient operation.
13	The ship shall have one, or more, gyro-compass bearing repeaters, or other means, to take bearings over an arc of the horizon of 360 degrees from within the enclosed wheelhouse, using the gyro-compass or other means. The repeater shall be directly connected to the WECDIS. The equipment shall be capable of correcting bearings to True at all times.	An 'Electronic Pelorus' provides the ability to input a 'manual' fix into WECDIS efficiently and quickly. Repeaters may also be required on the Bridge wings and at other locations agreed with the Naval Administration.

14	The ship shall, in addition to the Transmitting Heading Device (THD), or other means, have a gyro-compass, or other means, to determine and display its heading by shipborne non-magnetic means, clearly readable by the helmsman at each steering position. These means shall also transmit heading information for input to the navigational radar, WECDIS, WAIS, automatic radar plotting aid and recording equipment. The gyro, or equivalent, shall be capable of operation at high latitudes (above 75 degrees).	Requirement origin: • IMO Resolution A.424(XI) • IMO Resolution A.821(19) • IMO Resolution A.694(17) Recording may be by VDR.
15	The ship shall be fitted with a warship electronic chart display and information system (WECDIS) to facilitate the planning, execution and recording of an intended voyage so as to take account of relevant ship's routing systems, ensure sufficient searoom for safe passage, anticipate all known navigational hazards and adverse weather conditions, take into account the marine environmental protection measures that apply, and avoid, as far as possible, actions and activities which could cause damage to the environment.	Requirement origin: • IMO Resolution A.893(21) • IMO Resolution A.694(17) • IMO Resolution A.817(19), as amended by IMO Resolution MSC 64(67), Annex 5 and IMO Resolution MSC 86(70), Annex 4.
	Note: The Naval Administration shall define the extent of the 'warship' functionalities as captured in STANAG 4564. Note: If a single WECDIS is fitted a back-up system is required; either a further independent WECDIS or paper charts.	

16	The WECDIS equipment provided shall be capable of use for navigation at high latitude (above 75 degrees). The ship shall be provided with adequate and up to date nautical publications, or other means, necessary for the planning and execution of the intended voyage. Access to the publications shall not be denied in the event of complete WECDIS failure.	
17	The ship shall have a ship's Log-book, or other means, to retain onboard a record of navigational activities and incidents which are of importance to safety of navigation and which must contain sufficient detail to restore a complete record of the voyage. When such information is not contained in the ship's log-book it shall be maintained in another form approved by the Naval Administration.	Requirement origin: • SOLAS V/28
18	Ships shall have an Operator Guidance System, or other means, to measure, display, record and analyse, in real time, the vessel's behaviour in the prevailing conditions of wind and sea so as to better determine its stability and identify combinations of course and speed which will preserve stability and enable the safe conduct of evolutions constrained by motion limitations.	The most useful Operator Guidance System output is a polar diagram showing areas of where acceptable motion should be achieved which may be displayed as an overlay on the WECDIS.
19	The ship shall have a device for measuring, displaying and recording the angle of heel. The equipment may be part of the Operator Guidance System, if fitted.	
20	The ship shall have a device for measuring, displaying and recording the angle of pitch. The equipment may be part of the Operator Guidance System, if fitted.	

21	The ship shall have means to collect, examine, disseminate and exchange high resolution meteorological and ice data, including imagery, at sea. The ship shall have a facsimile receiver, or other means, to receive, in both text and graphic form, meteorological information and forecasts and, when appropriate, Ice Patrol products, some of which should be capable of being displayed on WECDIS. The ship shall have sufficient, tested, meteorological instruments (such as a barometer, a barograph, a psychrometer, a hygrometer, thermometers, an anemometer and suitable apparatus for measuring sea temperature) to take, record, and transmit meteorological observations at the main standard times for surface synoptic observations.	
22	The ship shall be provided with a receiver capable of receiving international NAVTEX service broadcasts automatically if the naval ship is engaged on voyages in any area in which an international NAVTEX service is provided. The NAVTEX receiver shall be capable of exchanging data directly with the WECDIS such that message content will be automatically displayed at a chart presentation. The receiver may be part of the vessel's GMDSS installation.	Antennae are to be so positioned as not to be subjected to EM fields likely to interfere with their efficient operation. Requirement origin: • SOLAS IV/7.5
	Note: The receiver(s) shall also comply with Chapter VIII Regulation 2 Paragraph 3.4 of this Code	

23	The ship shall be provided with adequate and up to date nautical charts and publications, or other means, necessary for the planning and execution of the intended voyage so as to take account of relevant ship's routing systems, ensure sufficient searoom for safe passage, anticipate all known navigational hazards and adverse weather conditions, take into account the marine environmental protection measures that apply, and avoid, as far as possible, actions and activities which could cause damage to the environment, whilst navigating to a safe haven in the event of complete loss of WECDIS. If an appropriate folio of paper nautical charts is provided the navigation Bridge shall be provided with a suitable table and storage for chartwork.	
Solutions		
24	The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	
25	All equipment provided for sensing, measuring, processing and recording shall be compliant with the latest version of IEC 60945, Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results and the latest version of IEC 61162 Maritime navigation and radiocommunication equipment and systems – Digital interfaces series.	It is a requirement that this equipment is Type Approved.

26	The ship shall be provided with one, or more, precise time and frequency generating equipment to a specification agreed with the Naval Administration.	
27	The ship, if not fitted with a gyro compass, shall be provided with one, or more, transmitting heading device compliant with ISO 22090:2002, Ships and marine technology – Transmitting heading devices (THDs) series and ISO 11606 – Ships and marine technology – Marine electromagnetic compasses.	It is a requirement that this equipment is Type Approved.
28	The ship shall be provided with a properly adjusted standard magnetic compass independent of any primary power supply, or other means approved by the Naval Administration, compliant with ISO 1069: 1973, Magnetic compasses and binnacles for sea navigation - Vocabulary or ISO 25862: 2009 – Ships and marine technology – Marine magnetic compasses, binnacles and azimuth reading devices as appropriate.	It is a requirement that this equipment is Type Approved.
29	The ship shall be provided with Speed and Distance Measuring Equipment compliant with the latest version of IEC 61023, Maritime navigation and radiocommunication equipment and systems - Marine speed and distance measuring equipment (SDME) - Performance requirements, methods of testing and required test results.	It is a requirement that this equipment is Type Approved.
30	The ship shall be provided with Echo Sounders compliant with ISO 9875: 2000, Ships and marine technology – Marine echo-sounding equipment.	It is a requirement that this equipment is Type Approved.
31	The ship shall be provided with a Rate of Turn indicator compliant with ISO 20672: 2007, Ships and marine technology – Rate of turn indicators.	It is a requirement that this equipment is Type Approved. The Naval Administration should determine the means of determining rate of turn according to the size of the vessel and its intended operational activity (CONOPS).

32	The ship shall be provided with GNSS receivers compliant with the latest version of IEC 61108 Maritime navigation and radiocommunication equipment and systems - Global navigation satellite systems (GNSS) series. Receivers intended to utilise 'limited access' signals shall also comply with additional Defence standards as agreed with the Naval Administration.	It is a requirement that this equipment is Type Approved.
33	The ship shall be provided with terrestrial radionavigation receivers compliant with the latest version of IEC 61075, Loran-C receivers for ships - Minimum performance standards - Methods of testing and required test results.	It is a requirement that this equipment is Type Approved. Requirement origin: • STANAG 4294: 1993 Navstar Global Positioning System (gps)
34	The ship shall be provided with one, or more, inertial navigation systems to a specification agreed with the Naval Administration.	
35	The ship shall be provided with gyro repeaters compliant with ISO 449: 2000, Ships and Marine Technology – Magnetic compasses, binnacles and azimuth reading devices – Class A, ISO 613: 2001, Ships and Marine Technology – Magnetic compasses, binnacles and azimuth reading devices – Class B, ISO 25862: 2009, Ships and Marine Technology – Marine Magnetic compasses, binnacles and azimuth reading devices.	It is a requirement that this equipment is Type Approved.
36	The ship shall be provided with gyro compasses compliant with ISO 8728: 1999, Ships and marine technology – Marine gyro-compasses or ISO 16328: 2001, Ships and Marine Technology – gyro-compasses for high speed craft as appropriate.	It is a requirement that this equipment is Type Approved.

37	The ship shall be provided with a warship electronic chart display and information system compliant with the latest version of IEC 61174, Maritime navigation and radiocommunication equipment and systems - Electronic chart display and information system (ECDIS) - Operational and performance requirements, methods of testing and required test results , ISO 22472; 2006, Ships and marine technology – Guidelines for the operation and installation of voyage data recorders and such additional Defence standards as agreed with the Naval Administration.	It is a requirement that this equipment is Type Approved. The Naval Administration may determine that a commercial ECDIS is sufficient for smaller craft according to their operational activities
38	The ship shall be provided with a means of automatically recording navigation related information compliant with the latest version of IEC 61996, Maritime navigation and radiocommunication equipment and systems - Shipborne voyage data recorder (VDR) - Part 1: Voyage data recorder (VDR) - Performance requirements, methods of testing and required test results and ISO 22472; 2006, Ships and marine technology – Guidelines for the operation and installation of voyage data recorders if a programmable system.	It is a requirement that this equipment is Type Approved. The Naval Administration or statutory law may also require additional and/or manuscript records. Provision of appropriate recording forms rests with the Authority.
39	The ship shall be provided with an Operator Guidance System to a specification agreed with the Naval Administration. A programmable system shall also be compliant with ISO 22472; 2006, Ships and marine technology – Guidelines for the operation and installation of voyage data recorders.	It is a requirement that this equipment is Type Approved.
40	The ship shall be provided with analogue roll and pitch indicators readily visible at the conning position.	Roll and Pitch may also be derived from any Attitude and Heading Reference System installed and /or Operator Guidance System if fitted.

41	The ship shall be provided with a meteorological data facsimile receiver or equivalent compliant with the Recommendations of the CCITT committee of the ITU and/or a meteorological data suite as agreed with the Naval Administration.	
42	The ship shall be provided with suitable certified measuring instruments.	The supply of instruments may be from the Naval Administration.
43	The ship shall be provided with a NAVTEX receiver complaint with the latest version of IEC 61097-6, Global maritime distress and safety system (GMDSS) - Part 6: Narrowband direct-printing telegraph equipment for the reception of navigational and meteorological warnings and urgent information to ships (NAVTEX) The latest version of ETSI 300 065-1; 2009, Electromagnetic compatibility and Radio spectrum Matters (ERM);Narrow-band direct-printing telegraph equipment for receiving meteorological or navigational information (NAVTEX);Part 1: Technical characteristics and methods of measurement and ETSI 301 843-4: 2004, Electromagnetic compatibility and Radio spectrum Matters (ERM);ElectroMagnetic Compatibility (EMC) standard for marine radio equipment and services; Part 4: Specific conditions for Narrow-Band Direct-Printing (NBDP) NAVTEX receivers.	It is a requirement that this equipment is Type Approved.
44	The ship shall be provided with nautical publications and charts issued by a recognised Hydrographic Office to augment or complement the WECDIS. Where a Chart Table is fitted it shall comply with the dimensions in ISO 8468: 2007, Ships and marine technology – Ships bridge layout and associated equipment – Requirements and guidelines.	The supply of Hydrographic products may be from the Naval Administration.

Regulation 5 Operation & Control Systems

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	A ship shall be provided with appropriate means to control propulsion and manoeuvring, navigation and other systems from the Bridge for the conduct of safe navigation, collision avoidance and operational evolutions.	Requirement origin: • SOLAS II-1 Pt C, V
Performance Requirements		
2	An engine-room telegraph (or equivalent) shall be provided between the navigation Bridge and the machinery space.	Requirement origin: • IMO Resolution MSC.137(76)
3	The vessel shall be provided with a means of operating the steering system by hand on the navigation Bridge. The steering system shall be capable of being brought into operation from a position on the navigation Bridge. The system shall be so arranged as to permit, at least, the testing routines laid down in SOLAS Chapter V Regulation 26.	
	Note: The steering system shall also comply with Chapter IV of this Code.	
4	The vessel shall be provided with a sufficient control system, or other means, to enable safe manoeuvring of the vessel from the navigation Bridge or Bridge wings. In particular the control system shall include a means of ordering a reversal of thrust so as to bring the ship to rest within a reasonable distance.	Requirement origin: • COLREGs Rule 6 May extend to include other conning positions for vessels of special purpose or the Dynamic Positioning desk in vessels so equipped.
5	The vessel shall be provided with a heading or track control system, or other means, to automatically control and keep to a heading and/or track.	
6	A Pilot Information Card shall be prepared for the vessel and displayed on the navigation Bridge of the vessel.	

7	When its role demands, the vessel is to be provided with an appropriate, discrete propulsion and manoeuvring control system (Dynamic Positioning system) or equivalent, integrated with the navigation system. The installation of such a system shall not prevent the conventional operation of propulsion and manoeuvring systems when required.	Requirement origin: • Class Rules
8	A system for controlling and monitoring the vessel's navigation and additional signal light arrangements shall be provided. The system shall enable individual lamps to be activated, dimmed, and (where multi-colour lanterns are installed) colour selected. Provision shall be made for the operation of discrete sets of lights. The system shall be capable of automatically changing over lanterns where the selected one has failed. It shall also enable the OOW to control lights from any Bridge workstation. It shall be possible to control the navigation lights from a position other than the navigation Bridge. The system shall include a 'master control panel'. Operation of the master control panel shall not be dependent upon operation of any other bridge system.	Requirement origin: • IMO Resolution MSC.253(83) • Class Rules
9	The vessel shall be provided with at least one adequate searchlight controllable from the navigation Bridge. The vessel shall be provided with a portable daylight signalling lamp, to communicate by light during night and day, maintained ready for use on the navigation Bridge.	Requirement origin: • Class Rules
10	Provision shall be made for the OOW to have overriding control of all lighting on the upper deck (working lights, screen lighting, red lighting).	Including the capability to extinguish all those lights by a single operator action.

11	A system for controlling and monitoring the vessel's sound signalling arrangements shall be provided. The system shall include means for the automatic sounding of prescribed sound signals and enable the manual operation of the combined whistle arrangement or individual whistles. One of the control positions is to be located adjacent to the helmsman's workstation and the primary conning position.	Requirement origin: • COLREGs Rules 32-35, Annex III • Class Rules
12	Facilities to operate the Emergency Alarm Signal from the navigation Bridge shall be provided.	Requirement origin: • Class Rules To be included in the internal and external communications 'point-to-point' matrices.
	Note: The system shall also comply with Chapter VII Regulation 10 of this Code	
13	Facilities to operate the Public Address System from the navigation Bridge (including the Bridge wings and roof) shall be provided.	Requirement origin: • SOLAS II-2 Pt D/1, III/6 • Class Rules To be included in the internal and external communications 'point-to-point' matrices.
	Note: The system shall also comply with Chapter VII Regulations 10 and 11 and Chapter VIII Regulation 7 of this Code	
14	A fixed or portable emergency means of two-way communication between emergency control stations, muster and embarkation stations and strategic positions on board (see Chapter VII) shall be provided from the navigation Bridge.	Requirement origin: • Class Rules To be included in the internal and external communications 'point-to-point' matrices.
	Note: The system shall also comply with Chapter VII Regulation 12 and Chapter VIII Regulations 6 and 8 of this Code	

15	A means of communicating between the navigation Bridge and the machinery control position shall be provided. Facilities to operate the Machinery Broadcast (or equivalent) from the navigation Bridge shall be provided. A means of communicating between the navigation Bridge and the steering gear compartments and the emergency steering positions shall be provided. Facilities to operate the Conning Broadcast (or equivalent) from the navigation Bridge shall be provided.	To be included in the internal and external communications 'point-to-point' matrices.
	Note: The system shall also comply with Chapter VIII Regulation 6 of this Code	
16	The vessel shall be provided with means for controlling IMM VHF radiotelephone channels at the conning position and from the Bridge wings.	To be included in the internal and external communications 'point-to-point' matrices.
	Note: The system shall also comply with Chapter VIII Regulation 2 of this Code	
17	The vessel may be provided with a 'distress panel', or other means, on the navigation Bridge, which, when operated, initiates a distress alert using all radiocommunications installations fitted in the vessel.	To be included in the internal and external communications 'point-to-point' matrices.
	Note: The system shall also comply with Chapter VIII Regulation 2 of this Code	
18	The vessel may be provided with a ship security system, or other means, controllable from the navigation Bridge and at least one other location.	Requirement origin: • SOLAS XI-2/6 The Naval Administration should support non-installation with a certificate of exemption and a justification, perhaps as part of the platform Safety Case. Requirement origin: • Class Rules
	Note: The system shall also comply with Chapter VIII of this Code	

19	A list of the operational limitations applicable to the vessel shall be prepared and be readily available to the Commanding Officer onboard.	Requirement origin: • SOLAS V/30 As agreed by the Naval Administration during the design stage.
20	The vessel may, if capable of operating rotary wing aircraft from a purpose installed Flight Deck, be fitted with a means of exchanging visual signals between the navigation Bridge, Flight Deck and helicopter controller's position for conducting aviation operations.	As agreed by the Naval Administration during the design stage.
21	The vessel may be fitted with a means of exchanging visual signals between the navigation Bridge, seaboat/rescue craft and other craft davit positions for conducting small craft operations.	As agreed by the Naval Administration during the design stage. Such a system will be appropriate in vessels where it is difficult to see the launch point from either the Bridge or the Bridge wing.
22	The vessel may be fitted with a means of exchanging visual signals between the navigation Bridge and the cable or manoevring deck for controlling anchoring.	As agreed by the Naval Administration during the design stage. Such a system will be appropriate especially in vessels where the cable deck is enclosed.
Solutions		
23	The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	
24	The steering gear operating and control system shall be compliant with the principles laid down in IMO Resolution MSC 137(76).	
25	There shall be a manoeuvring control system compliant with the principles laid down in IMO Resolution MSC 137(76).	

26	The vessel shall be provided with a heading or track control system compliant with one of the latest version of IEC 62065, Maritime navigation and radiocommunication equipment and systems – Track control systems – Operational and performance, ISO 16329: 2003, Ships and marine technology – Heading control systems for high speed craft or ISO 11674: 2006, Ships and marine technology – Heading control systems as appropriate to the ship type.	
27	A 'Pilot Information Card' shall be prepared for the vessel, suitable for permanent display on the navigation Bridge, adjacent to the conning and pilot's positions compliant with the requirements of IMO Resolution A.601(15).	The Naval Administration may require additional data to be provided. It shall be possible to remove or mask the Card for security when necessary.
28	A vessel intended to conduct Dynamic Positioning (DP) operations shall be provided with a DP control system compliant with a standard agreed by the Naval Administration.	
29	The vessel shall be provided with a control panel for the monitoring and control of the navigation light arrangements, readily available to the OOW and independent of any other control system and compliant with an agreed Classification Society's rules and any additional requirements of the Naval Administration.	
30	The vessel shall be provided with at least one searchlight and at least one daylight signalling lamp, or a lamp or lamps which combine both functions and are compliant with ISO 17884: 2004, Ships and marine technology – Searchlights for high speed craft.	Unless there is a dedicated signalling deck at least one lamp on, or near, each Bridge wing.
31	The vessel shall be provided with at least one portable daylight signalling lamp operable from the navigation Bridge, which shall comply with a performance standard agreed with the Naval Administration.	

32	The vessel shall be provided with a control panel for the monitoring and control of those Upper Deck lights (working lights, screen lighting, red lighting) which may interfere with the maintenance of lookout or the conduct of safe navigation, readily available to the OOW and independent of any other control system and compliant with an agreed Classification Society's rules and any additional requirements of the Naval Administration.	
33	The vessel shall be provided with a control system for sound signalling arrangements compliant with the rules of a classification Society as agreed with the Naval Authority.	
34	The vessel's Emergency Alarm System and operating functions shall be installed so as to be compliant with Chapter VII of this Code.	
35	Control of a Public Address system compliant with the requirements of Chapter VII and VIII of this Code installed in the ship shall be provided from the navigation Bridge.	
36	Access to and control of the emergency communications system provided in compliance with Chapter VIII of this Code shall be available in the navigation Bridge.	This may take the form of IMM VHF portable radios kept in a charging rack in the Charthouse or similar compartment adjacent to the Navigation Bridge.
37	Provision shall be made for control from the Bridge of the means of communication between the navigation Bridge and machinery control positions installed in compliance with Chapter VIII of this Code.	
38	Means to control the IMM VHF radio installation provided in accordance with Chapter VIII Regulation 2 of this Code, as approved by the Naval Administration, shall be provided near the conning position in the navigation Bridge and on the Bridge wings.	

39	The vessel shall be provided with a GMDSS suite, to be fitted in accordance with Chapter VIII Regulation 2 of this Code, as approved by the Naval Administration.	Where there is a separate communications room which is not continuously manned, a 'distress panel' should be placed on the Bridge
40	If required by the Naval Administration a ship security system compliant with Chapter VIII of this Code shall be installed.	
41	A consolidated list of operational limits applicable to the vessel, its propulsion and steering gear arrangements, anchors and cable and any other data which will assist the Commanding Officer to prevent collision or environmental damage.	Format as agreed with the Naval Administration.
42	The vessel may, if capable of operating rotary wing aircraft from a purpose installed Flight Deck, be fitted with a 'Stop/Go' Light system between the navigation Bridge, Flight Deck and helicopter controller's position for conducting aviation operations compliant with a standard or standards agreed with the Naval Administration.	
43	The vessel may be fitted with a 'Stop/Go' Light system between the navigation Bridge, seaboat/rescue craft and other craft davit positions for conducting small craft operations compliant with a standard or standards agreed with the Naval Administration.	
44	The vessel may be fitted with a 'Stop/Go' light system for controlling anchoring compliant with a standard or standards agreed with the Naval Administration.	

Regulation 6 Resilience and Continuous Availability

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	The ship shall be provided with sufficient equipment to assure that there is resilience and continuous availability in navigation related systems and equipment.	
Performance Requirements		
2	The vessel's spaces, systems and equipment essential to the maintenance of a proper lookout and the conduct of safe navigation shall be so arranged as to ensure high reliability and minimise the risk of mal-operation.	As agreed by the Naval Administration during the design stage.
	Note: The measures to ensure continuous availability shall be appropriate to the size, operational role, area of operations and maximum speed of the vessel.	
3	Machinery, equipment and systems essential to safe navigation shall be so arranged that, as far as is reasonable and practical, they will continue to function correctly and/or be easy to restore in the event of a minimum of a single operational error and/or system/equipment fault.	As agreed by the Naval Administration during the design stage.
4	Equipment necessary for the safety of navigation shall be capable of being accessed for the purpose of routine maintenance to keep it in efficient working order.	As agreed by the Naval Administration during the design stage. The layout of the navigation Bridge and other related compartments shall have due consideration for the access routes and 'maintenance envelopes' of that equipment.
5	There shall be reversionary methods of controlling propulsion and manoeuvring systems from the navigation Bridge and alternative remote and local emergency control positions.	
	Note: The system shall also comply with Chapter IV Regulation 13 of this Code	

6	The angular position of the rudder shall be indicated on the navigation Bridge when reversionary modes of control are in use.	Requirement origin: • Class Rules
	Note: The system shall also comply with Chapter IV Regulation 13 of this Code	
7	The direction of rotation of shafts and/or thrust of the propulsion system shall be indicated on the navigation Bridge when reversionary modes of control are in use.	Requirement origin: • SOLAS II-1 Pt D/42
	Note: The system shall also comply with Chapter IV Regulation 13 of this Code	
8	The navigation light arrangement is to be so designed that it is capable of being powered for up to 36 hours independently of the vessel's primary power supplies.	Requirement origin: • SOLAS II-1 Pt D/42
	Note: The system shall also comply with Chapter IV Regulation 9 of this Code	
9	Portable signalling lamps provided in accordance with Chapter IX Regulation 5 of this Code are to be capable of using an energy source of electrical power not solely dependent upon the vessel's power supply.	Requirement origin: • SOLAS II-1 Pt D/42
	Note: The system shall also comply with Chapter IV Regulation 9 of this Code	
10	The vessel shall be able to utilise available terrestrial radionavigation services during emergency operation.	
	Note: The system shall also comply with Chapter IV Regulation 9 of this Code	
11	The vessel shall be provided with a means of determining and distributing time independent of GNSS positioning systems and the ship’s primary power supply.	
	Note: The system shall also comply with Chapter IV Regulation 9 of this Code	

12	The vessel shall be provided with a means of determining heading and displaying it at the main, secondary and emergency steering positions independent of the primary power supply. The vessel shall be provided with a means for correcting heading and bearings to True at all times.	Requirement origin: • SOLAS V/19
	Note: The system shall also comply with Regulation 4 of this Chapter	
13	There shall be an independent back-up WECDIS.	Requirement origin: • SOLAS V/19
14	If fitted, the Sound Reception System shall be so arranged that it is capable of operating for up to 36 hours independently of the vessel's primary power supply.	Whilst SOLAS II-1/42 does not specifically list the Sound Reception System, it does include intermittent operation of, inter alia, the ship's whistle. It should be possible to listen for, as well as make, sound signals. The Naval Administration may reduce this requirement to 12h.
15	The internal communications facilities required in an emergency shall be so designed that they are capable of being powered for up to 36 hours independently of the vessel's primary power supply. There shall be a means of communicating between the navigation Bridge, the machinery space and the steering gear compartment that is independent of the primary power supply.	Requirement origin: • SOLAS II-1 Pt D/42
	Note: The system shall also comply with Chapter IV Regulation 9 and Chapter VIII Regulation 6 of this Code	
16	When installed under Regulation 5 of this Chapter, a BNWAS shall be capable of being powered for up to 36 hours independently of the vessel's primary power supply.	Requirement origin: • SOLAS II-1/42, V/19

Solutions		
17	The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	
18	The provision of a compartment to be a navigation Bridge arranged in compliance with ISO 8468: 2007, Ships and marine technology – Ships bridge layout and associated equipment – Requirements and guidelines.	
19	As agreed with the Naval Administration the provision of an external Emergency Conning position arranged with the minimum facilities to exercise control of the vessel's manoeuvring and maintain a proper lookout.	To include internal communications – especially to emergency steering and emergency propulsion control positions, a means of taking bearings and method of fixing the vessel's position.
20	The provision of duplicate systems, power supplies , internal communications bearers and instrumentation, reversionary modes of control, alternative control locations and means of automatic reinstatement after loss and restoration of power supplies shall be compliant with the appropriate international standards.	In some circumstances duplication of systems and/or equipment should be based on a different mechanism to the primary system and/or equipment - i.e. the secondary system should be electrically and physically independent from the primary system. The vessel is to be provided with emergency navigation lanterns, which may be permanently installed or capable of being hoisted, to replace defective fixed lanterns. Emergency navigation lights are to be provided with an alternative energy source of electrical power by means of a battery, or other means, independent of the vessel's primary power supply. The navigation light arrangements will be agreed by the Naval Administration by the issuance of a Certificate of Approval.
	Note: The electrical distribution system shall also comply with Chapter IV Regulation 9 and 10 of this Code	
21	Use of intelligent control systems, safety interlocks, consideration of the human element in the design process.	

22	The vessel shall be provided with an independent time (and, if necessary, frequency) generating system. The system shall have at least one alternative power source to the primary supply.	To a standard agreed with the Naval Administration.
23	The vessel shall be provided with a properly adjusted standard magnetic compass, or other means, compliant with ISO 449: 2000, Ships and marine technology – Marine magnetic compasses, binnacles and azimuth reading devices – Class A or ISO 613: 2000, Ships and marine technology – Marine magnetic compasses, binnacles and azimuth reading devices – Class B, approved by the Naval Administration, independent of the primary power supply. The vessel shall be provided with a means for correcting heading and bearings to True at all times.	
24	The navigation Bridge and related systems shall be provided with primary, alternative and emergency power supplies such that safety of navigation is capable of being maintained in a 'dead ship' condition.	
25	Equipment and systems are to be routinely maintained and surveyed.	Requirement origin: • MSC.1/Circ.1252 SOLAS V requires that VDR (including sensors) and (W)AIS have an annual survey. Maintenance schedule and survey intervals to be in accordance with the guidance of the Naval Administration. The Configuration control of software issues, modification states and other methods of managing equipment effectiveness shall be in accordance with instructions issued by the Naval Administration.

Regulation 7 Integrated Bridge

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	If an Integrated Bridge System (IBS), Integrated Navigation System (INS), or both (INBS), is installed, the system shall be capable of presenting all relevant information necessary for the conduct of safe navigation, manoeuvring and collision avoidance to ensure that additional hazards are not introduced as a result of installing or operating the system.	
Performance Requirements		
2	The INBS shall be designed, constructed and able to be maintained so as to maintain a proper lookout, sustain safe conduct of navigation and manoeuvre as required.	Requirement origin: • SOLAS V • HSC • COLREGs
	Note: The system shall also comply with Regulation 1 paragraph 3 of this Chapter.	
3	The INBS shall be so arranged that its performance is at least equivalent to the performance required of the individual components and sub-systems by IMO Resolutions and international standards.	Requirement origin: • Class Rules
4	The INBS shall be such as to permit operating crew members to perform their duties in a correct manner without unreasonable difficulty, fatigue or concentration, and to minimize the likelihood of injury to operating crew members in both normal and emergency conditions.	Requirement origin: • SOLAS V/15 • HSC Paragraph 15.2 • Class Rules
5	The INBS shall contain equipment which provides relevant information to enable the officer in charge and any assisting officer or other crew member or pilot to carry out navigational and safety functions safely and efficiently.	Requirement origin: • Class Rules

6	Instruments, equipment and controls shall be so installed that they remain functional, visible to the operator and operable in heavy seas or after subjection to vibration or shock and will not present a loose object hazard to the operators.	Requirement origin: • HSC Ch 15.5.1
7	All instruments and equipment shall be installed so as to reduce to a minimum the risk of human error.	Requirement origin: • SOLAS V/15.7 • HSC Code 15.5.2
8	Instruments and equipment shall not be rationalized by sharing functions or by inter-switching.	Requirement origin: • HSC Paragraph 15.5.2
9	The Bridge operators and/or pilot shall be provided with immediate and easily recognisable annunciation of fault conditions, including human error, in time to take appropriate action and to permit 'alarm management'.	Requirement origin: • SOLAS V/15.7 • Class Rules
10	The operators shall be presented with consistent warning annunciation across all the vessel's systems.	
	Note: The system shall also comply with Regulation 5 of this Chapter	
11	A failure of one part of the system, or parts of other systems integrated with the INBS shall not affect the functionality of other parts except for those functions directly dependent upon the information from the defective part.	
12	Programmable electronic systems shall be robust, resilient to at least one operator error and able to continue functioning in extremis.	
	Note: The system shall also comply with Chapter IV Regulation 15 of this Code	
13	The navigation systems and equipment shall be able to function whether or not the ship's combat functions are available.	Requirement origin: • Class Rules

	Note: Failure of the INBS shall not interfere with the operation of the combat functions.	
14	It shall be possible, by a 'single operator action' function, to remove all tactical data that may have been transmitted to the INBS by the Command System.	
15	The ship shall be provided with appropriate communications equipment, including daylight signalling lamp(s), for the transmission and receipt of distress messages.	Requirement origin: • IAMSAR Manual • ISO 25861: 2007, Ships and marine technology – Navigation – Daylight signalling lamps
	Note: The equipment shall also comply with Chapter VIII of this Code	
16	The ship shall be provided with appropriate communications equipment, including daylight signalling lamp(s), for the transmission and receipt of lifesaving messages.	Requirement origin: • SOLAS V/8 The Naval Administration should determine whether the connection is left to stand, is capable of being interrupted as dictated by naval operations, or is permanently disabled upon the justification that, in case of distress, ship's position will be passed by military means.
	Note: The equipment shall also comply with Chapter VIII of this Code	
17	Bridge and communications operators shall have instant access to the appropriate message formats and codes for messages relating to distress and lifesaving.	Requirement origin: • SOLAS V/21
Solutions		
18	The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	

19	The INBS shall be designed, constructed and installed in accordance with the latest version of IEC 61209, Maritime navigation and radiocommunication equipment and systems – Integrated bridge systems (IBS) – Operational and performance requirements, methods of testing and required test results, the latest version of IEC 61924, Maritime navigation and radiocommunication equipment and systems – Integrated Navigation Systems, the HSC Paragraph 15.4.11 and the standards for operational performance of the individual components.	
20	Instruments, equipment and controls shall be permanently mounted in consoles or other appropriate places, taking into account operation, maintenance and environmental conditions.	This shall not prevent the use of new control or display techniques, provided the facilities offered are not inferior to recognized standards.
21	All instruments and equipment shall be logically grouped according to their functions and shall not be rationalized by sharing functions or by inter-switching.	
22	Instruments and equipment shall be plainly visible and easily read in daylight and in darkness, with the minimum risk of confusion under all operating conditions in compliance with the latest version of IEC 62288, Maritime navigation and radiocommunication equipment and systems – Presentation of navigation-related information on shipborne navigational displays – General requirements, methods of testing and required test results and HSC Chapter 15.	
23	The INBS shall include a monitoring and alarm system which employs warning annunciations consistent with the monitoring systems of other ship's equipment.	

24	The utilisation of programmable electronic systems compliant with ISO 17894: 2005, Ships and marine technology – Computer applications – General principles for the development and use of programmable electronic systems in marine applications..
25	The navigation systems and equipment shall be so arranged that they are not dependent upon ship's combat systems being available.
26	The daylight signalling lamps installed as part of the INBS shall be compliant with ISO 25861: 2007, Ships and marine technology – Navigation – Daylight signalling lamps.
27	Use of intelligent control systems, safety interlocks, consideration of the human element in the design process.
28	The Ship shall be provided with copies of the International Code of Signals and the IAMSAR Manual, in whatever medium they are available, such that they are instantly accessible to the Bridge and communications personnel.

Regulation 8 Data Communication

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	The ship shall be fitted with equipment and systems in order to receive, transmit, record and analyse data, in recognised formats, relevant to safe navigation.	Requirement origin: • IMO Resolution A.86(20)
Performance Requirements		
2	The ship shall be fitted with a means for recording all navigation related data for a period of at least 12 hours such that the sensor presentations, internal and external voice communications, Bridge staff decision making process and the vessel's movements might be adequately re-constructed if necessary.	Requirement origin: • SOLAS V/14,20 and 28 The Naval Administration should consider this when determining the vessel's wider operational; recording requirements. Where the Naval Administration determines that a VDR shall not be fitted it shall issue an appropriate exemption Certificate and include a justification which may be part of the Safety Case.
3	The vessel shall be provided with systems/equipment to support the regular reporting of its position and movement to the appropriate command. The position of a naval vessel is confidential, therefore a commercial Long Range Identification and Tracking (LRIT) system is not required for naval ships.	The Naval Administration should record the dispensation by means of a Certificate and supporting justification, which may be a Fleet wide policy statement. The Naval Administration shall determine by what means the vessel shall be able to utilise the product of LRIT data
4	Irrespective of size, the ship shall be capable of the automatic transmission and reception of specified navigation and safety-related information to and from appropriately equipped ships, aircraft and shore stations The system shall:	Requirement origin: • SOLAS V/18, 19
4.1	monitor and track ships;	
4.2	be so arranged that information exchanged shall be available to both the Bridge and the Operations Room.	Requirement origin: • Resolution MSC.74(69) Annex 3 • The latest version of IEC 61993 – Maritime navigation and radiocommunication equipment and systems – Automatic Identification systems (AIS)

	Note: The equipment shall also comply with Chapter VIII of this Code	
5	Irrespective of size, the vessel should be capable of the automatic transmission and reception of specified navigation and safety-related information to and from appropriately equipped ships, aircraft and shore stations and able to process that data as part of naval operations. The system shall:	Requirement origin: • SOLAS V/18, 19
5.1	be able to be controlled from the Operations Room or the Bridge and may be interfaced with, or an integral element of, the Combat System provided that independent operation is possible;	
5.2	be capable of providing (at the Commanding Officer's discretion) to similarly fitted ships, aircraft and shore stations the ship's identity, position, course, speed, navigational status and other safety related information;	WAIS is operating with different modes, one mode is receiving data from commercial ships but not transmitting any data."
5.3	receive automatically such information from AIS fitted vessels;	
5.4	monitor and track ships;	
5.5	exchange data with shore-based facilities.	
	Note: The equipment shall also comply with Chapter VIII of this Code	
6	The ship shall be able to receive automatically maritime safety information on 518 kHz by means of narrow-band direct-printing telegraphy.	Requirement origin: • SOLAS IV/2.1.7 See also Regulation 4
7	The vessel shall be provided with sufficient communications facilities to be able to send and receive, by at least two separate and independent means, distress alerts, SAR co-ordination communications, maritime safety information, general radiocommunications and bridge-to-bridge communications.	This addresses automatic distress transmitters, AIS and other programmable, and/or automated means of transmitting distress messages and information relating to the safety of life and navigation available to the Bridge and immediate surrounds e.g. Bridge wings and signal deck.

	Note: The equipment shall also comply with Chapter VIII of this Code	
8	The vessel shall be provided with the necessary installations to be capable of participating in the exchange of maritime safety information with other ships and shore stations as established under the eNavigation programme.	In 2012 the evolution of 'eNavigation' was still on its early phases. Whatever the refined description of the service it will inevitably involve exchange of data between at least, AIS, WECDIS and VTS control stations by one, or more, communications bearers. Consideration should be given at the design phase to making provision for additional capacity, volume, power supplies and interfacing ports to accommodate new equipment.
Solutions		
9	The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	
10	The ship shall be provided with a Voyage Data Recorder (VDR) compliant with the latest version of IEC 61996 – Maritime navigation and radiocommunication equipment and systems – Shipborne voyage data recorder (VDR).	It is a requirement that this equipment is Type Approved.
11	The ship shall be provided with an automatic identification system or warship automatic identification system compliant with the latest version of IEC 61993 – Maritime navigation and radiocommunication equipment and systems – Automatic Identification systems (AIS) and other defence standards as agreed with the Naval Administration.	It is a requirement that this equipment is Type Approved.
12	The ship shall be provided with eNavigation equipment compliant with international standards .	It is a requirement that this equipment is Type Approved. eNavigation is under development and standards have not yet been set. It may be expected that (W)AIS and WECDIS will be part of the overall suite.

Regulation 9 Collision Avoidance

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	The ship shall be provided with sensors, systems and equipment to enable the maintenance of a proper lookout in all circumstances and conditions and the early and accurate determination of the risk of collision.	Requirement origin: • COLREGs
2	The ship shall be provided with systems and equipment to signal its nature and general intentions so as to enable other shipping to make an early and accurate determination of the risk of collision.	Requirement origin: • COLREGs
3	The ship shall be provided with equipment and systems in order to manoeuvre as necessary for collision avoidance.	Requirement origin: • SOLAS V/25
Performance Requirements		
4	The ship shall be able to exhibit by day and in twilight periods, in all weathers, where they may best be seen, shapes in order to indicate its size, orientation, activity and limitations so as to facilitate the determination of risk of collision by other mariners.	Requirement origin: • COLREGs Rules 20 and 24 and Annex I
5	The ship shall be able to exhibit, by day and night, in all weathers, where they may best be seen, lights, in order to indicate its size, orientation, activity and limitations so as to facilitate the determination of risk of collision by other mariners.	Requirement origin: • COLREGs Rules 20, 21, 22 and Annex I The vessel should be provided with emergency navigation lanterns, which may be permanently installed or capable of being hoisted, to replace defective fixed lanterns. Emergency navigation lights are to be provided with an alternative source of power by means of a battery, or other means, independent of the vessel's primary power supply. In determining whether to adopt permanent installation rather than e.g. hoistable lights, the necessity of exposing personnel to the elements in order to actually hoist the lanterns should be carefully considered. The navigation light arrangements will be agreed by the Naval Administration by the issuance of a Certificate of Approval.

6	The ship shall be able to exhibit, by day and night, in all weathers, where they may best be seen, lights, for specific military purposes, which cannot be mistaken for those lights required by COLREGs.	
7	The vessel's lights, required by paragraphs 5 and 6, may be capable of being continuously adjusted in intensity from the minimum required for a vessel of its size to zero. The Naval Administration may require the lights to be adjusted simultaneously.	The requirement to dim the lights to zero is a military requirement. The Certificate of Approval issued by the Naval Administration must include dispensation to include this capability.
8	It shall be possible to revert all navigation lights to full brilliance by a single operator action.	The adoption, subject to agreement by the Naval Administration, of a programmable control system so that some signals (NUC, Aground, Towing) will always show at full brilliance can include such a facility.
9	Vessels greater than 30 metres in length and if aviation capable, may be provided with red 'masthead obstruction' lights, visible all-round from a range of at least one nautical mile, placed at or near the highest point of each mast, or other similar structure.	
10	The Naval Administration may require additional lights for the purpose of specific military signalling.	
11	It shall be possible to exhibit any, or all, of the light signals above without the necessity for personnel to access the Upper Deck.	
12	The lights installed for all navigation and signalling purposes shall be night vision device compatible.	
13	The vessel shall be provided with such other signalling lights as are required by the Naval Administration. Any such lights installed shall not obscure those lights required by the COLREGs or be capable of being interpreted as a COLREG signal.	The Naval Administration should ensure that it has a method for formal approval of the navigation and signal light arrangements so that the duty of Government articulated at COLREGs Rule 1.e can be seen to be discharged.

14	The vessel shall be provided with the capability of sounding, in all weathers, so that they may best be heard, those sound signals prescribed by the COLREGs for vessels of its size, nature, movement and limitations.	Requirement origin: • COLREGs Rules 32, 33, 34, 35 and Annex III
14.1	If fitted, a bell should be capable of automatically generating the signals required in COLREGs and of manual operation.	
14.2	If fitted, a gong should be capable of automatically generating the signals required in COLREGs and of manual operation.	
15	The vessel shall be provided with a whistle or whistles, or combined whistle system.	Requirement origin: • COLREGs Annex III
16	The officer in charge of the navigational watch shall be able to hear other sound signals and determine their direction from within the enclosed bridge.	
17	The ship shall be provided with an image intensifier, or other means, installed on the navigation Bridge to supplement an operator's night vision to maintain a proper lookout.	
18	The ship shall be able to determine the range and bearing of radar transponders and of other surface craft, obstructions, buoys, shorelines and navigational marks, to assist in navigation and in collision avoidance.	Requirement origin: • SOLAS V/19
19	The ship shall be able to plot automatically the range and bearing of other targets to determine collision risk.	Requirement origin: • SOLAS v/19.2.5.5 Independent of any tracking capability that is part of the combat system.
20	The ship shall have sufficient power for going astern to secure proper control of the ship in normal circumstances.	Requirement origin: • SOLAS II-1/28
	Note: The propulsion installation shall also comply with Chapter IV of this Code	

21	It shall be possible for the vessel to reverse the direction of thrust of the propeller, or other means of propulsion, in sufficient time, and so to bring the ship to rest within a reasonable distance from maximum ahead speed.	
22	The ship shall always have a means of steering available.	
	Note: The steering gear installation shall also comply with Chapter IV of this Code	
23	The main steering gear and rudder stock shall:	Requirement origin: • SOLAS II-1/29
23.1	be capable of steering the ship at maximum ahead speed;	
23.2	not be damaged at maximum astern speed.	
24	It shall be possible to control both the main and auxiliary steering gear from the navigation Bridge.	
Solutions		
25	The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	
26	the vessel shall be provided with shapes compliant with COLREGs Rules 24, 27, 28 and 30 and Annex I. In addition, a spare of each shape shall be carried.	
	Note: It is recommended that not less than 5 ball shapes, 3 diamond shapes and (if over 30m in length) 2 cylinder shapes are fitted.	

27	The vessel shall be provided with appropriate stowages for the shapes adjacent to the means of exhibiting them. The style of the stowages to be agreed with the Naval Administration.	
28	The ship shall be provided with sufficient white, red, green and yellow navigation lights compliant as closely as possible with COLREGs Rule 1(e) and Annex I for a vessel of its dimensions and purpose and IEC 14744, except that:	Arrangement should be such that there is a main and emergency lantern for all the lights required by COLREGs such that failure of one lantern doers not require immediate external access to replace it.
28.1	The lanterns provided shall be compatible with night vision devices in compliance with standards agreed with the Naval Administration;	
28.2	The lanterns shall not be installed in a position where they contribute to light pollution of the navigation Bridge.	
29	The ship shall be provided with additional, sufficient white, red, green and yellow lamps for the purpose of specific military signalling:	The Naval Administration may require lights to indicate: masthead obstructions; hull contour and vessel orientation during RAS.
29.1	Ships which are the Guide or Supplying ship for Replenishment at Sea evolutions shall be provided with the following 'contour' lights:	
29.1.1	along each side at the deck edge at least two red lights, at the break of the bow and the turn of the stern, and if deemed necessary additional ones in between, so arranged as to cast light onto the hull to assist spatial orientation for the Bridge staff of another vessel making an approach. The installations shall be such that the light source is not directly visible to an observer from another vessel and the intensity of the light is such that it shall not be seen at ranges of greater than one nautical mile;	
29.1.2	an additional red light, of an intensity that it shall be visible at a range of one nautical mile, be mounted above the stern light;	

29.1.3	an additional red light, of an intensity that it shall be visible at a range of 1nm, be mounted forward and higher than the light at Paragraph 10.2 so that, together, they will indicate the fore and aft line of the vessel to an observer approaching from astern.	May be combined with an obstruction light if on the centreline or the same fore and aft line as the stern light.
29.2	It shall be possible to:	
29.2.1	exhibit contour lights when all other lights are extinguished;	
29.2.2	adjust the intensity of individual contour lights.	
29.3	In ships that are capable of operating aircraft from their deck or whose design includes masts or other projections more than 15 metres above the main superstructure shall have one, or more, red 'obstruction' lights that:	
29.3.1	are fitted at or near the extremities of those projections;	
29.3.2	may be seen from all round;	
29.3.3	are of such an intensity that they may be seen at a range of not less than one nautical mile;	
29.3.4	shall be capable of being exhibited as a steady light, or flashing, or occulting.	
30	The ship shall be provided with a comprehensive control system for the management of navigation and signalling light arrangements. If the control system is programmable it shall be compliant with ISO 17894: 2005, Ships and marine technology – Computer applications – General principles for the development and use of programmable electronic systems in marine applications. and Classification society rules as agreed by the Naval Administration.	The control system shall be part of any Naval Administration approval process.
31	The ship shall be provided with an arrangement of sound signalling apparatus compliant with COLREGs Annex III for a vessel of its size.	

32	The ship shall be fitted with a Sound Reception System compliant with ISO 14859: 2012, Ships and marine technology – Sound reception systems. The Naval Administration may accept a justification for alternative arrangements to meet the requirement at paragraph 0.	
33	The navigation Bridge shall be provided with a fixed or portable image intensifier to a standard agreed with the Naval Administration.	An image intensifier could be a night vision device, thermal imager, infra red or similar. This facility may be part of a camera based surveillance system.
34	The ship shall be fitted with one, or more, 9 GHz marine radar compliant with the latest version of IEC 62388, Maritime navigation and radiocommunication equipment and systems – Shipborne radar – Performance requirements, methods of testing and required test results and IHO S.52: 2010, Specifications for chart content and display aspects of ECDIS, Appendix 2. If more than one radar is fitted each shall be functionally independent of the others.	This radar may also contribute to the vessel's combat system.
35	The ship shall, be fitted with one, or more, 3 GHz marine radar compliant with the latest version of IEC 62388, Maritime navigation and radiocommunication equipment and systems – Shipborne radar – Performance requirements, methods of testing and required test results and IHO S./52: 2010, Specifications for chart content and display aspects of ECDIS, Appendix 2. If more than one radar is fitted each shall be functionally independent of the others. The Naval Administration may exempt smaller ships from this requirement.	This radar may also contribute to the vessel's combat system.

36	The ship shall be provided with one, or more, automatic radar plotting aids (ARPA), or equivalent, compliant with the latest version of IEC 62388, Maritime navigation and radiocommunication equipment and systems – Shipborne radar – Performance requirements, methods of testing and required test results.	
37	The ship shall be provided with a propulsion installation and machinery control system appropriate to its size and intended operations, compliant with the requirements of SOLAS II-1, having sufficient power for going astern to secure proper control of the ship in all normal circumstances and the ability to reverse the direction of thrust of the propeller in sufficient time, and so to bring the ship to rest within a reasonable distance from maximum ahead speed.	
38	The ship shall be provided with a main and an auxiliary steering gear and associated control systems compliant with the requirements of SOLAS II-1, such that the failure of one of them will not render the other one inoperative.	
39	The requirements at Chapter IV of this Code articulate the means of ensuring that a vessel's propulsion and steering installations are compliant with the requirements of SOLAS.	

Regulation 10 Training of Personnel

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	The personnel who operate a ship's Bridge, navigation systems and equipment shall be adequately trained, suitably qualified and experienced.	The Naval Administration's complementing process combined with the Naval training and development strategy especially for watchkeepers, navigation officers and Commanding Officers.
Performance Requirements		
2	English shall be used on the bridge as the working language for bridge-to-bridge and bridge-to-shore communications as well as for communications on board between the pilot and bridge watchkeeping personnel, unless those directly involved in the communication speak a common language other than the English Language.	Requirement origin: • SOLAS I • SOLAS V/15
3	Personnel in command or in charge of a navigational watch are to have attained the appropriate STCW qualification (or the Naval equivalent) before undertaking their duties unsupervised.	Requirement origin: • IMO Resolution MSC.273(85) Naval training process and MoUs for equivalence
4	Personnel in charge of the vessel during Dynamic Positioning operations are to have attained the appropriate DP qualification (or the Naval equivalent) before undertaking their duties unsupervised.	Naval training process and MoUs for equivalence. Nautical Institute DP Certification process.
5	Personnel whose duties include the operation of a WECDIS equipment for purposes related to the safe navigation of the vessel, are to have undertaken the appropriate generic and equipment specific training before undertaking their duties unsupervised.	Requirement origin: • ISM Code • MCA MIN (M+F)442 *Training for ECDIS as Primary Means of Navigation* – this is the MCA interpretation of ISM Code and covers specific type specific course for ECDIS. More general training in use of systems (common equipment fit eases load). Platform endorsement or an equivalent process to ensure watchkeepers are competent to operate the equipment in a given vessel, to include knowledge of equipment available. See IMO Model Course 1.27

6	To ensure safety of life at sea, all ships shall be sufficiently and efficiently manned.	Requirement origin: • SOLAS V/14 The Naval Administration's complementing process.

Solutions

7	The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	
8	The Naval Administration shall ensure that its professional development strategies and training courses ensure that a sufficient number of personnel with the necessary qualifications and experience to complement and safely operate its vessels are available.	
9	The Naval Administration shall ensure that personnel likely to be employed on the navigation Bridge of its ships have sufficient language skills to use and comprehend English as the common language of the sea whether or not its national language is used internally to operate those vessels.	
10	Where there are specific international requirements for training in the use of systems the Naval Administration shall utilise a recognised external training deliverer or take steps to establish formal acceptance that internal training is equivalent to the required standard. In particular the method adopted shall recognise that training in use of particular systems may well involve both a 'generic' principles element and equipment specific training.	

11	The Naval Administration shall ensure that the process for establishing manning levels for a vessel takes account of the requirement for safe operation in normal circumstances and has the capacity to continue to operate safely when a vessel is in extremis or is, by force majeure, compelled to operate beyond the established Concept of Operations Statement.	

Regulation 11 Pilot Transfer Arrangements

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	Ships engaged on voyages in the course of which pilots may be employed shall be provided with pilot transfer arrangements for the safe transfer of pilots from either side of the vessel.	
Performance Requirements		
2	The pilot transfer station shall be located such that it provides safe and unobstructed access for any person embarking on or disembarking from the vessel.	
3	Arrangements permitting pilot access to, or egress from the vessel should be either available on both sides of the ship, or be capable of being transferred for use on either side.	
4	Effective means of communication, in accordance with Chapter VIII, are to be provided between the Navigation Bridge, pilot station and pilot vessel.	
5	Adequate lighting shall be provided to illuminate the transfer arrangements overside and the position on deck where a person embarks or disembarks.	
6	Crew engaged in the operation of mechanical equipment or rigging shall be adequately instructed in the safe procedure for their use.	
7	All equipment used in the transfer operation should be maintained and tested in accordance with manufacturers' specifications or to a recognised standard.	

Solutions	
8	The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.
9	The requirements of SOLAS Chapter V, Regulation 23 and IMO Resolution A.1045(27) shall be met.

11 GUIDANCE ON NSC CHAPTER X DANGEROUS GOODS

Regulation 0 Goal

CODE REQUIREMENTS		GUIDANCE ONLY
	Note: Currently this chapter applies to the carriage and use of Class 1 articles only (namely explosives).	This Chapter has been developed by the working group focussing on Class 1 items. A review by the working group has suggested that the Chapter as written should be applicable to Classes 2-9 however this has not been substantiated and as such this Chapter offers a framework only which could be tailored with reduced and/or additional requirements relevant to Class 2-9 dangerous goods. It is intended that this chapter will cover all appropriate dangerous goods within the scope of the *UN Recommendations on the Transport of Dangerous Goods – Model Regulations* in due course.
1	The ship arrangements for the carriage and use of dangerous goods shall:	
1.1	minimise the risk of an incident associated with the carriage of dangerous goods;	This specifically relates to the transportation of dangerous goods. The overriding principle is to manage risk. The degree to which it is minimised is a decision for each Navy to make as it depends on their societal view of risk and the operations in which they engage, however such assessment should start from that inherent in the IMDG Code for the transport of dangerous goods.
1.2	manage the risk to the people, property and the environment including essential safety functions arising from incidents associated with the carriage and use of dangerous goods to an acceptable level;	This relates to the consequences of an incident. Specifically hazardous circumstances such as explosion, fire, release of toxins etc should be assessed and the ensuing risk managed to an acceptable level. Such incidents can occur at any time that the dangerous goods are aboard the vessel or under the control of the vessel's crew.
1.3	enable the safe movement, maintenance and preparation for use of dangerous goods.	This relates to the arrangements of the ship that support the carriage and use of dangerous goods in that they are fit for purpose and designed to control the risk of an incident occurring.
	Note: This Chapter seeks to control the risk of an incident arising from the carriage and use of dangerous goods and could be considered a component of an environmental protection policy.	Whilst Regulation 0 covers risk to the environment, Chapter X has not been written to capture all aspects of environmental protection, neither will it be in the future. The focus has been on protecting life. Other aspects would need to be added such as low environmental impact explosives to develop a complete environmental policy – should this be required.

Regulation 1 General

CODE REQUIREMENTS	GUIDANCE ONLY
Functional Objective	
1 The purpose of this Regulation is to outline the principles and framework of Chapter X that must be met if the role of the ship requires the carriage or use of dangerous goods.	Essentially this Chapter only applies when dangerous goods are to be carried or used aboard the vessel or fall under the control of the ship's crew.

These regulations assume that dangerous goods will go through a cycle of activity whilst on the ship:

- Phase 1 of the cycle starts with the arrival of the dangerous goods at the ship, they are either then transported to their place of stowage directly, transported to a holding point, for later stowage (fully covered by Regulation 6) or prepared for stowage such as the removal of packaging or the addition of stowage equipment (covered by Regulation 10).
- Phase 2 is when the dangerous goods are in their dedicated stowage under the protection of the ship's arrangements and the dangerous goods safety management system (Regulation 6).
- Phase 3 is the use phase, this occurs when dangerous goods are removed from their stowage for any purpose other than to transfer from the ship. Phase 3 might involve the assembly of a number of dangerous goods into a system, or the maintenance of a dangerous good (Regulation 10). During this phase the inherent safety of the dangerous goods may be affected and designers and operators should take care in identifying how this affect may manifest itself.
- Phase 4 is the activation of the dangerous goods (Regulation 10).
- Phase 5 sees the dangerous good reverted back to its condition suitable for stowage (Regulation 10). Care should be taken to identify how the inherent safety may have been modified by use and the ship arrangements designed accordingly. For instance, a missile which has been carried by an aircraft may have experienced conditions during flight which mean its sensitiveness to vibration has increased and hence the ship arrangements should assess whether it is still suitable for returning to its previous stowage.
- Phase 6 sees the dangerous goods prepared (Regulation 10) for permanent transfer (Regulation 6) off the ship and this could include an intermediate step (Regulation 10) whilst it is loaded into a vehicle etc.

Typical activities undertaken under Regulations 6 and 10 (and 11) are detailed in the following table:

Situation	Regulation	Explanation
DG loading onto ship	6	Inherent safety preserved by transport packaging
DG moved directly from point of loading to stowage space	6	Ditto
Stored in dedicated stowage or space	6	Normal state of protection during carriage
Held in a temporary store or area during relocation around ship,	6	e.g. landing area after being brought aboard, gun bay.
DG removed from transport packaging	10	Inherent safety may be changed
Relocated within the ship with no action being taken to the DG whilst in transit	6	
Handling gear attached to DG in preparation for movement	6	
DG prepared to off-load to another vessel at sea.	10	e.g. making up pallets for loading onto rafted vessel alongside by crane or for transfer via replenishment at sea,
Transferred to another vessel	6	e.g. RAS. The inherent safety of the moved package is not affected by the movement.
DG maintained, serviced	10	
DG prepared for use or disassembled following use or preparation for use,	10	e.g. the addition of flight control surfaces or fuzes. This may affect the inherent safety of the DG.
Packaged for	10	

off load		
Moved to a vehicle on the ship	6	No different to moving around the ship for any other purpose.
Installed on a vehicle for its use	10	The inherent safety may be changed whilst the installation process takes place. E.g. installing a torpedo onto a helicopter
Loaded onto a vehicle for transport elsewhere	6	The process does not change the inherent safety of the DG during the loading process
Stored on a vehicle within the ship	6	
Moved to a launcher	6	
Installed in a launcher	10	
Damaged packaging or suspected damaged DG	11	Covered under Emergencies.

Definitions

	Note: Definitions which are applicable to all Chapters are located in Chapter I, Regulation 2.	
Definitions table not reproduced		

International Maritime Organization (IMO) Documents

IMO Documents table not reproduced

Scope

2	Chapter X Dangerous Goods is written in a goal based format which specifies high level objectives to achieve a minimum level of safety. It also provides some Solutions which form the foundation for the selection of standards and development of practices and procedures.	
3	Ship arrangements associated with dangerous goods shall be in accordance with the requirements of SOLAS and IMDG Code. Where compliance, in whole or part, is not compatible with the Concept of Operations Statement the Owner shall comply with this Chapter by the implementation of:	This Chapter assumes that the requirements of SOLAS and IMDG represent the minimum standard that should be achieved. The concept of SOLAS and IMDG Code applies solely to the transportation of dangerous goods. However, in most cases naval carriage and use of dangerous goods will fall outside of the scope of SOLAS and IMDG Code. The term 'carriage and use' has been adopted by the Naval Ship Code to differentiate between the pure transportation of dangerous goods and the naval practice of transporting and using dangerous goods.

		Where the IMDG Code is not applicable other benchmarks for the delivery of safety need to be developed. Chapter X is developed to form the foundation for such standards, practices and procedures to be built on. Where naval use of dangerous goods is demonstrated to lie within the scope of SOLAS and IMDG Code then the Naval Administration may accept these as the design and operating standard.
3.1	equivalent arrangements for aspects within the scope of SOLAS or IMDG Code; and/or	For example: • Ammunition which is removed from packaging for stowing is provided with equivalent vibration protection.
3.2	additional arrangements for aspects outside the scope of SOLAS or IMDG Code.	For example additional requirements would be required for: • Preparation of a missile for use.
4	The requirements of this Chapter apply directly to all spaces and systems in which dangerous goods are stowed, maintained, handled or used and to those adjacent spaces containing items that might produce an unacceptable risk of incident. The list of affected spaces and equipment shall be agreed with the Naval Administration.	It is important to define all compartments and areas within the ship that are at risk from or present a risk to dangerous goods so that their arrangements can be designed and maintained appropriately. For instance a space adjacent to a dangerous goods store that must contain pressure vessels should be assessed to ensure that the risk of fragments from a fractured vessel does not endanger the dangerous goods unacceptably.
5	Chapter X does not apply to dangerous goods which are a permanent component of a ship's system except for Class 1 items stored within their launching mechanisms.	This clause attempts to draw a distinction between dangerous goods manufactured off the ship that are brought aboard, stored and then used to those that are an intrinsic part of a system or produced by a system on board for immediate use. The assumption is that in the latter case the standards and regulations for such systems will address the safety of the dangerous items within them. E.g. oils within machinery, LOX produced for aircraft systems etc. The naval administration will need to define clearly at what point Chapter X applies to dangerous goods manufactured onboard which are then stored.
6	Once equipment containing dangerous goods is removed from its host system it is subject to the Regulations of this Chapter.	For instance aircraft emergency flares, ejection seat systems, and explosive canopies. These are part of the system whilst fitted to the aircraft therefore not covered by these regulations but their existence should be taken into account when deciding ship arrangements. However, once they are removed from the system for whatever reason, then safe management of the equipment should be in accordance with this Code.

7	Where a ship loads and unloads dangerous goods to vehicles (boats, craft, vehicles and aircraft) the ship arrangements shall manage the safety of the dangerous goods until the loaded vehicle no longer places the ship at risk.	This requirement is aimed at managing risk when vehicles operating to and from the ship carry dangerous goods and from time to time will be stored on the ship with their dangerous goods, include transfer of safety responsibility. For instance, for road vehicles carrying dangerous goods which are stowed within the ship, consideration should be given to: • Roll back canopies to facilitate fire fighting • Isolate vehicle carrying white phosphorous • Controlled access to vehicles • Securing for movement in rough weather • Parking under fully formed spray patterns • Access gap around vehicles • Segregate bulk fuel and explosives
Application		
8	This Chapter shall apply from the point at which dangerous goods directly contact or place at risk the receiving vessel (e.g. landing on the deck or attachment to ship's lifting equipment) to the point at which they no longer put the vessel at risk (e.g. after consumption or transfer to another vessel or shore).	A ship carrying dangerous goods need only comply with NSC Chapter X when dangerous goods are actually embarked. The test being when they are under the direct control or responsibility of the ship's crew.
9	This Chapter applies to the carriage and use of dangerous goods during Foreseeable Operating Conditions. For extreme threat conditions, the Owner shall define the requirements in the Concept of Operations Statement and set the performance requirements for the safety of dangerous goods.	Chapter X does not attempt to define requirements for the protection of dangerous goods during combat. However, it recognises that this is a subject that must be considered by the Navy. The degree of protection is specific to each Navy's requirements. Measures introduced to manage risk during combat can be taken into account when assessing performance during foreseeable conditions.
	Note: Foreseeable Operating Conditions and extreme threat conditions are defined in Chapter I	
10	Where the ship arrangements do not meet the requirements of the other chapters the implications for dangerous goods shall be identified and ship arrangements provided specific to the risk management of the dangerous goods.	Chapter X assumes that the basic level of safety is provided by the other chapters within Naval Ship Code and requires additional measures germane to the safety management of the dangerous goods carried or used. Non compliance with other Chapters – particularly Chapter VI – should be reviewed against the requirements of Chapter X and additional requirements to maintain the safe carriage and use of dangerous goods shall be approved.

General Performance Requirements		
11	A Dangerous Goods Safety Management System specific to the dangerous goods, whose scope at a minimum addresses all the elements of this Chapter, shall be operated and independently assured. Design standards, acceptance criteria and verification of effective ship arrangements throughout the ship's life shall be derived from the Dangerous Goods Safety Management System.	The body of evidence consisting of at least requirements, analysis, production and support information that together demonstrates that the risks associated with the dangerous goods are being managed to an acceptable level. It defines the acceptance criteria for the design and the boundary within which the design decisions should be made.
12	Ship arrangements supporting the safe carriage and use of dangerous goods shall be clearly identified, operated and maintained commensurate with the importance of the risk they manage.	During the life of a ship modifications may be made that impact on the arrangements provided to manage dangerous goods safely. Safety arrangements may be used so infrequently that they cease to become associated with the safe management of dangerous goods, particularly if they only relate to emergency scenarios. There may also be a temptation to use arrangements in a manner they were not intended for to the detriment of the safety of the dangerous goods. This requirement is aimed to preventing such circumstances.
13	Dangerous goods shall be designated in accordance with the UN Recommendations on the Transport of Dangerous Goods – Model Regulations.	In order to apply the right hazard control procedures, the ship's crew needs to know the details of the dangerous goods embarked, including where to stow the items, how to manage hazardous events and the likely reaction of the dangerous goods to circumstances that can be foreseen reasonably.
14	Dangerous goods shall not be embarked without appropriate documentation that identifies the dangerous goods' inherent safety and associated safety parameters.	A foundation of these regulations is that dangerous goods are not permitted to be embarked under normal conditions where their inherent safety falls below an acceptable level. Maintaining the inherent safety is a key premise to protecting the ship and personnel and in the event of an incident procedures are in place to manage the risk
15	Where, for extraordinary immediate operational reasons, the requirements of Chapter X are unable to be met, approval for the safe carriage, and use of dangerous goods and potentially dangerous goods shall meet the requirements of Chapter I Regulation 5.	It is recognised that in extreme circumstances it is not always possible for the Ship's crew to follow precisely the procedures laid down – e.g. during operations or emergencies. Such instances must be the exception and not the rule. However, even during such occasions safety must be taken into consideration. Reference to the overarching principles in Chapter I is intended to capture this requirement.
	Note: Potentially dangerous goods are items whose safety is not fully understood that may reasonably be suspected of being either a) hazardous in accordance with the UN Recommendations on the Transport of Dangerous Goods – Model Regulations or; b) may endanger embarked dangerous goods.	

16	The standards, criteria and/or procedures for design, construction, test, operation, inspection, maintenance and repair of the ship arrangements shall be approved.	It is important that the approach and the standards and practices used that underpin the safe carriage and use of dangerous goods are documented and assessed. This is to provide assurance that the appropriate standards are used in the design and support requirements and operating practices are maintained through the life of the vessel.
17	The ship, systems and equipment shall be approved in accordance with the agreed standards by the Naval Administration.	
18	Ship arrangements for the safe carriage and use of dangerous goods shall be present and their functioning verified/tested prior to embarkation of dangerous goods.	A pre-embarkation inspection of the ship and a check on the competence of the crew to deal with the dangerous goods is good practice.
19	Ship arrangements shall be demonstrated by analysis or test to maintain safety of dangerous goods during normal, failure and fault conditions that the ship may reasonably be expected to encounter.	This requires the designer and operators to identify normal operating conditions in which the ship is expected to operate and demonstrate that the safety of the dangerous goods is maintained. This might include training or other exercises in which normal functions of the ship are degraded. This should also be undertaken to ensure that failure or faults within the ship arrangements (both specified for dangerous goods and otherwise) or conditions the ship may be expected to encounter under such circumstances do not degrade safety of dangerous goods to an unacceptable degree. Examples might be procedures to recover dangerous goods after a flooding incident. The designer and operator will need to agree the range of conditions under which these tests shall be undertaken.
20	Dangerous goods shall be independently assessed and demonstrated to be suitable for use within the ship arrangements.	
Solutions		
21	Verification that the ship complies with this chapter shall be by the Naval Administration. Provision of evidence to support verification shall be by the owner. All decisions that affect compliance with the requirements of this chapter shall be recorded at all stages from concept to disposal and these records maintained throughout the life of the ship.	The Naval Administration should also ensure that other relevant parts of the Code are complied with.
22	The degree of risk control shall be commensurate with the hazards associated with the dangerous goods and be approved.	The owner needs to agree with the regulator the risk management approach.

23	The level of inherent safety required of dangerous goods shall be approved.	A system should be developed for assessing the inherent safety of dangerous goods at all stages of the ship-borne operation and the acceptable level of safety determined. This system should then be applied such that only ship arrangements and dangerous goods that are approved by a recognised authority are utilised.
24	The ship arrangements shall remain under periodic review against the risks posed by the carriage and use of dangerous goods to ensure safety standards are maintained.	The periodicity of the review needs to be determined by the naval administration and should consider factors such as the risk, and operational use of the ship.
25	Dangerous goods stowage areas, and other ship arrangements protecting the dangerous goods shall be identifiable by clear and informative labelling and signage.	It is important that all aspects of the safety systems are clearly identified to ensure rapid assessment of their condition and repair if defective. This is key to supporting regular inspection of the dangerous goods and their support arrangements as part of the safety management system.
26	Labelling shall be clearly visible and inform all relevant persons of the dangers associated with the dangerous goods stored and any restrictions or instructions they must comply with. This is to include personnel in the vicinity of the store area. Labelling shall also identify spaces and systems that are part of the dangerous goods safety management systems and inform the appropriate actions to be take by personnel.	
27	Appropriate personal protection equipment shall be worn.	
28	Design review, operational trials and material state inspections shall be undertaken for Naval Administration review and acceptance.	
29	A maintenance plan for ship arrangements shall be approved.	
30	Ship arrangements shall, where appropriate, provide for the recording of the environmental conditions to which dangerous goods have been exposed during Carriage and Use.	The inherent safety of dangerous goods may be degraded after exposure to certain environmental conditions, e.g. vibration. Such circumstances need to be ascertained by the designer and where necessary, ship arrangements might need to measure exposure to ensure the inherent safety parameters are maintained or where breached appropriate precautionary risk mitigation measures can be taken.

Regulation 2 Layout and Services

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	Ship arrangements for the location within the ship, layout of spaces and the provision of supporting services shall maintain the inherent safety of the dangerous goods and manage incidents.	This regulation aims to ensure that the physical and procedural infrastructure that is necessary to maintain safety are provided by the ship, shown to function correctly and maintained whilst dangerous goods are embarked.
Performance Requirements		
2	The design requirements and operation of the ship safety arrangements shall be determined through a systematic assessment of the safety risks associated with the dangerous goods carried derived from the Dangerous Goods Safety Management System including managing risks associated with external events and managing risks to external events from dangerous goods.	Design decisions should be made by either utilising a appropriate standard or methodology that is agreed by the Naval Administration balancing risk against design specification and cost.
3	The size, shape and location of the dangerous goods stowage areas, maintenance facilities, embarkation and disembarkation routes and emergency procedures shall be designed taking into account the Concept of Operations Statement, the use of the dangerous goods, their sensitiveness and their compatibility.	
4	Spaces adjacent to dangerous goods stores and ship equipment (for both normal and fault conditions) shall be designed to manage the hazards they present to the dangerous goods.	The risk posed to the dangerous goods from equipment, systems, etc within adjacent space needs to be assessed and managed accordingly. This should account for the length of time the risk is present.

5	Ship arrangements for temporary holding areas for dangerous goods shall manage the risk from and to the dangerous goods commensurate with the time at risk.	The degree of protection provided to the dangerous goods should be commensurate with the length of time the risk is present. For instance a temporary holding area might not necessitate a similar level of protection to a long term store. However, consideration needs to be given to the use and risk present at the time. All flight decks, garages, hangars or other spaces or decks where dangerous goods are loaded onto or off vehicles shall be treated as dangerous goods stowage areas for the time that dangerous goods are present. The degree of risk management shall be commensurate with the time at risk and the potential consequences of an incident.
6	The ergonomics of the spaces in which dangerous goods are stored, prepared, maintained or used shall provide for the safe carriage and use, maintenance and inspection of dangerous goods and the dangerous goods stowage areas.	
7	Ship arrangements shall mitigate the risk of a reaction occurring between dangerous goods.	Chain reactions need to be prevented or limited in extent.
8	Systems or equipment passing through or resident in spaces in which dangerous goods are stored or used shall not present an unacceptable risk to the dangerous goods or vice versa during normal operation or fault conditions.	
9	Dangerous goods stowage areas shall be designed to reduce the concentration of hazardous gases or vapours that might emanate from dangerous goods or other items.	The likelihood of the dangerous goods giving off hazardous substances during normal and fault conditions should be assessed. Build-up of such substances that could present a hazard; e.g. fire risk, shall be avoided and measures taken to control such instances.
10	Ship arrangements shall be such that an incident associated with dangerous goods does not degrade essential escape, evacuation and rescue systems below an acceptable level.	An event associated with dangerous goods could lead to the need to evacuate compartments within the ship or in the extreme abandon the ship to await rescue. As such the integrity of the escape, evacuation and rescue arrangements should not be degraded by an event associated with dangerous goods such that they endanger safe escape, evacuation or rescue of the ship's crew.
11	Incident control systems such as pressure relief systems and containment control shall not endanger the crew or third parties when operated.	For example pressure venting systems should not vent into an occupied space. Direct overboard venting would be preferred provided it is located away from areas where people may be present or sufficient shielding is provided.

12	Dangerous goods stowage areas shall provide emergency escape and evacuation arrangements for personnel. The scope of such arrangements shall be commensurate with the size of the vessel and the type of hazard presented by the dangerous goods.	(See also Chapter VII).
13	The ship arrangements shall control the environment to be within the General Naval Environment (GNE) or additional requirements as required by the dangerous goods embarked.	As an example the scope of the GNE should include: • Temperature & Humidity • Water • Ice • Atmospheric pressure • Salt • Mould • Fluid contamination • Acidic Contamination • Drop heights • Vibration • Shock • Electromagnetic Radiation (RF, EM and Electrostatic discharge) The designer needs to establish an interface between the loading that the ship will impose on the dangerous goods and the sensitiveness of the dangerous goods to stimuli to be sure that the environment within the ship is safe.
14	Ship arrangements shall be demonstrated at build and through life to control the environment in accordance with the GNE or dangerous goods requirements whichever is the more onerous.	Dangerous goods often require storage in controlled conditions to maintain their safety parameters, e.g. temperature. Such conditions need to be understood by the ship designer and operator to ensure these are delivered. Likewise the authority for the dangerous goods needs to understand the environment to be found in the ship (defined in the GNE) to ensure the likely response of the dangerous goods can be assessed, e.g. vibration and appropriate measures taken to avoid an incident.
Solutions		
15	The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	

16	The location of dangerous goods stores shall be determined by hazard identification and risk analysis against the foreseeable damage (and extreme threat damage where required) and taking into account the Concept of Operations Statement and the risks associated with the dangerous goods stored. For Class 1 items it is good practice to meet the following but should this not be possible, mitigation will be required to control the risks. The final arrangement shall be approved.	Class 2 - 9 items have not been taken into account by this regulation and the associated good practice, however, the principles apply.
16.1	Avoid locating dangerous goods stores adjacent to compartments whose contents present a high risk to the dangerous goods, such as for Class 1 items:	This reflects the high fire risk presented but also to ensure that an incident in one compartment does not become a catastrophic incident due to carry-over to two high risk consequence spaces when the ships arrangements may not be sufficient to cope with them simultaneously.
16.1.1	Main Machinery Spaces including fuel pump rooms;	
16.1.2	Galley;	
16.1.3	Pressurised gas stores inc LOX;	
16.1.4	Electrical Spaces;	These are compartments containing significant electrical equipment such as switchboards, distribution centres and electrical generation or conversion equipment.
16.1.5	Structural tanks or spaces containing flammable stores;	
16.1.6	Heated tanks;	
16.1.7	Other high fire risk spaces.	
16.2	Additionally provide at least an A60 boundary between auxiliary machinery spaces, exhausts, workshops and hangar and vehicle stores;	This regulation aims to provide a high integrity fire barrier between a dangerous goods stowage area and a high fire risk space. Where A60 is not possible or appropriate requirements, the Naval Administration shall identify an appropriate equivalent arrangement.
16.3	Provide maximum separation between accommodation spaces and dangerous goods stowage areas;	
16.4	Locate dangerous goods stores above the double bottom and between the collision bulkhead and aft peak bulkhead;	This aims to provide protection from collision or grounding. Where this is not possible the designer will need to take a view of the risks of such incidents driven by the ship's role and use.
16.5	Locate dangerous goods stowage areas below the waterline.	Wherever possible locating dangerous goods stores below the waterline protects them from external above water threats.

17	Dangerous goods stowage areas shall not share drains or vents with compartments containing flammable liquids. Where this is not possible, ship arrangements shall prevent ingress of hazardous atmospheres or liquids into the dangerous goods store.	This is to prevent accidental ingress of flammable liquids area or the products of a fire incident concerning the flammable liquids into the stowage.
18	Consideration shall be given to the length and complexity of re-location and transfer routes.	
19	Initiation systems (e.g. fuzes and detonators) required to be separated from dangerous goods when stored shall be isolated either in a separate compartment or suitable locker.	This aims at ensuring appropriate action is taken for munitions whose safety management approach to inherent safety is to remove the initiation system. Ship arrangements should take into account how and where the removal and replacement of initiation systems is undertaken and the relative safety risks that arise.
20	Dangerous goods stowage areas shall provide for segregation of incompatible dangerous goods.	Physical separation to avoid chain reactions and to reduce the quantity of dangerous goods exposed to risks.
21	Over-pressure relief systems are to be led directly to a safe location on the open deck. The boundary of the relief route shall withstand the over-pressure and the route chosen to avoid increases to pressure. The relief route shall not be obstructed and shall be marked accordingly.	
22	Pressure relief systems are to remain captive when operated. They are to resist water and weather loads under normal operation. Pressure relief systems shall not be obstructed and shall be marked accordingly.	
23	Where it is necessary to fumigate spaces containing dangerous goods, an assessment shall be made of the impact on the safety of the dangerous goods and where necessary they shall be disembarked prior to fumigation.	
24	Ship arrangements shall allow regular inspection of dangerous goods and associated safety systems without the requirement to breach protective boundaries or increase the risk to the dangerous goods or personnel.	It is anticipated that the safety management system and the condition of the dangerous goods will require regular inspection.

25	A system for the control of quantity and variety of items within a dangerous goods store shall be implemented.	As the ship arrangements are derived from an assessment of the safety risk likely to be present it is important that a system is operated that determines that the actual risk in operation is commensurate.

Regulation 3 Structural Protection

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	Ship arrangements shall provide appropriate structural integrity to support dangerous goods and their associated safety systems.	Structural requirements are set out in Chapter II. The intent of the regulation is to ensure that where the structure forms part of the safety management of the dangerous goods it is design and maintained accordingly. For instance blast arrangements have sufficient strength to operate effectively or critical structure is protected from damage caused by the dangerous goods.
Performance Requirements		
2	Ship structure associated with the carriage and use of dangerous goods shall be designed using a recognised and appropriate structural design code.	
3	Structure which is a component of the ship's dangerous goods safety management system shall be designed, constructed and maintained to protect the ship from incidents occurring with dangerous goods.	The designer shall consider possible ship conditions that could arise during an incident including the dangerous goods and provide structural robustness or other measures that provide appropriate protection to the ship and its equipment. The degree of protection required will stem from the role and use of the ship and the degree of risk deemed acceptable to the Navy.
	Note: For foreseeable damage conditions structural requirements relating to fire incidents are in Chapter VI, regulation 2 and structural requirements relating to damage are in Chapter II, Regulation 3.	
4	Ship structure shall withstand or be protected from loads (e.g. blast, heat, and shock) arising from the use of dangerous goods.	Where dangerous goods are used; e.g. firing of missiles, the ship's structure or equipment might be subject to dynamic, heat or blast loading. This should be taken into account when designing the structure and equipment. Location of personnel or provision of shielding should be employed to protect personnel.
5	Ship structure shall support safety and consequence management systems.	Structure shall have sufficient strength and integrity such that any safety systems fastened to it or reliant on its presence can function reliably during an event associated with the dangerous goods – e.g. sprinkler systems remain in place to provide cooling during the event.
6	Safety factors of structure associated with handling and operating equipment shall be appropriate for the hazard classification of the dangerous goods being used and the operation under consideration.	This regulation ensures an appropriate safety factor is used when designing supporting structure to lifted equipment for use with dangerous goods.

7	Temporary or portable ship structure, or fittings associated with the carriage and use of dangerous goods shall be designed, built, assembled and tested commensurate with the risk associated with the dangerous goods.	
8	Structural fixing of items within dangerous goods stowage areas shall ensure items remain fixed in all foreseeable operating conditions and extreme conditions where required by the Naval Administration.	
Solutions		
9	The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	
10	Preservation systems shall be used to maintain functionality, structural integrity and safety between inspections.	
11	Design review and certification supported by appropriate tests and inspection of the ship arrangements shall be undertaken.	
12	Boundaries, penetrations and openings are to be designed to withstand the water pressure head associated with the requirements to flood the space in the event of an incident and the damage stability requirements defined in Chapter III.	

Regulation 4 Fire Protection

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	Ship arrangements shall manage to an acceptable level, the risk of fire incidents initiated by dangerous goods or that threaten dangerous goods.	The designer and operator needs to understand the fire risk that if it occurred could create an incident with the dangerous goods and provide measures to manage this risk to an acceptable level. Similarly fire stemming from the dangerous goods should be understood to provide appropriate protection to the ship. For instance a burning munition may not be extinguishable but measures to limit the spread of fire should be considered.
	Note: This regulation applies whenever and wherever dangerous goods are present and are additional to the requirements of Chapter VI – which should be read in conjunction with Chapter X.	Regulation 4 assumes that the basic level of fire protection is afforded by compliance with Chapter VI. As such the ship will be able to deal with insipient fires in dangerous goods stowage areas from items other than dangerous goods. Chapter X, Regulation 4 focuses on the requirements for fire protection to cater for the additional risk stemming from the presence of dangerous goods. It is the intention that Chapter X will cater for all classes of dangerous goods, however, this version only deals with Class 1 – Explosive Articles. For all other classes of dangerous goods refer to Chapter VI.
Performance Requirements		
2	The fire management policy for dangerous goods for the vessel, including prevention, detection, containment, control and extinguishing of fires, shall be defined in the Concept of Operations Statement and be approved.	It is of critical importance that the way in which the ship and dangerous goods are to be used is fully understood such that appropriate protection systems can be employed. Distances from safe refuge, manning policy, degree of damage considered survivable etc are examples of factors that need to be take into account.
	Note: This will include a definition of the number and severity of fire incidents the ship shall be expected to manage and verified for operation in the extreme threat conditions as defined in Chapter I, Regulation 0	
3	The fire detection, alarm and response system (e.g. fully automated or require manual activation) shall be appropriate to the ship Concept of Operations Statement.	
4	Materials shall be selected to minimise the fire risk they present.	

5	Drainage, flooding and fixed fire fighting systems for dangerous goods stowage areas shall be controllable from outside the space.	Drains should be controllable to facilitate stability control, enable a build up of water for boundary cooling and the containment of products from an incident within the stowage should this be required. Measures will be necessary to enable the drain down of lockers, stowage bins etc. Control points should be easily accessible and immediately close to the compartment.
6	To prevent fire escalation, the fire protection system design, coverage, reaction times and rates of deployment shall be commensurate with the type of hazard presented by the dangerous goods.	
7	Systems passing through dangerous goods stores shall be avoided where failure of the system presents a fire risk to the goods stored. Where this is not possible appropriate mitigation such as shielding or enhanced fire protection systems shall be provided.	
	Note: Systems refers to pipes, cables, vents etc.	
8	Integrity and operational efficiency of fire protection systems for dangerous goods stores shall not be compromised by failure or maintenance of the ship systems or equipment that support the fire protection system.	Whenever dangerous goods are carried there must be an effective fire protection system in operation. This includes if the fire protection system or supporting equipment are out of service through breakdown, repair or maintenance. Temporary measures may be employed during such circumstances provided they deliver an appropriate level of risk management.
9	Ventilation control shall ensure the effectiveness of the fire protection system provided for the protection of dangerous goods.	
10	The operation of the fire protection system should be monitored at all times whilst dangerous goods are embarked and reported to the ship's staff when activated.	A system is required to assure ship's staff that the fire protection system is operating correctly in standby and when activated. The degree of monitoring should be commensurate with the risk; e.g. for low risk items regular inspection may be appropriate whereas an automatic system with built in test might be needed for higher risk goods.
11	Reporting of the fire protection system shall be to a continually manned space.	Alarms should be audible and visible in continually manned spaces whilst at sea and in harbour.
12	Arrangements for dangerous goods stowage areas shall limit transfer of heat from fires, machinery systems or other equipment or systems outside of the stowage areas to within safe levels.	Insulation or separation of heat from the dangerous goods should be employed as part of the fire protection strategy.

13	Ship arrangements shall provide the rapid and direct distribution of appropriate fire suppressant or cooling media.	It is critical that the distribution of fire detection and suppressant application systems such as sprinklers take account of the layout of the dangerous goods stowage area. Heat and smoke flow and visibility of goods to observers (either personnel or remote sensors) should be considered to provide rapid identification of a fire incident. The location and flow patterns of suppressant systems should ensure rapid application to best effect.
14	Dangerous goods shall not be embarked until the fire protection system is operable and verified.	
15	Control points for fire fighting systems shall be provided and separated to reduce the probability of loss of system control.	Locations need to be thought through in the context of the role and use of the ship, including off-watch, berthed and at sea conditions. The key point is that for credible scenarios it should be possible to access the fire system controls.
16	Positions where dangerous goods are temporarily stowed, prepared or maintained shall be provided with fire detection, prevention and suppressant systems commensurate with the time at risk and the magnitude of the risk presented by the dangerous goods.	Loading of the ship might require stockpiles prior to securing into the appropriate stowage. Movement around the ship of dangerous goods might require them to pause during transport etc. This might arise from normal routines or fault or emergency scenarios. The fire risk associated with each evolution should be considered and appropriate provision made to manage the risk. Fire provision for spaces where dangerous goods are prepared or maintained should consider any increased risk associated with the preparation or maintenance processes. As a minimum the fire provision should be equivalent to that provided at the permanent stowage position of the dangerous goods.
17	Dangerous goods stored on exposed decks shall be provided with fire protection systems which maintain the dangerous goods in safe environmental conditions.	
18	Ship arrangements shall facilitate the testing of fire systems to ensure their availability and reliability is maintained whilst the dangerous goods are present.	The degree of fire testing will need to be developed for each application. It may not be necessary to activate the system to prove its functionality for instance. The test regime will need to be commensurate with the risk and the difficulty with testing along with the ship arrangements for back-up and alternative systems and the degree of confidence in the designed system from past experience or novelty.
19	Ship arrangements for fire protection of dangerous goods shall consider failure modes and provide suitable mitigation measures.	Designs need to identify circumstances which would lead to degradation or failure of the fire protection system and develop mitigation solutions. For example, back-up electrical supplies, contamination such as through grit clogging nozzles.

Solutions		
20	The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	
21	Fire detection shall incorporate at least two different types of detector (e.g. smoke, flame or heat) with either detector type triggering the system.	
22	Sufficient manual fire system activation points shall be installed and positioned to facilitate the rapid raising of an alarm or activation of the fire extinguishing system.	
23	The ship arrangements shall ensure the supply of services (e.g. electricity, water) to the dangerous goods fire safety management system and that equivalent alternative arrangements are available in the event of the loss of critical services.	
24	Number and distribution of detectors shall be to an agreed standard.	For smoke detectors the most onerous requirement of Chapter VI regulation 7 or for deck-head areas <12m2 1 set of detectors, 12m2 to 25m2 2 sets fitted and then 1 detector set for every additional 50m2 or part thereof may be used for initial design purposes. For heat detectors the most onerous requirement of Chapter VI regulation 7 or not less than 3 detectors per dangerous goods stowage area not more than 9m apart and no more than 2m from the bulkhead. Where dangerous goods stowages are zoned the detectors should be distributed evenly amongst the zones may be used for initial design purposes.
25	Adjacent spaces that present a fire risk shall be equipped with fire detectors.	
26	The fire protection system shall operate when the temperature in the dangerous goods stowage area reaches an appropriate threshold temperature.	The threshold temperature is agreed by the naval administration and represents the temperature above which the safety of the dangerous goods cannot be assured. It shall be set with a suitable safety margin taking account of the anticipated rate of temperature increase, the lag in the fire protection system and the rate at which cooling or fire suppressant is achieved.

27	Where dangerous goods stowages are split into zones the detectors shall be distributed evenly amongst the zones.	
28	Detectors protecting the dangerous goods stowage area shall be configured to raise the alarm in a continually manned space linked into the dangerous goods fire protection arrangements.	
29	Detectors shall operate individually – the system architecture shall not include combined detector loops.	
30	Detectors shall be constructed to a recognised standard and certified safe. Heat detectors shall be of low thermal inertia and be capable of responding to an appropriate temperature/ time gradient.	Temperature gradients of at least 25oC per second are possible for class 1 articles.
31	Any single heat detector indicating the threshold temperature or above is to activate distinctive local and remote audible and visual alarms.	
32	Boundaries of dangerous goods stowage areas and adjacent spaces shall provide a fire barrier as required by Chapter VI, Regulation 8.	Boundaries need to be designed to facilitate cooling of the boundary by water systems.
33	Where water spray systems are installed they shall be arranged to provide 100% coverage of all dangerous goods stowage areas as defined as the larger of the deck or deckhead area.	This is to facilitate cooling of Class 1 items.
34	Fully automatic systems shall be capable of manual operation.	
35	The reaction time of fully automatic systems shall be appropriate to the carriage and use of dangerous goods and the consequences of an incident.	The maximum reaction rate of the fire protection system shall be set with a suitable safety margin taking account of the anticipated rate of temperature increase, the lag in the fire protection system, the frequency with which detector systems are polled and the rate at which cooling or fire suppressant is achieved.
36	Fully automatic systems shall be designed to assure its operation and performance can be routinely tested without detriment to the safety of dangerous goods.	

37	Remote control stations are to be separated by at least one deck or a main watertight bulkhead with independent power supply.	
38	Water systems are to be fitted with flow and pressure sensors configured to operate distinctive audible and visual alarms at the appropriate manned monitoring position.	
39	Flow rates for water systems shall be appropriate to the quantity and type of dangerous goods embarked and account for both fire suppressant and cooling of dangerous goods and stowage boundaries.	
40	Water systems shall provide cooling for a time after the end of the fire incident.	A minimum of 30 minutes should be considered.
41	First aid fire extinguishers shall be provided appropriate to the content of the dangerous goods store.	
42	Where dangerous goods are stowed on the upper deck, ship arrangements shall provide a dedicated fire management system.	
43	Ship arrangements are to control pressurisation as a result fire safety system activation.	

Regulation 5 Electrical Fittings

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	The ship arrangements shall protect dangerous goods from electrical conditions that could lead to an incident.	The requirements of this regulation apply directly to all electrical items in spaces in which dangerous goods are stowed, maintained, handled, transferred or used and to those adjacent spaces containing electrical items that might produce an unacceptable risk of incident.
Performance Requirements		
2	Electrical equipment shall be approved and certified safe for operation in dangerous good stowage areas or in the vicinity of dangerous goods or their associated safety systems.	Electrical conditions that might hazard dangerous goods include heat from electrical items, electromagnetic environment such as sparking, static and alternating magnetic fields, direct contact with electrical terminals, induced currents or fields, static electricity. Normal and fault conditions of electrical equipment need to be taken into account. They may create a source of ignition should a hazardous atmosphere occur.
3	The design of electrical items under normal, overload and fault conditions shall maintain the safety arrangements associated with the protection of dangerous goods.	
4	Electrical items under normal, overload and fault conditions shall not create a source of ignition; wherever and whenever dangerous goods are present.	Dangerous goods may create, typically when in a fault or damaged condition, an explosive or flammable atmosphere within the dangerous goods stowage area that could be initiated by, for example, an electrical spark. Whilst ventilation of the dangerous goods stowage area should ensure the rapid dispersal of such an atmosphere, it cannot be guaranteed that pockets of concentration may not build up or that a sudden release overwhelms the ventilation system. To mitigate the risk of ignition by electrical equipment, appropriate design precautions should be taken to isolate sources of ignition from the explosive or flammable atmosphere. The ATEX Directive (EU 94/9/EC) offers an appropriate design starting point for some electrical items. The hazardous environment or atmosphere that might occur during carriage or use needs to be identified using a recognised standard and the electrical equipment must be shown to be appropriate for use in those environmental atmospheres.
5	Ship arrangements shall maintain the electromagnetic conditions within safe limits wherever and whenever dangerous goods are present.	This includes transport of dangerous goods around the ship where an electrical environment may need to be modified temporarily when dangerous goods are within the vicinity.
6	Electrical items under normal, overload and fault conditions shall maintain the safety arrangements associated with the protection of dangerous goods.	

7	Arrangements for electrical items shall be such that their maintenance or repair shall not create an incident.	
	Note: Authorised electrical equipment is recognised by the Naval Administration to be safe for operation through meeting or exceeding applicable standards associated with the dangerous goods embarked.	
Solutions		
8	The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	
9	Ship arrangements shall prevent the use of non-authorised electrical equipment in areas where dangerous goods are present.	Systems will be needed for identification of authorised equipment and for the verification of approval prior to entering the dangerous goods stowage area. Additionally the systems will need to prohibit un-authorised items such as mobile phones from entering the dangerous goods stowage area. As a minimum a log should be kept of all authorised electrical equipment and for checking personnel entering the space for prohibited items.
10	Construction of lighting systems shall be of a certified safe type appropriate to the type of dangerous goods.	See also Regulation 2 for lighting requirements.
11	Fixed and portable lighting shall be provided in dangerous goods stowage areas to support inspection and operation under normal and fault conditions. Portable lighting and light switches shall be readily accessible at the entrance to the space and appropriate for use in hazardous environments.	Lighting needs to have the required coverage and luminescence to facilitate safe operation of a dangerous goods stowage area by ship's crew and inspection of all areas of the space, including around stowages. Fixed lighting should be the main source of lighting but where coverage for inspection is not possible portable lighting may be used. The lighting arrangement should provide suitable cover under fault conditions such as loss of power to facilitate making safe of the compartment and regular inspection.
12	Portable electrical equipment shall be of the same certified safe type as fixed installed electrical equipment in dangerous goods stowage areas.	
13	Failure of safety related electrical devices shall be detected rapidly and fail safe.	

14	Emergency stop or safety related shut-down shall be fitted with a lock-out to prevent re-start without an intentional command.	This is to promote investigation and repair of shut-down events prior to restarting to prevent the continuation of a potentially unsafe scenario.
15	Electrical items shall be protected from accident damage arising from operations in the dangerous goods stowage area.	This is intended to preserve a safe electrical environment as a result of an accident. For instance electrical equipment being crushed by transporter equipment.
16	Cabling shall be:	
16.1	routed away from dangerous goods stowages as far as is practicable;	
16.2	arranged to prevent lightning or other external RF event from discharging into the dangerous goods stowage area;	
16.3	joint and termination free within the dangerous goods stowage area;	
16.4	fitted with glands at the dangerous goods stowage area boundaries that control fire transition across the boundary;	
16.5	capable of total isolation unless there is no termination or junction within the dangerous goods stowage area;	Intrinsically safe cables that are required for continuous operation, e.g. fire monitoring systems do not require total isolation.
16.6	separated, screened, sheathed or protected where necessary to prevent contamination or false signals;	
16.7	not attached directly to the dangerous goods stowage area boundary except for lighting and low power cables, e.g. alarms;	
16.8	of a rating selected to avoid self heating;	
16.9	protected against mechanical damage.	Cables shall be armoured or braided unless they are laid in metal conduits.
17	Where compliance with safety standards is achieved through the use of environmental isolation, containment shall be secure to prevent accidental opening.	
18	Earth arrangements shall ensure earth links are as short as possible with minimal earth loops.	

19	Safety related switching should not involve intermediate software control and be fitted with manual override.	
20	Power outlets in dangerous goods stowage areas shall be of socket type only and designed to contain any arcing on make/break.	This regulation is intended to provide inherent shielding of electrical arcs within the body of the socket rather than expose it to dangerous goods or hazardous atmospheres.
21	The temperature of electrical items (or any other item) shall not exceed levels likely to lead to the ignition of gases or vapours or risk elevation of the temperature of dangerous goods above safe levels.	
22	Arrangements within dangerous goods stowage areas shall prevent the accidental creation of sparks.	
23	Electro-static build-up or discharge, stray electric and leakage currents shall be assessed and managed to prevent corrosion, overheating, sparks or arcs.	
24	Electrical items within the dangerous goods stowage area shall not create an unsafe electrical environment when the fire fighting system is activated.	This might require electrical equipment to be housed in watertight enclosures etc. This should include accidental activation of the fire system.
25	The boundary arrangements for dangerous goods stowage areas shall prevent external RF conditions from creating an unsafe internal electrical environment.	
26	Magnetic field (both static and transitory) shall be controlled through shielding or location to be within safe limits.	
27	Electrical items shall be capable of isolation on all poles from outside the dangerous goods stowage area.	
28	Where more than two light fittings are provided they shall be split into at least two independent systems fed from a different fuse.	

29	Cables carrying greater than 440 volts shall not be permitted in a dangerous goods stowage area containing class 1 items or attached to its boundaries.	

Regulation 6 Stowage and Handling

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	Ship arrangements shall provide safe and secure stowage, handling, movement, re-location and transfer of dangerous goods.	This regulation is intended to ensure that the inherent safety of the dangerous goods is not degraded whilst it is being moved or stored. For instance the inherent safety of an item may be preserved provided it does not experience a drop above a certain height. In this case lifting arrangements should control the maximum possible drop to below this or where not possible alternative precautions are taken such as the use of shock matting etc to preserve the inherent safety. This regulation is not intended to control the safety of dangerous goods whilst in use. This is the subject of Regulation 10.
Performance Requirements		
2	Ship arrangements shall have secure restraint systems that maintain the integrity and safety of the dangerous goods.	Tie downs, bins etc in which dangerous goods are stored need to secure the dangerous goods for the envisaged ship motions but not impose loads that might reduce the inherent safety or safe operation of the dangerous goods. For instance, tie downs should not circumvent vibration reducing mounts or impose undue point loads that could lead to a breach of the safety containment of a dangerous good. Securing arrangements need to maintain the integrity of any packaging used to ensure the safety of the item.
3	All other items stored within dangerous goods stowage areas shall be assessed for compatibility with the dangerous goods and restrained such that they do not endanger the dangerous goods.	Items that are not classed as dangerous goods or not controlled might under certain circumstances affect the inherent safety of dangerous goods or exacerbate on incident with dangerous goods. Such conditions need to be identified and appropriate precautions taken such as prohibition of the item from the dangerous goods stowage area. Other items such as handling or maintenance equipment should be provided with suitable stowage arrangements to prevent them endangering the dangerous goods during ship operations, e.g. deck coverings should not become projectiles in heavy seas.
4	Where bulk or versatile stowage of dangerous goods is used, ship arrangements shall provide appropriate segregation, restraint and partitioning.	Cargo holds designated for the stowage of a range of dangerous goods that differ from time-to-time, such as on replenishment or amphibious ships, need to have flexible stowage arrangements such that they can accommodate a range of dangerous goods whilst still providing suitable restraint and preserving a safe environment. Temporary partitioning or hold layout should ensure that dangerous goods are segregated in accordance with the UN Recommendations on the Transport of Dangerous Goods – Model Regulations. Segregation is required to manage the risk of escalation of an incident, the creation of a higher-order event, a chain reaction or degrade the inherent safety of dangerous goods e.g. contamination. Additionally the safety systems such as fire protection, should be appropriate for the dangerous good, for instance an item sensitive to water should not be stored where a water spray system is used without adequate provisions being made.

5	Dangerous goods stores on exposed decks shall be provided with protection from weather and solar radiation (heating and UV) and sited to control the risk from ship operations.	Where it is necessary to store temporarily dangerous goods on decks exposed to the weather consideration needs to be given to protecting them from adverse environmental conditions. For instance, munitions awaiting loading onto aircraft might be parked on the flight deck. The location of such munition parks should be away from operations which would put the munitions at risk, provide protection from solar radiation, ensure adequate cover from fire fighting apparatus and control access to the munitions. The positioning of the munitions should consider minimising the possibility of a chain reaction through measures such as separation, misalignment of warheads with other munitions or ship structure, use of barriers. Consideration should also be given to the rapid removal of munitions from a hazard area as required; e.g. ability to ditch munitions rapidly. Such ship arrangements need to be clearly marked.
6	Stowage layouts shall be commensurate with the protection systems (e.g. adequate clearance to bulkheads and decks for boundary cooling from fire fighting systems).	
7	The temperature of surfaces in the vicinity of dangerous goods shall be maintained at safe levels during normal and fault conditions.	This requires the designer to understand the temperatures and exposure limits for the dangerous goods to be carried and used and to deliver ship arrangements that prevent the dangerous goods from exceeded these limits. Normal and fault conditions need to be considered.
8	Where dangerous goods safety is at risk from submergence in sea water, flood alarms shall be fitted and reported in a continually manned space, at sea and in harbour.	
9	Ship arrangements shall incorporate embarked vehicles in which dangerous goods are stored for transfer.	Where the ship operation includes the embarkation of vehicles in which dangerous goods are stored and where there is no intent to offload the dangerous goods to the ship's stores, the vehicle and its dangerous goods should be treated as a discrete entity and the ship arrangements designed and operated to manage the safety risk from the vehicle and its cargo. Where the intent is to offload and then reload the vehicles whilst embarked this is covered by Regulation 10.
10	The interface between safety arrangements for the ship and any system delivering dangerous goods to and from the ship shall be carefully managed and controlled.	Accidents often occur because of a breakdown between the interfaces of safety management systems. Transfer of dangerous goods is an example of where it is key that the relevant safety information is available to the ship to ensure appropriate safety measures are taken. For instance, a dangerous good that may have questionable inherent safety due to a dropped load should be identified and a risk assessment undertaken before the transfer occurs and the ship arrangements modified accordingly – e.g. segregation from other items.
11	Restraint systems and layout shall allow access to and removal of dangerous goods without detriment to the safety of other dangerous goods.	This requires securing arrangements to consider the way in which the dangerous goods stowage area will be operated. Restraints should not secure multiple dangerous goods simultaneously if it is unlikely that all the restrained items will be removed at the same time.

12	Movement, re-location or transfer shall be undertaken in accordance with a procedure to efficiently, with the minimum of delay or pausing in the process to limit the exposure of the ship to increased safety risk.	Before a dangerous goods is removed from its stowage or an operation is undertaken that may impact the inherent safety a safe procedure should be established with the aim of minimising and controlling the risks associated with the movement, re-location or transfer. Plans should take into account: • Quantities of dangerous goods exposed to risk; • Environmental conditions (both internal and external) under which the transfer of dangerous goods is assessed to be safe shall be determined and established; • Sequence movement to avoid increasing risk such as lifting over dangerous goods; • Fault or failure of ship arrangements or vehicles; • Control of multiple simultaneous operations such as fuelling vehicles whilst loading of dangerous goods; • Exposure of dangerous goods to stimuli which affect their inherent safety such as dropping or EM radiation; • Monitoring, responsibilities of ship's staff and supervision; • Pre determined plans for the recovery of an incident to a safe situation.
13	Primary and alternative re-location and transfer routes shall be defined and approved.	If alternative routes are not possible then alternative arrangements should be considered to protect dangerous goods should they become stranded.
14	All handling equipment is to comply with approved standards and regulations for the areas in which they are to be used commensurate with the risks appropriate to the dangerous goods stored.	
Solutions		
15	The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	

16	Handling systems for dangerous goods shall ensure that at all times during lifting and movement the load is under positive control, is within its design limits for the environmental conditions and will not slide or topple.	Consider: • Use of contour lifting, do not lift higher than packaging designed to survive; • Use shock mats; • Cover up sharp covers, spigots; • Lift evenly so as not to damage dangerous goods or its packaging; • Undertake an inspection after lifting for damage.
17	The ship's stowage and handling arrangements shall include communication systems such that operators have full control of the dangerous goods at all times.	
18	Loading, unloading, movement and stowage arrangements shall be tested and verified using inert substitutes to prove arrangements before dangerous goods are embarked.	
19	Readiness of fire-fighting and environmental protection equipment and ship's crew shall be ensured prior and during the movement, relocation or transfer.	
20	Power failure shall not compromise the safety of the dangerous goods.	
21	Relocation routes shall be assessed, as a minimum, to verify that:	
21.1	they are free from obstruction;	
21.2	they afford protection to the dangerous goods;	Such protection should consider ship arrangements to ensure that throughout the relocation that the ship arrangements do not pose a risk to the Dangerous Goods. For instance use millers flaps to limit drop heights and reduce exposure of dangerous goods to incidents; avoid human lifting via ladders or if not possible limit quantities carried; review lashing points and cordage to ensure they are appropriate for the dangerous goods such as no chaffing or electrostatic build up.
21.3	alternative routes are available;	Alternative routes provide a pre-approved option for relocation of dangerous goods should the main route become unusable for some reason. This reduces the risk of dangerous goods becoming stranded in an area of the ship not designed for long-term stowage of dangerous goods
21.4	emergency arrangements are in place;	

21.5	they maintain the environmental conditions in accordance with the safety requirements of the dangerous goods;	
21.6	they prevent access by unauthorised personnel.	
22	Handling systems shall be tested and certified for use with the dangerous goods taking account of sea states in which the handling system is expected to operate.	
23	Dangerous goods containing white phosphorous shall be stowed in either floodable spaces capable of submerging the dangerous goods or jettisonable stowages.	White phosphorous burns uncontrollably when exposed to air. The purpose of the submergence criteria is to isolate the item from air to avoid a chain reaction should an incident expose the white phosphorous to air.

Regulation 7 Security

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	Ship arrangements shall prevent malicious or unintended interference with the dangerous goods or their safety management system.	The purpose of this regulation is to control the safety of dangerous goods by preventing access to dangerous goods for malicious intent and control access to avoid the unintended disruption of the safety management system.
Performance Requirements		
2	The permission of the Commanding Officer or a delegated responsible representative is required for the embarkation of any dangerous goods.	The Commanding Officer or a delegated responsible representative need to be assured that the ship arrangements are suitable to embark the dangerous goods and that the dangerous goods are in a condition suitable for embarkation.
3	Ship arrangements shall prevent access to dangerous goods or associated safety management systems by unauthorised persons and be approved.	The level of security needs to be agreed with the administration including the degree to which the external security impacts on the physical protection provided by the ship. For instance the effort required to break into a dangerous goods stowage area should be commensurate with the frequency with which the compartment is patrolled by the ship's crew. The degree of security should be commensurate with the risk and the availability of the dangerous goods elsewhere. For instance it might not be appropriate, or advisable, to secure SOLAS stores to the same degree required for demolition charges. As a minimum, dangerous goods should be afforded the same physical and procedural security that they would be provided under SOLAS and IMDG Code and national port state legislation or the appropriate land based requirements. The approval of the ship's security arrangements is to be by the Naval Administration or national government department.
	Note: Authorised persons are those approved by the Owner to have access to dangerous goods and have been assessed as competent or are appropriately supervised.	
	Note: Access includes physical presence, control of procedures, or freedom to affect the safe carriage and use of dangerous goods. This may apply when dangerous goods are not present.	

4	The location, condition and quantity of all dangerous goods shall be known, logged and monitored at all times by the Commanding Officer or a delegated responsible representative and a system in place for reporting discrepancies.	
Solutions		
5	The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	
6	Permission to embark should only be granted when a satisfactory inspection of the ships security arrangements for the carriage and use of dangerous goods has been conducted.	
7	The ship's security arrangements shall be agreed by the Naval Administration and demonstrated through design review and physical testing as appropriate.	

8	A dangerous goods security plan that complies with a recognised standard shall be implemented.	The dangerous goods security plan should address at least: • Security organisation and its operation, including roles and responsibilities, instructions, training and qualifications; • Policy for assessment of the level of security required at each stage of carriage and use, including requirements for review, testing, integration with port security arrangements and application; e.g. • target times to delay entry to stowage areas and adjacent spaces; • Physical and information security standards; • Identify the security requirements for the ship arrangements; • Monitoring and maintenance of security systems, e.g. alarms, inspection; • Access to the vessel when in harbour or at anchorage; • Response to security related incidents; • Control of access to dangerous goods; • Procedures for reporting and dealing with security threats, breaches of security and security related incidents.

Regulation 8 Incident Reporting

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	Incidents involving dangerous goods or associated safety systems shall be reported, investigated and, where appropriate, ship arrangements amended to maintain or improve safety levels.	The intent of this regulation is to ensure that: • the requirements of Chapter I Part C Reg.21 (to report incidents involving Dangerous Goods) and all legislative requirements regarding reporting are met; • the circumstances of the dangerous good incident are established; • trends regarding incidents can be identified; • faults or failure of the dangerous goods safety management system are examined to identify where modification of the system is required such that the intended acceptable safety levels are maintained; • reoccurrence of incidents are prevented. The direct management of Incidents (including procedures while they are occurring) is covered by Regulation 11 (Emergencies).
Performance Requirements		
2	A management system shall exist to ensure that dangerous goods incidents are recognised and reported.	The Naval Administration should have clear procedures in place for the identification and reporting of incidents.
3	The Naval Administration shall make adequate and proportional arrangements for the investigation or review of each dangerous goods incident.	
4	Appropriate measures shall be taken such that the intended acceptable safety levels are maintained or improved following a dangerous goods incident.	
Solutions		
5	The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	

6	An incident reporting system should be operated such that clear procedures for the identification and reporting of incidents are in place and communicated in such a manner that all personnel directly or indirectly involved with the carriage and use of dangerous goods understand their responsibilities.	Good practice includes: • guidance on what constitutes an incident with the clear statement that where there is doubt, it should be reported; • a single point of reporting for all dangerous good incidents (which may include an anonymous procedure to encourage reporting); • standard incident report templates in place to capture as much relevant information as possible; • a system to record and prioritise all incidents.
7	Incidents should be independently investigated or reviewed by suitably qualified and experienced personnel.	Those undertaking the investigation or review should be sufficiently detached from those involved in the incident in order to maintain an independent and objective level of scrutiny.
8	Incidents should be investigated or reviewed to identify patterns and trends and to determine the root cause/s of the incident.	The aim should be to identify and address any safety issues rather than just apportioning blame. Consideration should be given to: • design issues; • material failure; • shortfalls in risk assessment; • operating procedures and instructions; • organisational arrangements; • competence and training.
9	Corrective and preventative actions should be taken in a timely manner to prevent any recurrence of an incident, or to improve safety levels.	
10	Any lessons identified from incident investigations or reviews should be widely communicated.	This should be part of a continuous safety improvement process and should be aimed at a wide audience to increase overall awareness of safety relating to the carriage and use of dangerous goods.
11	A system for tracking, monitoring and evaluating the implementation of safety measures and recommendations arising from incident investigations should be in place.	

Regulation 9 Training and Personnel Competence

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	All persons directly or indirectly responsible for or affected by the safe carriage and use of dangerous goods shall be demonstrably competent to discharge their duties.	
Performance Requirements		
2	The Naval Administration shall define and certify the manning levels and required competence and responsibilities of all personnel involved in the carriage and use of dangerous goods.	To include all personnel involved in the training, design, construction and operation of the ship for the safe carriage and use of dangerous goods. Note: “Operation” of the ship includes ship’s crew, other embarked personnel and associated shore based support.
3	Appropriate manning levels shall be maintained throughout to ensure the safe carriage and use of dangerous goods.	
4	All personnel managing the safety of dangerous goods are suitably qualified, and experienced or supervised.	
5	A formal process for assessing, validating and recording evidence of qualification, experience and training shall be in place	
Solutions		
6	The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society’s rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	
7	All personnel associated with the safe carriage and use of dangerous goods shall be made aware of and understand their duties and responsibilities.	

8	All personnel responsible for managing the safety of dangerous goods are in place prior to and throughout the carriage and use of dangerous goods.	
9	All personnel associated with the safe carriage and use of dangerous goods should be provided with appropriate training and experience.	The scope and scale of the training requirement needs to be determined. The IMO Model course 1.10 provides a good starting point for the definition of a training programme, however consideration must be given to the navy operation to ensure that the training is applicable to the navy and the scope is appropriate. See also Chapter VI for fire training requirements. The purpose of training is to ensure that ships personnel are able to operate the dangerous goods safety management system, avoid disrupting the dangerous goods safety management system and respond to incidents. The training programme must consider the roles and responsibilities of each of the ships personnel and be appropriate. For instance, it is unlikely that the ship's cook needs to be fully conversant with a munitions reaction in a fire but should be aware of the associated risks and their responsibilities. Training analysis should consider at least the following: • Knowledge of international and/or national conventions, regulations, policies and procedures; • Roles and responsibilities of personnel involved; • Hazards of dangerous goods and the UN system for classification; • Consignment procedures: marking, Labelling/Placarding and documentation of dangerous goods; • Packing Requirements, construction and testing of packaging; • Transport operations: Stowage, segregation, actions to be taken in the event of an incident, packing and transport of cargo transport units, temperature control, transport of wastes; • Reporting procedures; • Cargo securing; • Fire-fighting.
10	Procedures and information necessary for the trained personnel to undertake their duties shall be readily available and maintained up to date.	An information management system should be implemented that ensures the availability of the correct information to the appropriate personnel at the appropriate time to enable safe carriage and use of dangerous goods.
11	Where appropriate, personnel should be adequately supervised if there are any shortfalls in their training or experience	

12	A personnel management system shall be implemented that:	
12.1	ensures independent assurance of competence;	
12.2	meets legal requirements;	
12.3	communicates that safety of dangerous goods is critical;	
12.4	is based on evidence; and	
12.5	is proportionate to the risks involved.	

Regulation 10 Use of Dangerous Goods

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	Ship Arrangements shall control the safety risk associated with use of dangerous goods.	The focus on the other regulations within this chapter is on the safely of the dangerous goods in their designed stowage. This regulation aims to focus attention on the safe conduct of military operations involving dangerous goods which are often outside of the bounds of civil legislation or custom and practice. The intention is to preserve safety levels whilst the dangerous goods are being prepared, moved and re-located to a point of use or during use. Use is assumed to include any activity involving the dangerous goods for any purpose other than to transfer it. Handling, movement, re-location and transfer of the dangerous goods are the subject of Regulation 6. Regulation 10, focuses on activities which directly impact the inherent safety of the dangerous goods.
Performance Requirements		
2	All planned activities involving the use of dangerous goods shall be identified with a safe system of work defined for each activity	
3	The ship arrangements shall provide for the safe disassembly and assembly of packaging.	Where dangerous goods arrive at the ship in packaging that differs from that which will be used whilst the dangerous goods are embarked or that needs to be broken into to retrieve individual items during use, the ship arrangements need to provide a safe place to undertake this activity. This is also the case if dangerous goods need to be packaged for transportation or transfer. The risks involved will differ between categories of dangerous goods and the quantities involved. At the least the space should be treated as if it were a dangerous goods stowage area but consideration should also be given to whether it needs to be a separate space, can be undertaken on an open deck and the time at risk. Consideration should also take into account the possible change in the inherent safety level as a result of the modification of the packaging. Consideration should also be given to protection and stowage of packaging where it might be required for further re-location or transfer.
4	Ship arrangements shall manage the safe preparation of dangerous goods.	Preparation of dangerous goods includes: • Preparation for stowage; • Assembly for use; • Dis-assembly for stowage of a previously prepared dangerous good; • Preparation for movement, transport or transfer.

5	Ship arrangements shall manage the safe activation of dangerous goods.	The launch of Class 1 dangerous goods from the ship is likely to have safety implications for the ship in that the ship might be required to be in a certain condition to protect the ship and personnel such as personnel away from the area to avoid noise and blast and ventilation hatches closed to avoid ingress of toxins released during launch. Additionally the safe launch might require the ship is in certain conditions to ensure the safe launch procedures such as electromagnetic conditions, weather and ship motions and control of the process is exercised. Illustrative examples of items to consider include: • Spent shell casing with residual dangerous material; • empty packaging; • empty launchers; • Cleaning of systems; • Release of or toxins gases.
6	Ship Arrangements shall manage the risk due to the carriage of dangerous goods by offboard systems operating to and from the ship.	Offboard systems include: such as rotary and fixed wing, unmanned aircraft, boats, ROVs, etc. Consider: • Need to manage the interface to provide the correct environment to manage DG e.g. electromagnetic, motions, dangerous zone created by aircraft); • Ship will provide suitable environment – aircraft doesn't fly through hazardous area created by the ship (e.g. Radar); • Boats. e.g. firing circuits made safe whilst a/c on ship and within a safe zone around the ship.
7	Ship Arrangements shall manage the risk due to carriage and use of dangerous goods by embarked personnel.	This is not intended to regulate use of personal items such as aerosols etc. However, it is anticipated that ship's personnel – whether they are crew or embarked forces -, will have occasion to carry, bring aboard or be equipped with dangerous goods as part of their military role. The range of dangerous goods carried and their inherent safety could be varied. A system is needed, therefore, that identifies such circumstances and manages this risk. Options might include immediate removal of all dangerous goods from personnel for safe stowage, only issuing dangerous goods immediately prior to disembarkation, quarantine of personnel with dangerous goods to spaces with additional safety systems etc. Care must be taken when identifying dangerous goods and segregation requirements as some items at personal quantities may be considered low risk, but once pooled may constitute a much greater risk – cooking fuel, Lithium ion batteries.
8	Ship Arrangements shall manage the safety of tests, trials and experiments involving dangerous goods.	

Solutions		
9	The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	
10	Planned activities shall have an approved risk control regime or safety case in place ahead of the event taking place.	
11	Emergency procedures and any other safety arrangements shall be verified before activation.	
12	Personnel involved with the activation shall be aware of their safety responsibilities.	
13	Safety protection measures shall be in place for personnel and material and equipment.	To include procedures for safe handling of any residue, contamination, chemicals or articles resulting from the activation of dangerous goods.
14	The interface between the ship and off board system shall be managed to provide a safe environment to manage the dangerous good.	e.g. electromagnetic, motions, dangerous zone created by aircraft, firing circuits made safe whilst a/c on ship and within a safe zone around the ship.
15	A system shall be in place to identify and categorise all dangerous goods carried by embarked personnel.	
16	Stowage plans shall be in place to manage the risk associated with dangerous goods carried by embarked personnel.	Options might include immediate removal of all dangerous goods from personnel for safe stowage, only issuing dangerous goods immediately prior to disembarkation, quarantine of personnel with dangerous goods to spaces with additional safety systems etc. Care must be taken when identifying dangerous goods and segregation requirements as some items at personal quantities may be considered low risk, but once pooled may constitute a much greater risk – cooking fuel, Lithium ion batteries.
17	Additional arrangements may be necessary to assure the safety of dangerous goods involved in tests, trials and experiments.	e.g. fire, personnel protection, ship conditions, emergency procedures, stowage.

18	Approved procedures shall be available for all activities involving removal of dangerous goods from their dedicated stowage that clearly identify the action and define a safe system of work.	Planned activities should have an approved risk control regime in place ahead of the event taking place.
19	Breakdown and make-up of transportation packaging shall:	This relates to the breaking-out of dangerous goods from their packaging for use or stowage and to the make-up of dangerous goods in their relevant packaging for disembarking.
19.1	Be undertaken by approved personnel;	
19.2	Follow procedures approved for the ship and operation;	
19.3	Occur only when the ship arrangements are functioning correctly;	
19.4	Be scheduled to reduce risk to personnel as far as possible;	
19.5	Be carried out efficiently to minimise time at risk;	
19.6	Expose as few dangerous goods as possible to risk consistent with efficiency and scheduling;	
19.7	Use an approved standard for packaging.	Any packing should seek to restore the DG to its original transportation conditions in accordance with the UN Recommendations on the Transport of Dangerous Goods – Model Regulations. A mechanism to identify the standard to which it has been packed.

Regulation 11 Emergency Procedures

CODE REQUIREMENTS		GUIDANCE ONLY
Functional Objective		
1	Ship Arrangements shall control the consequences associated with dangerous goods, arising from foreseeable emergency situations.	An emergency situation is an unintended event involving a dangerous good that poses a threat to life, operational capability, material or the environment, which requires immediate mitigation or recovery action. This regulation requires the Naval Administration to identify the possible range of events and make appropriate provision to deal with such situations.
Performance Requirements		
2	Emergency planning shall be conducted to identify and prioritise all foreseeable emergency situations.	Emergency situations involving dangerous goods are likely to fall within two categories: 1) those where the stowage, handling, use or nature of the dangerous good itself causes an emergency, or 2) those where a separate event directly threatens the inherent safety of a dangerous good. Examples of foreseeable emergencies include: • fire in an adjacent compartment to a dangerous goods stowage area; • activation or partial activation of dangerous goods while being handled (e.g. dropped); • helicopter crash on deck with dangerous goods embarked; • misfire, hangfire or fail to fire while in use; • unexploded ordnance from enemy action.
3	Arrangements to control the consequences of emergency situations shall be put in place.	The aim is to determine the plans, procedures and provisions that need to be in place to enable an effective response to a given emergency.
4	Emergency arrangements shall be implemented effectively.	This includes appropriate information, resources, tools, maintenance and training and must include testing of the arrangements.
5	Appropriate measures shall be taken to return all dangerous goods to a safe condition following an emergency.	The aim of the recovery phase is to restore the dangerous goods to their previous safe state; it may be necessary to dispose of a dangerous good if this is not achievable.

Solutions		
6	The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.	
7	A formal risk assessment methodology shall be used to identify foreseeable emergency situations.	This could involve including risk assessments from systems external to dangerous goods e.g. fire risk assessments, harbour risk assessments etc.
8	Emergency arrangements to control or mitigate the consequences of an emergency situation shall consider:	The roles and responsibilities of all personnel involved in emergencies should be clearly stated. The emergency plans and procedures should be documented and available. They should also include the source/s of additional safety advice or guidance during, or following (recovery phase), an emergency. Safety information should include the results of dangerous good testing which may be useful in an emergency, e.g. Hazard & risk time for a Class 1 dangerous good from a fuel fire. The training requirement should include all ship's personnel and include, for example, communication protocols to: • reinforce the importance of maintaining the integrity of the dangerous goods protection system; and • emphasise how to respond to an emergency. It may be that emergency arrangement may involve other emergency services or agencies (e.g. police, fire service, base emergency services) and in these cases, coordination, with clear lines of responsibility, should be established.
8.1	the emergency organisation;	
8.2	emergency procedures and plans;	
8.3	supporting safety information;	
8.4	training requirement;	
8.5	the involvement of other emergency services;	
8.6	testing (see paragraph 9 below).	

9	The arrangements for emergencies shall also consider, and incorporate where appropriate, generic safety measures which take into account the risks associated with the carriage and use dangerous goods.	The emergency organisation should have sufficient agility to respond to unforeseen emergencies – this means that the supporting arrangements and plans need to incorporate an element of flexibility. Emergency procedures of the ship should consider whether the carriage or use of dangerous goods affects the appropriate response and procedures. Consideration should be given to an automatic standard response to any ship emergency to protect dangerous goods until it is ascertained whether dangerous goods are involved in the event, in which case specific procedures would be activated or not. Where an emergency arises for which pre-planned responses are either not fully appropriate or available, procedures for the rapid development of appropriate measures should be determined.
10	Specific operator procedures shall be prepared for all unintended but foreseeable events involving the use of the dangerous good.	Specific operator procedures could include the provision of immediate action drills (for misfire, air weapon hangup etc).
11	The Emergency planning process and arrangements shall be constantly reviewed.	For example, emergency plans and arrangements should be reviewed when: • the material state, operational environment or role of the safety system changes; • lessons are identified from experience; • new technology or innovation which affect, or have the potential to affect the safety system are developed.
12	All ship arrangements designated as part of the emergency arrangements shall be available, maintained and tested to ensure availability.	
13	The emergency plans and arrangements shall be tested and regularly exercised.	This includes scheduling and recording the outcome of tests of the emergency arrangements (with independent assurance where possible).
14	Emergency arrangements shall consider the recovery phase of an emergency	This could include procedures for dealing with: • dangerous goods in an unknown state of safety; • the disposal of dangerous goods involved in an emergency. The recovery phase may also involve secondary impacts – e.g. media attention / public response, and arrangements should also cover this aspect.

ANNEX A APPENDIX 1

Extracts from United Nations Convention on the Law of the Sea

ANNEX A APPENDIX 1 - Extracts from United Nations Convention on the Law of the Sea

(see http://www.un.org/Depts/los/convention_agreements/texts/unclos/unclos_e.pdf)

SUBSECTION C. RULES APPLICABLE TO WARSHIPS AND OTHER GOVERNMENT SHIPS OPERATED FOR NON-COMMERCIAL PURPOSES

Article 29 Definition of warships

For the purposes of this Convention, “warship” means a ship belonging to the armed forces of a State bearing the external marks distinguishing such ships of its nationality, under the command of an officer duly commissioned by the government of the State and whose name appears in the appropriate service list or its equivalent, and manned by a crew which is under regular armed forces discipline.

Article 30 Non-compliance by warships with the laws and regulations of the coastal State

If any warship does not comply with the laws and regulations of the coastal State concerning passage through the territorial sea and disregards any request for compliance therewith which is made to it, the coastal State may require it to leave the territorial sea immediately.

Article 31 Responsibility of the flag State for damage caused by a warship or other government ship operated for non-commercial purposes

The flag State shall bear international responsibility for any loss of damage to the coastal State resulting from the non-compliance by a warship or other government ship operated for non-commercial purposes with the laws and regulations of the coastal Sate concerning passage through the territorial sea or with the provisions of this Convention or other rules of international law.

Article 32 Immunities of warships and other government ships operated for non-commercial purposes

With such exceptions as are contained in subsection A and in articles 30 and 31, nothing in this Convention affects the immunities of warships and other government ships operated for non-commercial purposes.

ANNEX A APPENDIX 2

Naval Ship Characteristics

ANNEX A APPENDIX 2 - Naval Ship Characteristics

AIM

A2.1 This appendix sets out the key aspects of the operation of Naval ships compared to the operation of merchant ships. It is to be used by those developing the Naval ship Code to assist the process of justifying departures from the civil system, namely SOLAS. Furthermore, the philosophies can also be used to help Naval staff, government departments and industry in understanding and applying the Naval Ship Code.

SCOPE

A2.2 The overall requirements for a Naval ship, and for that matter a merchant ship, need to capture both the capability of the ship specific to the particular role and generic requirements that reflect the overall nature of operations beyond safety. For example, a specific role for a Naval ship may require a surface-to-surface missile system. Similarly, a specific role for a merchant ship may require a first class lounge on a cruise liner. Generic requirements would include the need for a Naval ship to remain operable in extreme environmental conditions, for a merchant to be able to weather route.

A2.3 This appendix concentrates on the generic differences between Naval ships and merchant ships. Specific aspects will need to be taken into account on a case by case basis when applying the Naval Ship Code.

THE ROLE OF A NAVAL SHIP

A2.4 Before outlining the key attributes of a naval ship it is necessary to understand the role of the navy. Each Navy will have overarching policies and doctrines and these should be made available so that staff involved in the design, build and in-service operation of a Naval ship can understand the basis for technical and safety related decisions.

A2.5 It is clear from such documents that the use of the sea will continue to be an essential component of future military operations; surface Naval ships will be expected to serve more often and further from home. Furthermore, there has been a definite shift towards littoral operations. The range of effects based operations continues to broaden, encompassing full military operations (including combat operations against the land or other forces, protection of maritime trade, peace enforcement), through constabulary activities (enforcement of embargos, drug interdiction, counter-terrorism) to benign operations (disaster relief, search and rescue, hydrographic survey).

A2.6 Moreover, the nature of threats to Naval ships also continues to evolve as operations are focused on the littoral environment rather than blue water operations. The increased number of terrorist attacks is one example of change.

A2.6.1 Given the above, it can be deduced that a Naval ship may well be expected to be capable of:

A2.6.2 independent operations and reliably far from home;

A2.6.3 undertaking operations in conjunction with other friendly assets (ships, aircraft, land forces);

A2.6.4 operating in extreme environments;

A2.6.5 being survivable following anticipated military action;

A2.6.6 undertaking a range of missions, possibly at once; and

A2.6.7 being flexible, i.e. being capable of receiving short or long term modifications to accommodate future requirements.

A2.7 The role of a Naval ship as described above can then be used to establish a Naval ship benchmark which can then be compared to a benchmark merchant ship.

THE WARSHIP AND MERCHANT SHIP BENCHMARKS

MERCHANT SHIPS

A2.8 There are two principle categories of merchant ships; passenger ships and cargo ships. A passenger ship is used to transport members of public from one place to another for a fee. The crew are trained in the operation of the ship, but passengers are not. Cargo ships on the other hand are used to transport goods from one place to another, typically on longer voyages than those of passenger ships. Facilities on board for accommodation and safety reflect the time and sea and the limited number of trained personnel on board. In both cases, merchant ships provide a commercial service where safety of life at sea and protection of the environment are paramount.

A2.9 The process of setting design and operational requirements for merchant ships is founded upon international conventions published by the International Maritime Organisation. The two main conventions affecting the design and operation of merchant ships are the International Convention for the Safety of Life at Sea (SOLAS) and the International Convention for the Prevention of Pollution from Ships (MARPOL). Furthermore, the International Code of Safety for High-Speed Craft (HSC Code) is rapidly being established as a credible alternative to SOLAS for smaller faster craft.

A2.10 These conventions are applied in conjunction with Classification Society rules which address safety and functionality, covering subjects such as structure, machinery and engineering systems including prime movers, transmission systems, propulsion devices, steering gear, piping, control and electrical systems. Both the legislative and classification requirements are then supplemented by owner's requirements.

NAVAL SHIPS

A2.11 The design and operation of Naval ships necessarily differs from merchant ships. The role of a Naval ship has already been described. What remains is the framework within which design and operation takes place.

A2.12 The design and operation of Naval ships is complicated. The required capabilities outlined above lead to a high level of sophistication, demanding integration of systems, reliability and redundancy. These are controlled though the application of military standards and requirements.

A2.13 Most importantly, as a result of the nature of Naval ships, they are excluded from international conventions. For example SOLAS states "the present regulations, unless expressly provided otherwise, do not apply to…..ships of war and troopships" (Regulation 3 Exceptions, Chapter 1 General Provisions to the Annex to the SOLAS Convention). As a consequence, navies have been relatively free to establish their own arrangements for the management of safety. This has lead to navies developing unique requirements for Naval ships that duplicate the subjects covered in civil legislation for merchant ships.

A2.14 Merchant ships provide a commercial service where safety of life at sea and protection of the environment are paramount. The fundamental philosophy being that the role of Naval ships is such that the safety of the ship and embarked personnel may be secondary to the safety of those under the protection of the Naval ship. Commanding Officers of Naval ships have to determine the balance between saving life, protecting their vessel and projecting military capability. For example, in peacetime maintaining a life-sustaining ship for the ships company is the primary aim for Damage Control and Fire Fighting. In wartime, the overriding aim is to maintain military capability.

BENCHMARKS

A2.15 These differences may be summarised in the following philosophies:

A2.15.1 Naval Philosophy. The role of Naval ships is such that the safety of the Naval ship and embarked personnel may be secondary to the safety of those under the protection of the Naval ship.

A2.15.2 Merchant Philosophy. Merchant ships provide a commercial service where safety of life at sea and protection of the environment are paramount.

NAVAL SHIP CHARACTERISTICS

A2.16 With the role of a Naval ship defined and high level merchant shipping and Naval ship benchmarks established, it is now possible to examine how they impact on more detailed aspects, or attributes, of ship design and operation.

A2.17 Ship attributes can be described as a consequence of the role under what are colloquially referred to as the "ilities"- including operability, interoperability, mobility, survivability, habitability, supportability. In addition to these capability and functional issues, safety, and the management thereof, is a further aspect for which differences exist between merchant ships and Naval ships. These attributes are discussed below.

OPERABILITY

A2.18 Environmental Conditions. The key aspect under operability is the environmental conditions in which the Naval ship is expected to operate. This covers the external environment (from sea state, temperature, humidity, wind, precipitation, ice through to airborne particles, wildlife and indeed land mass) and the internal environment (temperature, humidity, ship motion, noise and so on).

A2.19 During peace (or benign) operations, and to some extent during constabulary operations, it is reasonable to assume that a Naval ship will be able to weather route or at least take up a more favourable heading in bad weather. However, during conflict, Naval ships may not have a free choice of route and will be expected to operate in harsh environments. For example, during the Falklands conflict, aircraft operations from the carriers continued through the night in very poor conditions.

A2.20 Access. In order to support the need to operate the ship in a flexible manner and recover the ship efficiently and effectively following damage, the layout of a Naval ship is complex. In addition to primary access routes, secondary routes are provided to effect escape and evacuation when necessary. Due to the nature of Naval ships, designers can assume a degree of ship staff fitness and training over and above that of person's on board merchant ships. Consideration of access for the very young, the very old and the infirm is not necessary.

A2.21 C4I. Command, Control, Communication, Computing and Information (C4I) is one area where Naval ship requirements differ significantly from their merchant shipping counterparts. Although the requirement for safe navigation and communication with other shipping and port authorities is no different from a merchant ship, there is a need to integrate mission systems. This includes the operation of complicated weapon and mission systems from missiles to aircraft, and covering sensors, information management and implementing action, and the ability to communicate securely with other assets ("Networked Enabled Capability").

A2.22 Complement. Warships require a significant number of skilled personnel to operate them and such personnel demands are a significant driver of platform whole-life costs (there is a drive towards lean manning of Naval ships to reduce through life costs). It is therefore essential that the complement of a Naval ship is optimised. The approach to determining the complement is to decompose the mission into a number of scenarios and then defining the associated platform functionality to a level where the demands on personnel can be quantified. This is a complicated process made more so by the fact that the complement needs to be defined at a relatively early stage in design before much of the equipment and system design has been completed.

A2.23 Once the complement has been defined, the training needs are captured. The Naval ship designer may then assume that those on board are highly training in ship knowledge, which then influences the design of equipment and systems associated with operations, and recoverability or evacuation in the event of damage.

A2.24 At first sight, this process is no different than that for a merchant ship. However, as there is little scope for sideways transfer due to the skills required for specialist posts, recruitment and retention of skilled personnel has always been and will remain an issue for navies. There is a fine line between maximizing the effectiveness of the Naval ship as a fighting unit and the need to create an acceptable living environment. A navy will need to constantly monitor this balance and ensure that the necessary design drivers are put in place for each new class of Naval ship. Moreover, this balance will be different for a Naval ship as compared to a merchant ship and so the direct application of merchant ship standards for recruitment, training and ship design will not be same as those for a Naval ship.

A2.25 Functionality. This refers to the general functionality of the Naval ship covering husbandry, robustness, access to equipment, and ergonomics. At a high level, there is no difference between a merchant ship and Naval ship – both requiring the designer to pay attention to how the ship will be operated. However, the need for a Naval ship to be flexible and more survivable tends to lead a Naval ship to have less complicated solutions. For example, the use of linings in merchant ships to reduce cleaning demands is not always achievable in Naval ships where there is a risk of injury from splinters in the event of an explosion. Traditionally, functionality has been a difficult aspect to define in contract specifications and can only be successfully achieved through greater emphasis on whole life costs and attention to detail during design and construction.

A2.26 Medical. Medical facilities on Naval ships may need to be more extensive and focused on injuries incurred during active operations. Conversely, some capabilities may be less of a priority on Naval ships – maternity, for instance.

A2.27 Ship Management. Both merchant ships and Naval ships need to be managed and there are a number of similarities. Both require stores and provisions to organised and co-ordinated. Staff duty rosters, pay, leave and so on are similar in principle, even if the nature of the ship operation differs. Each navy and merchant owner will select a management system for ship and shoreside operations that is likely to be unique to the owner and applicable to all his ships.

A2.28 Operator Interaction. Increasing attention in both the Naval ship and merchant shipping world is being to human factors. For Naval ships, the man-machine interface for combat system equipment has always been addressed, although not necessarily in a systematic manner. However, there is increasing recognition that as many accidents are caused by human error, that attention to human factors issues can improve safety, and consequently operational effectiveness. For example, a boat handling mechanism that provides for excellent safety in calm conditions, is likely to offer reasonable safety in higher sea states, thus increasing the operational window. There are many guides and source documents on this subject from which designers can draw advice. There are many other examples such as bridge layout, machinery controls, maintenance procedures and for Naval ships, Replenishment at Sea.

A2.29 Seamanship. Upperdeck operations are likely to be hazardous, notably boat handling and Replenishment at Sea (both are discussed below under interoperability). Other seamanship operations such as mooring and berthing are not dissimilar from those for merchant ships. However, there is a need to be able to complete seamanship evolutions in more extreme weather conditions and without being able to depend upon shore support. As a result, safety of personnel directly involved is of concern to the designer.

A2.30 Security. There are two aspects, security from external threats during routine peacetime operations and the discipline of the personnel on board.

A2.31 For more significant merchant ships such as cruise liners, the nature of ship security while alongside or at anchor is little different from that which affects Naval ships, although the significance of the threat for Naval ships and the political consequences of an incident may be greater. We have seen in recent years the danger of terrorist operations using small boats. As a result, navies have ship protection organisations and fleet protection units.

A2.32 Security considerations for the designer will include the need to protect the ship covering access, surveillance and response and any facilities needed to enforce discipline on board.

A2.33 Stores Handling. Internally within the ship, both Naval ships and merchant ships need to manage, move, store and access stores. Primarily, this covers food, but also spares (propulsion, auxiliary systems and organic units such as boats and aircraft), liquids (water, fuels, lubricants), seamanship equipment (chains, hawsers and so on). This does not cover cargo (oil, containers) which is role specific, nor stevedoring which is discussed under “Ship to Land” below.

A2.34 Where merchant ships may be optimised for stores handling with many automated features, many Naval ships do not often have the luxury of volume and the handling of most stores on small ships is manual (or manually assisted) through normal access routes. On larger Naval ships with many decks (aircraft carriers) then store lifts may be fitted. However, lifts may be used for more than one purpose including the movement of munitions which will have design implications on the reliability of the lift.

A2.35 Aesthetics. Often overlooked by the designer is the need to make a Naval ship appear warlike and embody the visual characteristics that the public expect to see. This aspect is not overlooked for merchant ships, particularly cruise liners. There is little reference material on aesthetics although the designer should become familiar with basic principles such as the divine cut and how sheer, rake, freeboard and so on can affect how the type and purpose of the Naval ship is consistent with the form, detail and colouring.

A2.36 Although not a significant design driver, it is also necessary to take into account ceremonial duties for a Naval ship (e.g. “Flying the Flag”, defence diplomacy).

INTEROPERABILITY

A2.37 Inter-governmental. Navies operate Naval ships that are in the main, exempt from statutory legislation (United Nations Convention on the Law of the Sea, Subsection C Rules Applicable to Warships, Articles 30 and 31). However, there is still a need to ensure that Naval ships are operated in a demonstrably safe manner and that they enter national waters in a legally and diplomatically. Increasingly, the safety of Naval ships is being compared to that of merchant ships and there is a need to benchmark the former against the latter. One area that directly affects Naval ships is that of environmental protection.

A2.38 Ship to Air. The operation of aircraft from ships, be these rotary or fixed wing, was pioneered by navies. Some merchant ships are able to operate helicopters, as are the majority of offshore platforms, but few have the ability to store and maintain the aircraft. As a result, the civil requirements for helicopter operations captured in merchant ship Classification Society rules incorporate factors of safety over and above those for Naval ships.

A2.39 Ship to Boat. Both merchant ships and Naval ships operate boats. Some merchant ships have dedicated facilities for launching boats in extreme conditions, notably search and rescue ships. Cruise liners have passenger transfer boats to take passengers ashore. The latest designs operate from waterline boat bays in calm conditions. Warships operate boats for maritime interdiction operations, for diving and for rescue purposes.

A2.40 However, most other boat handling equipment for merchant ships is intended for emergency use only and not routine operations as required for Naval ships. Therefore, robustness, reliability and safety need greater attention for Naval ships.

A2.41 Ship to boat also includes the ability to offload military vehicles and personnel onto landing craft or intermediate platforms during amphibious operations. With the increasing emphasis being placed on littoral operations, such design features need to be addressed generically for similar types of Naval ship. Implications for the designer include operation in higher sea states and the inevitable breach in watertight integrity.

A2.42 Ship to Ship. Replenishment At Sea (RAS) is an operation that is unique to Naval ships. By its nature, it is a hazardous operation with two ships running a close parallel course with limited ability to manoeuvre. Reception areas need to be clear and integrated with stores routes.

A2.43 Furthermore, Naval ships operate in close proximity to other ships during Officer of the Watch manoeuvres and task force operations.

A2.44 Ship to Land. Warships visit many ports, both at home and foreign. Often constrained by internal volume, they are often more dependent upon the support provided by the port than a merchant ship. For example, there is limited space to store gangways on board.

A2.45 A further complication in recent years has been the tightening of environmental legislation. This has limited the amount and quality of discharges from the ship and disposal of waste. Older Naval ships are now often dependent upon the ability to connect to a barge. New designs are taking these requirements into account, but the challenge remains significant.

A2.46 Ship to Underwater. Unmanned, or indeed manned, submersibles are being developed for many naval and merchant operations. At the moment, the integration of facilities and services to accommodate the safe operation, storage and maintenance underwater vehicles is being addressed on a case by case basis. However, as the use of such vehicles increases, it is likely that generic Naval ship characteristics can be captured and defined.

MOBILITY

A2.47 Endurance. Should there be a need to sustain operations far from home, Naval ships need to carry sufficient fuels and stores for long voyages. In this respect, there is little to distinguish between a merchant ship and a Naval ship, other to emphasise the flexibility required for Naval ship operations. Without pre-defined voyages that are generally known to a merchant ship designer, a Naval ship is designed with sufficient stores and fuel to be able to achieve a specific single voyage, and/or defined mission profiles. A Naval ship may be expected to remain at sea, hence the evolution of Replenishment at Sea techniques.

A2.48 Manoeuvring. The statutory requirements for manoeuvring do not go far beyond stopping distances. Merchant ship owners often require their ships to be able to berth unassisted and this leads to the incorporation of low speed manoeuvring devices such as retractable or tunnel thrusters.

A2.49 Naval ships have more demanding requirements for operations at sea that result from their roles, notably aircraft operations, navigating mine swept channels, minesweeping and the ability to align weapon systems. More specialist Naval ships may have additional requirements for operations in the littoral such as restricted draft for landing craft and ships. Increasing, Naval ships are being fitted with low speed propulsors similar to those for merchant ships to be able to berth unassisted.

A2.50 Navigation. As mentioned under “inter-governmental” above, a Naval ship needs to navigate through international and national waters and must therefore comply with the statutory requirements for navigation. However, there may well be certain design aspects of the Naval ship, primarily concerned with the superstructure such as weapon masts and sensors that impinge on the ability of the Naval ship to comply with statutory requirements for navigation systems. One such example is the location of navigation lights.

A2.51 Seakeeping. The seakeeping attributes of Naval ships differ from those for merchant ships. Where merchant ships are more able to weather route to continue a voyage or seek shelter where the safety of the ship is at risk, a Naval ship is expected to survive more extreme conditions while remaining at sea and to continue operations in higher sea states. More importantly, a Naval ship must provide a stable platform for the operation of missions systems such as aircraft, weapons and sensors.

A2.52 The process of designing the hull for a Naval ship incorporates this characteristic through setting and achieving particular motion criteria. Active and passive devices are therefore features common to both merchant ships and Naval ships.

A2.53 Seaworthiness. Linked with seakeeping is design of the upper deck, exposed superstructure and vulnerable equipment. The degree of watertight and weathertight integrity is key. Currently, the manner in which Naval ships are designed for differs from merchant ships, although Classification Society naval ship rules often clarify the situation by defining zones on a ship and criteria for those zones. It is worth noting the comment at paragraph A2.58 regarding the origins of Naval ship and merchant ship practices.

A2.54 Speed. Warships often have conflicting requirements for maximum speed and cruise. Whereas merchant ships can be optimised for a defined voyage speed, the nature of a Naval ship demands an ability to maintain a high top speed. It is not possible to optimise a propeller or propulsor to achieve a high top speed and to maximise efficiency at cruise speed. Not surprisingly, considerable research and development has been invested into Naval ship propulsion systems.

<u>SURVIVABILITY</u>

A2.55 Survivability for Naval ships is described in terms of susceptibility (i.e. how easily the ship can be detected), vulnerability (i.e. the inherent ability of the ship and its systems to resist damage) and recoverability (i.e. the ability of the ship staff to repair the ship and sustain operational capability). In addition to damage sustained through collision, grounding or enemy action, the issue of Nuclear, Chemical and Biological defence is treated as a specialist subject.

A2.56 Susceptibility. The first main element of survivability is susceptibility, i.e. the ability of the Naval ship to avoid detection from the enemy. A Naval ship may detected in many ways and it is therefore necessary to design the ship to minimise the ship signature in terms of underwater acoustic (i.e. cavitation), radar cross section, heat, airborne noise, visual and so on. Merchant ships do not have to meet these requirements with a few exceptions, namely statutory legislation covering internal noise as a health issue for personnel.

A2.57 Vulnerability. The vulnerability of Naval ship and of a merchant ship is addressed through subdivision, stability, watertight and structural integrity, and fire boundaries. For key ship systems on Naval ships, the issue of shock protection is also considered.

A2.58 However, the way in which these are addressed for Naval ships and for merchant ships differs, partly due to logical arguments, but mainly as a consequence of historically different origins. When it was agreed by governments that statutory legislation would not affect Naval ships, the development of subdivision, stability, watertight and structural integrity and related requirements diverged.

A2.59 For merchant ships, the developments lead to very limited extents of damage and associated onerous criteria for survival. The intention is to provide a platform that will survive for sufficient time for the ship to be evacuated. For Naval ships, the emphasis is on large extents of damage with more relaxed criteria that are intended to ensure that the ship remains afloat and stable to implement recovery action. The aim is to maintain military capability.

A2.60 These two approaches are largely incompatible and present a significant challenge to Naval ship designers. Considerable development work is underway by many navies and Classification Societies to, in the first instance, understand the different approaches, and secondly, to align the two cultures.

A2.61 Recoverability. A difference between Naval ships and merchant ships is the policy associated with recovery of the ship following damage, and the associated escape and evacuation. Warships with the command priorities “float, fight, move” differ from the merchant ship priority of “Safety of Life at Sea”. Personnel on Naval ships are organised into damage control teams whose role it is to contain damage and regain operational capability.

A2.62 As it is not possible to predict where on the ship damage from enemy action may be sustained, the emphasis for a Naval ship is on manual damage control and not automatic. For a merchant ship, and indeed for a Naval ship in peacetime operations, it is possible to identify high risk compartments where automated systems may be located. There many consequences of this difference, not least the adoption of active boundary cooling on Naval ships as opposed to passive insulated bulkheads and decks.

A2.63 NBC. An aspect unique to some Naval ships is Nuclear, Biological and Chemical defence. There is a need to close down the boundary between the external and internal environment and to maintain the quality of the internal environment. Citadels need to be established and airlocks with cleansing stations incorporated to allow personnel to move from inside to outside and vice versa with protective clothing and breathing apparatus. Each citadel then needs to be as independent as possible so that if one part of the ship becomes breached, personnel can still work and live in the remaining citadel.

HABITABILITY

A2.64 Accommodation. As alluded to in paragraph A2.22, there is a need to provide functional accommodation in Naval ships that does not compromise operational effectiveness, but which provide suitable levels of comfort that support the recruitment and retention of skilled staff.

A2.65 Accommodation on Naval ships tends to be more space constrained than that on merchant ships and the facilities are more basic; shared bathrooms, communal recreation equipment. Fittings are more often bespoke as the limitations on internal volume often preclude the use of modular fittings that are increasingly common on merchant ships. There is also the need on Naval ships to secure for action.

A2.66 Recreation. Merchant ships engaged on long voyages often provide good recreational facilities. Other than facilities in communal spaces, Naval ships provide limited facilities for recreation. More imaginative activities are undertaken to maintain the morale of ship staff.

A2.67 Messing. In addition to routine messing arrangements, Naval ships require the flexibility to provide messing during periods of higher alert states (“Action Messing”). Other than that, the requirements for messing differ little between merchant ships and Naval ships.

A2.68 Health. There is an obvious need to maintain the cleanliness of both Naval ships and merchant ships, particularly in the handling of food and personal hygiene.

A2.69 Husbandry. Again, for both Naval ships and merchant ships, there is a need to pay attention to the detail of fixtures and fittings, both internal and external, in order to minimise the level of maintenance and preservation and the associated drudgery on ship staff.

SUPPORTABILITY

A2.70 Availability and Reliability. The availability and reliability of key ship systems is a high priority for Naval ship designers. Complex systems on Naval ships that provide for redundancy in the event of damage and the demanding mission profiles make the achievement of very high levels of availability difficult. Similarly, commercial pressures on merchant shipping owners have resulted in remarkable levels of reliability being achieved, partly due to the ability to keep propulsion systems simple and by adopting tightly controlled operational profiles. This is not always the case though as demonstrated by several recent high profile failures of propulsion systems on cruise liners.

A2.71 Fuels and lubricants. In general, there is little difference between the requirements for Naval ships and those for merchant ships. There are exceptions, for example the use of gas turbines is relatively common on Naval ships, unlike commercial ships.

A2.72 Self-maintenance. Merchant ships may operate with lean crews and undertake the vast majority of maintenance in port with external assistance or in carefully planned repair and maintenance periods. Warships may operate far from their base port and are more dependent upon self-maintenance and repair undertaken by ship staff, particularly for the repair of action damage. The incorporation of workshops on board Naval ships reflects this. Moreover, their programmes may be more demanding and require a degree of flexibility and overrides the desire to incorporate routine and carefully managed repair and maintenance periods.

A2.73 Other than the design of the ship systems and equipment selection, the navy and designer also needs to take into account that the periodic survey cycles adhered to by merchant ships to maintain ships in class may not be compatible with naval operations. An acceptable alternative approach must be developed and agreed between the Navy and the Classification Society.

A2.74 Shoreside Support. The dependence upon shoreside support and how it is provided is very much a reflection of the policy for ownership. Traditionally, navies have maintained their own spares and support organisations, although there is an increasing trend towards contracted logistics support that is more common in the merchant ship world. It has yet to be demonstrated that such commercial approaches for navies will be cost effective.

A2.75 Preservation. The sea is a hostile environment, thus the corrosion of structure and fixtures is a persistent problem. There have been many innovative developments to minimise the onset and extent of corrosion and the subsequent maintenance and repair. This affects both Naval ships and merchant ships alike.

ANNEX A APPENDIX 3

Regulation template

ANNEX A APPENDIX 3 - REGULATION TEMPLATE

A3.1 The aim is to define a standard template for the use in developing Regulations in the Naval Ship Code. This is shown below.

Regulation 0 Goal

A3.2 To contain the goals of the chapter only.

Regulation 1 General

Functional Objective

A3.3 The purpose of this Regulation is to outline the principles and framework of Chapter ## TITLE and its application.

A3.4 To contain one of more of the following under one of the prescribed sub headings.

Definitions

Title	*Definition*

International Maritime Organization (IMO) Documents

Purpose

Scope

Application

General Performance Requirements

A3.5 The use of general performance requirements should be limited to requirements that are applicable to all regulations in a chapter. Subsequent regulations must provide solutions for the general performance requirements. Typically they will address transverse issues common to all equipment required by the regulations of the chapter.

Solutions

A3.6 Verification that the ship complies with this chapter shall be by the Naval Administration. Provision of evidence to support verification shall be by the owner All decisions that affect compliance with the requirements of this chapter shall be recorded at all stages from concept to disposal and these records be maintained throughout the life of the ship.

Regulation <##> <Title of regulation>

Functional Objective

A3.7 <text for functional objective of the Regulation>.

Performance Requirements

A3.8 The requirements for all ships are ….

ALTERNATIVE ARRANGEMENTS

A3.9 The Naval Administration may require the following alternative arrangements to paragraphs X to Y where necessary or appropriate to the ships role as defined in the Concept of Operations Statement:-

A3.10 The ship shall…

ADDITIONAL ARRANGEMENTS

A3.11 The Naval Administration may require the following additional arrangements where necessary or appropriate to the ships role as defined in the Concept of Operations Statement:-

A3.12 The ship shall…

Solutions

Where the Regulation sets out the general principles for the chapter, then:

A3.13 Verification that the ship complies with this chapter shall be by the Naval Administration. Provision of evidence to support verification shall be by the owner. All decisions that affect compliance with the requirements of this chapter shall be recorded at all stages from concept to disposal and these records be maintained throughout the life of the ship.

Where the Regulation relates to the Concept of Operations Statement, then:

A3.14 Approval of the Concept of Operations Statement shall be by the Naval Administration.

Where the Solutions include prescriptive criteria to be met, then:

A3.15 The ship, systems and equipment are to be approved in accordance with the following paragraphs. Alternatively the Naval Administration may agree to the use of validated classification society's rules, international convention or a suitable validated alternative or additional standard to facilitate verification of the performance requirements.

<This to be followed by prescriptive regulation>

Where the Solutions do not include prescriptive criteria to be met, then:

A3.16 Following Naval Administration agreement, the ship, systems and equipment are to comply with, and be approved in accordance with validated classification society's rules, international conventions or other suitable validated standard to facilitate verification of the performance requirements.

Where the Regulation relates to operational information, then:

A3.17 The [operational information, operating procedures, operator qualification] is/are to be approved by the Naval Administration as being compliant with the above Performance Requirements.

Where the Regulation relates to maintenance information, then:

A3.18 A3.14 The [maintenance information, maintenance procedures, maintainer qualification] is/are to be approved by the Naval Administration as being compliant with the above Performance Requirements.

Note: < Text of information note. May be used to capture military requirements that go beyond safety.

ANNEX A APPENDIX 4

Concept of Operations Statement References

ANNEX A APPENDIX 4 - CONCEPT OF OPERATIONS STATEMENT REFERENCES

A4.1 The policy on referencing the Concept of Operations Statement in the Code is:

A4.1.1 Only specific references should be made to the CONOPS (e.g. saying that the application of the Code depends upon what has been put in the CONOPS);

A4.1.2 Generic references should not be used (simply saying that a ship should reflect its roles).

A4.2 Excerpts of the regulations which reference the Concept of Operations Statement are provided in the table below.

Naval Ship Code Ref.	Paragraphs that reference the Concept of Operations Statement
Chapter I, Reg. 1a, Para. 1	The purpose of this Code is to provide a regulatory safety framework for naval surface ships that recognises their operational usage and the needs of Navies. The philosophy behind this Code is based on the management of risk which is addressed through: • the definition of the Concept of Operations Statement that describes the role, ship attributes, required survivability, the environment, and the operating and maintenance philosophies; • the selection of solutions appropriate to the Concept of Operations Statement and the safety goal outlined at Regulation 0 Goal above;
Chapter I, Reg. 1a, Para. 2	The documentation detailing the Concept of Operations – the Concept of Operations Statement – and the identified standards, procedures and modifications thereto shall be maintained for the life of the ship.
Chapter I, Reg. 2 Definition of Foreseeable Operating Conditions	Conditions in which the ship can be foreseen to operate in an intact, degraded, aged and/or damaged state in accordance with Regulation 1a paragraphs 4.1 and 4.2, normally defined in the Concept of Operations Statement. Subject to Naval Administration approval, Foreseeable Operating Conditions will generally also be limited by the conscious imposition of an environmental or other operating restriction (e.g. a sea state/ speed restriction, a restriction on navigating sea ice, limiting the number of persons that may be embarked, specification of the ship life, reversionary modes and breakdown drills etc).
Chapter I Reg. 8, Para. 7.1.1.2	The surveys referred to in paragraph 3 shall be carried out as follows: • the initial survey shall include an appraisal: • of the purposes and mode of operation(s) which is to include: • use appropriate to the Ship Type; • use as amplified in the Concept of Operations Statement;
Chapter II Reg. 3 Para. 9	In addition to the normal demands that are expected for a ship of the type under consideration, all demands specified in the Concept of Operations Statement must be assessed where relevant to the structural capacity of the ship.
Chapter II, Reg. 3 Para. 17	If the capacity dictates the demand, the demand may need to be limited. Any limitations applied to the structure must be consistent with the Owner's expectations as detailed in the Concept of Operations Statement. Operator Guidance on the limitations must be provided in a form that is readily understandable by the operator of the ship.

Chapter II, Reg. 5, Para. 7	The Naval Administration is to assure itself that the material state philosophy and operator guidance are consistent with the designer's intentions. Where the Concept of Operations Statement has been altered, the ship shall not be authorised for more demanding use until a certification review has been conducted and agreed by the Naval Administration.
Chapter III, Reg. 1 Para. 4	The ability to be deployed to any area of interest to the Navy defined in the Concept of Operations Statement shall be maintained.
Chapter III, Reg. 1 Para. 6.1	Be capable of operating in the environment defined in the Concept of Operations Statement.
Chapter IV, Reg. 11, Para. 6	Lighting systems are to permit the vessel to be operated in accordance with the Concept of Operations Statement.
Chapter IV, Reg. 20, Para. 2	The operational use of the anchoring and mooring equipment shall be defined in the Concept of Operations Statement.
Chapter IV, Reg. 21, Para. 2 & 3	Provision of facilities to allow vessel to tow another vessel if required by the Concept of Operations Statement. Provision of facilities to allow vessel to tow equipment if required by the Concept of Operations Statement.
Chapter IV, Reg. 21, Para. 5	The operational use of towing equipment shall be defined in the Concept of Operations Statement.
Chapter VI, Reg. 1 Definition of Structural Fire Protection Time	The time during which the structure maintains sufficient load bearing capabilities when tested to the FTP Code or standard approved by the Naval Administration, see Regulation 2. The Naval Administration may define an enhanced structural fire protection time in the Concept of Operations Statement. For non-steel ships the SFP shall be between 60 and 30 minutes depending on evacuation time of the ship.
Chapter VI, Reg. 1, Para. 5	The function of the ship as defined in the Concept of Operations Statement will determine the applicability of the Tier 4 Solutions of this Chapter.
Chapter VI, Reg. 1, Para. 6 Note	Revised assumptions can be defined in the Concept of Operations Statement and at a more detailed level in the Default Concept of Operations Statement, see Annex A.
Chapter VI, Reg. 2, Para. 1	Structural integrity of the ship shall be maintained preventing partial or whole collapse of the ship structures due to strength deterioration by heat consistent with the Concept of Operations for the ship.
Chapter VI, Reg 2, Para. 17	Load bearing structure constructed from aluminium or composite, shall be fire-resisting and shall provide by themselves or due to insulation provided, adequate structural integrity properties at the end of the structural fire protection time when exposed to the tests required by the FTP code or alternative standard agreed by the Naval Administration. The structural fire protection time is to be specified by the Naval Administration in the Concept of Operations Statement based on the time required for escape.
Chapter VI, Reg 3, Para. 5	A margin between the maximum ambient temperature of a space, consistent with the Concept of Operations Statement and the minimum flash point of oil fuel contained in piping in a space, is to be maintained.
Chapter VI, Reg 4, Para. 18.1.4.1 Note	Note: The Naval Administration may require compliance with either the FTP Code or STANAG 4602 Fire Assessment of Materials, Edition 1 in this regulation based on the fire fighting policy adopted by the navy as defined in the Concept of Operations Statement.
Chapter VI, Reg. 6 Para. 13.5	The smoke control philosophy is to be defined by the Concept of Operations Statement and agreed by the Naval Administration.

Chapter VI, Reg. 6 Para. 13.6	Emergency operation procedures for ventilation systems shall be available onboard. The procedures shall define which areas where ventilation is to be shut down in case of fire (stores) and areas where ventilation shall operate in case of fire (cabin, corridors and similar spaces) as per the Concept of Operations Statement. Drawings and descriptions of smoke zones, fan and damper location and control are to be enclosed. Procedures in case of fire when the vessel is in CBRN mode shall be defined.
Chapter VI, Reg 8. Para 34.6	The Naval Administration may require hatch coamings to be fitted with waterfall devices to assist in fire fighting where defined in Concept of Operations Statement.
Chapter VI, Reg. 9 Para 16.2.2	The number and location of fire pumps and their associated sources of power must be consistent with the vessel Concept of Operations Statement, action preparations and survivability requirements. Where fire pumps may also be used as bilge/ballast pumps, simultaneous fire and bilge/ballast pumping requirements must be accommodated.
Chapter VI Reg. 9 Para. 16.4.2	The sea water requirements of all consumers on the fire main system are to be considered to ensure that sufficient water and pressure for all fire fighting and operational scenarios, as identified in the Concept of Operations Statement, is available, when fire fighting systems are run concurrently with other essential sea water consumers.
Chapter VI, Reg. 9 Para. 18.1.4	The Naval Administration may increase the number of hoses required so as to ensure that hoses in sufficient number are available and accessible at all times, having regard to the type of ship and the Concept of Operations Statement.
Chapter VI, Reg. 10 Para. 1	In case of Fire, the capability of essential safety functions and other defined services can be maintained and/or recovered to a minimum level as specified in this regulation or to a specified level consistent with the Concept of Operations Statement, whichever is the most strict.
Chapter VI, Reg. 10 Para. 2	The purpose of the regulation is to provide for the following functions to a specified level consistent with the Concept of Operations Statement.
Chapter VI, Reg. 10 Para.5	Common requirements to all Ship Types: continuation or recovery of the safety and services related systems to a specified level consistent with the Concept of Operations Statement.
Chapter VI, Reg. 10 Para.7 Note	Note: The Naval Administration may require ships to comply with the requirements of this regulation based on the area of operation such as Arctic waters and distance from safe areas or ports as defined in the Concept of Operations Statement.
Chapter VI, Reg. 13, Para.2	For ships carrying dangerous goods as defined in the Concept of Operations Statement the following functional requirements shall be met in addition to other requirements in this Code:
Chapter VI, Reg. 13, Para. 3	For ships fitted with vehicle, special category and ro-ro spaces as defined in the Concept of Operations Statement, the following functional requirements shall be met:
Chapter VI, Reg. 13, Para.4	For ships fitted with special facilities for aircraft as defined in the Concept of Operations Statement, the following functional requirements shall be met:
Chapter VI, Reg. 13, Para.5	For ships fitted with special facilities for the carriage and transportation of explosives as defined in the Concept of Operations Statement, the following functional requirements shall be met:
Chapter VI, Reg. 13, Para.6	For ships fitted with well docks and boat handling areas as defined in the Concept of Operations Statement, the following functional requirements shall be met.
Chapter VII, Reg. 3, Para. 2	An Escape and Evacuation Analysis shall: • Optimise the effectiveness of escape and evacuation measures, considering: • normal seagoing conditions; • damaged conditions defined in the Concept of Operations Statement.

Chapter VII, Reg. 24, Para. 6.2	Additional survival craft shall be carried in the event that all the survival craft of either side of the vessel's centreline within the longitudinal extent of damage (defined in the Concept of Operations Statement) are considered lost of rendered unserviceable. Note: Where a longitudinal extent of damage is defined in the Concept of Operations Statement, each damage case is to be examined to determine that the remaining survival craft capacity is at least 110%, assuming that all survival craft on both sides of the ship are lost in the damage section.
Chapter VIII, Reg. 1, Para. 3	The ability to be deployed to any area of interest to the Navy defined in the Concept of Operations Statement shall be maintained and the communications fit and on-board personnel shall provide: • the capability to send and transmit all information as required by the Global Maritime Distress and safety System (GMDSS). This capability must be entirely independent from the military communications capability; • on-board safety communications including internal communications, main broadcast, portable and survival craft equipment; • qualified personnel certified to operate and, if required, maintain the GMDSS equipment to ITU Radio Regulations.
Chapter VIII, Reg. 1, Para. 4	The Concept of Operations Statement document is the Owner's vision of how the communications systems of the ship are to be operated and maintained throughout the life of the ship and is to be shared by the Naval Administration and, where appointed, it's Recognised Organisation.
Chapter VIII, Reg. 2, Para. 2	The GMDSS equipment to be fitted shall be determined by the naval ship's sea area of operation with reference to the Concept of Operations Statement.
Chapter VIII, Reg. 8, Para. 5	Portable radiocommunications shall be operable from all positions used for Escape, Evacuation and Rescue, damage control and command and control. The equipment may also be required by shore parties and boat parties as defined in the Concept of Operations Statement.
Chapter IX, Reg. 1, Para. 3	The ability to be deployed to any area of interest to the Navy defined in the Concept of Operations Statement shall be maintained and the navigation equipment and sensors fit and on-board personnel shall provide: • the capability to conduct safe navigation as required by SOLAS, the COLREGS and, where applicable, the HSC Code. This capability must be entirely independent from the military combat systems functionality; Note: The requirements of Chapter IV and Chapter VI, Regulation 10 which relate to navigation equipment and systems shall be met. • on-board safety communications including internal communications, main broadcast, Bridge Navigation Watch Alarm System (if fitted) and portable communications equipment; • qualified personnel certified to operate and, if required, maintain the NAVTEX equipment to ITU Radio Regulations.
Chapter IX, Reg. 1, Para. 4	The vessel's Concept of Operations Statement document defines how the navigation systems of the ship are to be operated and maintained throughout the life of the ship and is to be shared by the Naval Administration and, where appointed, its Recognised Organisation.
Chapter IX, Reg. 4, Para. 10	Where required by the Concept of Operations Statement, ships shall have two, or more, inertial navigation systems, suitable for use at all times throughout the intended voyage, including the capability to navigate at Latitudes higher than 75 degrees, which automatically establishes and updates the ship's position and transmits positional information for input to, at least, the navigational radar, an automatic radar plotting aid, or equivalent, and the WECDIS, (W)AIS and VDR equipment.
Chapter IX, Reg. 10, Para. 11	The Naval Administration shall ensure that the process for establishing manning levels for a vessel takes account of the requirement for safe operation in normal circumstances and has the capacity to continue to operate safely when a vessel is in extremis or is, by force majeure, compelled to operate beyond the established Concept of Operations Statement.

Chapter X, Reg. 1, Para. 3	Ship arrangements associated with dangerous goods shall be in accordance with the requirements of SOLAS and IMDG Code. Where compliance, in whole or part, is not compatible with the Concept of Operations Statement the Owner shall comply with this Chapter by the implementation of: • equivalent arrangements for aspects within the scope of SOLAS or IMDG Code; and/or • additional arrangements for aspects outside the scope of SOLAS or IMDG Code.
Chapter X, Reg. 1, Para. 9	This Chapter applies to the carriage and use of dangerous goods during Foreseeable Operating Conditions. For extreme threat conditions, the Owner shall define the requirements in the Concept of Operations Statement and set the performance requirements for the safety of dangerous goods.
Chapter X, Reg. 2, Para. 3	The size, shape and location of the dangerous goods stowage areas, maintenance facilities, embarkation and disembarkation routes and emergency procedures shall be designed taking into account the Concept of Operations Statement, the use of the dangerous goods, their sensitiveness and their compatibility.
Chapter X, Reg. 2, Para. 16	The location of dangerous goods stores shall be determined by hazard identification and risk analysis against the foreseeable damage (and extreme threat damage where required) and taking into account the Concept of Operations Statement and the risks associated with the dangerous goods stored. For Class 1 items it is good practice to meet the following but should this not be possible, mitigation will be required to control the risks. The final arrangement shall be approved.
Chapter X, Reg. 4, Para. 2	The fire management policy for dangerous goods for the vessel, including prevention, detection, containment, control and extinguishing of fires, shall be defined in the Concept of Operations Statement and be approved.
Chapter X, Reg. 4, Para. 3	The fire detection, alarm and response system (e.g. fully automated or require manual activation) shall be appropriate to the ship's Concept of Operations Statement.

ANNEX A APPENDIX 5

Defining the Required Survivability

ANNEX A APPENDIX 5 - DEFINING THE REQUIRED SURVIVABILITY

OVERVIEW

A5.1 As the Naval Ship Code is to provide a level of safety appropriate to the role of the ship and benchmarked against statute while taking into account naval operations, it is necessary to define the degree of survivability in a form that can be taken into account in the development and application of all Naval Ship Code chapters.

A5.2 By way of example, the fundamental difference between the approach to fire safety for naval and civilian shipping is that SOLAS considers the risk of fire based on the function of each compartment whereas for naval ships, hostile acts may result in fire anywhere on the ship, both externally and internally. The consequence is that the solutions that are adopted for accidents may differ from those that are required to prevent and counteract hostile damage events.

A5.3 Thus, for the effective application of the Naval Ship Code, it is necessary to clearly define:

A5.3.1 the extent of damage that reflects both accidental damage and potential damage caused by hostile acts;

A5.3.2 the location of the damage;

A5.3.3 the degree of vulnerability (protection, redundancy of systems, materials used);

A5.3.4 the required post-damage ship capability; and

A5.3.5 the philosophy for recovery from the damaged state.

A5.4 Each Navy will have its own unique approach to this issue, and it is not possible to be prescriptive in the Naval Ship Code. However, it is possible to provide a basic framework that can then be adapted by each Naval Administration.

A5.5 It is then essential that the Owner and Naval Administration agree the required level of survivability in these terms for each class of ship.

A5.6 The following guidance presents the framework for achieving this and also presents recommended minimum extents of damage that are equivalent to that applied under statute to civilian shipping.

A5.7 The framework is based on the definition of a number of damage categories that vary in size and significance. By adopting distinct “categories”, it is then possible to de-couple the link between Operational Analysis (undertaken by the Navy and Owner that defines the weapon threat) and the application of Tier 3 Performance Requirements in the Naval Ship Code. Whereas the former is managed by Navies under strict security arrangements, it is only necessary to communicate how much damage and the required level of post-damage capability to the Naval Administration and Classification Society in unclassified terms without reference to specific weapon threats.

DEFINING REQUIRED SURVIVABILITY

A5.8 Based on the definition of categories outlined in the following sections, it is then possible for the Owner and Naval Administration to agree and document the degree of survivability required in terms of the:

A5.8.1 extent of damage;

A5.8.2 location of the damage;

A5.8.3 degree of vulnerability;

A5.8.4 required post-damage ship capability; and

A5.8.5 philosophy for recovery.

A5.9 For a particular class of ship combinations of the above may be applicable. For example:

> “The ship shall be capable of sustaining damage of limited extent on the outer bottom with function of critical systems being maintained and being recovered to full operational capability with basic recovery operations”.

A5.10 Further examples based on the definition of categories are shown in Figure A5-1: Defining Required Survivability examples. These are defined in greater detail in the following sections.

Scenario	**Damage Extent**	**Damage Location**	**Vulnerability**	**Post-damage Capability**	**Recovery Philosophy**	**Supplementary Notes**
	DCA Limited DCB Moderate DCC Severe	DLI Internal DLSI Specific Internal DLE External DLS Side DLOB Outer Bottom	VB Basic VM Moderate VN Naval	PC1 Safe Abandonment PC2 Float and Move PC3 Operational	RPB Basic RPI Intermediate RPA Advanced	Relevant additional notes for clarification
#1	DCA	DLOB	VB	PC3	RPI	
#2	DCB	DLI	VN	PC3	RPI	
#3	DCB	DLSI	VN	PC2	RPI	Steering gear
#4	DCC	DLSI	VB	PC1	RPI	Main magazine and machinery space
Etc						

Figure A5-1: Defining Required Survivability examples

EXTENT OF DAMAGE

A5.11 The Damage Categories are based on defined shapes as shown in Figure A5-2 below are to be used as follows:

A5.11.1 Sphere. To be used for explosions. For explosions detonating against the outside of the hull, half the sphere to be used.

A5.11.2 Cube. To be used to define the volume directly affected by fire and which may change in shape to fit the compartment.

A5.11.3 Raking/grounding. To be used in the appropriate horizontal orientation to describe the extent of raking or grounding damage, the apex representing the maximum penetration.

A5.11.4 Collision. To be used in the correct vertical orientation to describe the extent of collision damage from the bow of another ship, the apex representing the maximum penetration.

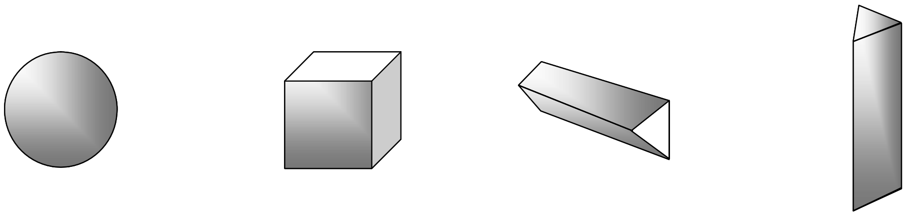

Figure A5-2: Damage Shapes

A5.12 The extent of each Damage Category is then defined as follows:

A5.12.1 Damage Category A (DCA) Limited:

A5.12.1.1 Sphere: 1m radius

A5.12.1.2 Cube: 2m sides

A5.12.1.3 Raking/grounding: 4m length 0.5m equal sides

A5.12.1.4 Collision damage: 4m height 0.5m equal sides

A5.12.1.5 Percentage of volume of shape within which structural capability and hardened systems destroyed: 50% (outside of this volume subdivision boundaries perforated and non-hardened systems destroyed).

A5.12.1.6 Temperature (heat caused by initiating event assuming no other combustion). Time to rise to peak: 5 minutes. Peak temperature: 200degC. Duration of peak temperature: 10 minutes. Time for temperature to revert to normal: 50 minutes.

A5.12.2 Damage Category B (DCB) Moderate

A5.12.2.1 Sphere: 4m radius

A5.12.2.2 Cube: 8m sides

A5.12.2.3 Raking/grounding: 16m length 2m equal sides

A5.12.2.4 Collision damage: 16m height 2m equal sides

A5.12.2.5 Percentage of volume of shape within which structural capability and hardened systems destroyed: 50% (outside of this volume subdivision boundaries perforated and non-hardened systems destroyed).

A5.12.2.6 Temperature (heat caused by initiating event assuming no other combustion). Time to rise to peak: 10 minutes. Peak temperature: 300degC. Duration of peak temperature: 20 minutes. Time for temperature to revert to normal: 100 minutes.

A5.12.3 Damage Category C (DCC) Significant

A5.12.3.1 Sphere: 10m radius

A5.12.3.2 Cube: 20m sides

A5.12.3.3 Raking/grounding: 40m length 5m equal sides

A5.12.3.4 Collision damage: 40m height 5m equal sides

A5.12.3.5 Percentage of volume of shape within which structural capability and hardened systems destroyed: 50% (outside of this volume subdivision boundaries perforated and non-hardened systems destroyed).

A5.12.3.6 Temperature (heat caused by initiating event assuming no other combustion). Time to rise to peak: 20 minutes. Peak temperature: 400degC. Duration of peak temperature: 40 minutes. Time for temperature to revert to normal: 200 minutes.

LOCATION OF DAMAGE

A5.13 Different types of damage may occur in different locations on the ships. Grounding clearly affects the outer bottom, raking damage the ship side, collision the bow or ship side and so on.

A5.14 These areas may be simply defined as follows:

A5.14.1 Damage Location Internal (DLI). All enclosed spaces with the ship that may be isolated from the external environment.

A5.14.2 Damage Location Specific Internal (DLSI). Specific enclosed spaces such as high risk compartments.

A5.14.3 Damage Location External (DLE). All external surfaces above the waterline and compartments immediately inside.

A5.14.4 Damage Location Side (DLS). Anywhere on the periphery of the ship and compartments immediately inside.

A5.14.5 Damage Location Outer Bottom (DLOB). Areas vulnerable to raking damage and compartments immediately inside.

VULNERABILITY

A5.15 The vulnerability of various parts of the ship and systems will directly affect the overall survivability. This includes the level of redundancy, the type of materials used and the level of protection employed.

A5.16 The degree of vulnerability may be described in high level terms as follows:

A5.16.1 Vulnerability Basic (VB). Insulation of systems and compartment boundaries and control of materials in key compartments. Redundancy of critical systems only.

A5.16.2 Vulnerability Moderate (VM). Insulation of systems and compartment boundaries and control of materials in all manned spaces. Redundancy of all systems associated with the ability of the ship to float and move.

A5.16.3 Vulnerability Naval (VN). Insulation of systems and compartment boundaries and control of materials in all manned spaces. Redundancy of all systems associated with operational capability. Specific compartment boundaries may be left without insulation to enable boundary cooling to be applied.

POST-DAMAGE CAPABILITY

A5.17 The level of post-damage capability may be considered separately from the degree of damage assumed. For convenience, it is possible to define categories for post-damage capability:

A5.17.1 Post-Damage Capability Category 1 (PC1) Safe Abandonment. The ship shall be recovered to enable all persons to safely escape and evacuate in such a way as to maximise their chances of safe rescue.

A5.17.2 Post-Damage Capability Category 2 (PC2) Float and Move. The ship shall be recovered to provide a safe platform and be capability of limited movement to a safe haven in limited sea states.

A5.17.3 Post-Damage Capability Category 3 (PC3) Operational. The ship shall be recovered to achieve operational capability in all environmental conditions for which the ship has been designed.

A5.18 PC 1 and PC2 relate to safety and are within the scope of the Naval Ship Code.

A5.19 PC3 is a matter for the Owner and is therefore beyond the scope of the Naval Ship Code. In this latter case, the definition of “operational capability” will be complex and will require the Owner to carefully model critical systems, redundancy, vulnerability and so in complex analytical tools. Although PC3 is outside the scope of the Naval Ship Code, the Owner may gain some assurance from the achievement of PC2 that can be built on to then demonstrate the achievement of PC3.

RECOVERY PHILOSOPHY

A5.20 It is not sufficient to just define the damage extent and the post-damage capability. The Owner and the Naval Administration must also agree the means by which the ship is recovered to the desired state.

A5.21 Principally, this will either be achieved with automatic systems or with manual intervention, or a combination of both at each phase of the recovery operation from detection, to initial response, to repair. Finally, the point at which the ship will be dependent on external assistance will also need to be defined. Although there are many potential combinations, the following categories reflect the usual approaches to recovery:

A5.21.1 Recovery Philosophy Basic (RPB). Detection of an incident with local alarms and patrols. Initial response using handheld devices. Limited onboard repair capability.

A5.21.2 Recovery Philosophy Intermediate (RPI). Detection of an incident with local alarms connected to central command point in additional to limited patrols. Initial response with automatic systems in key compartments, supplemented with handheld devices as required. Primary recovery undertaken by embarked personnel, with external support for significant damage.

A5.21.3 Recovery Philosophy Advanced (RPA). Detection of an incident with an extensive alarm system centrally managed. Initial response with automatic systems in all manned compartments. Primary recovery achieved through reconfigurable systems, limited repair by embarked personnel, and with external support for significant damage.

ANNEX A APPENDIX 6

Watertight Integrity Surveys

ANNEX A APPENDIX 6 – WATERTIGHT INTEGRITY SURVEYS

SURVEY SCOPE

A6.1 Material State surveys are categorised as:

A6.1.1 Initial Survey – confirming confidence in the construction of the new ship.

A6.1.2 Periodic Survey – maintaining confidence in the material state during the period of certification and thus maintaining certification validity.

A6.1.3 Renewal Survey – confirming confidence in the material state for a subsequent period of certification.

A6.2 For periodic and renewal surveys a risk based approach may be used to target areas where defects are expected. In addition to the normal extent of survey for periodic and renewal surveys, the survey is to include survey of changes to the design as audited by the Naval Administration.

A6.3 The percentages shown in the key below indicate the minimum survey requirements. It is the responsibility of the surveyor to survey to a greater extent if there are any concerns over the condition of a particular item.

A6.4 The key below shows the icons used throughout the example survey record. The icons indicate the extent of survey required for each item under each survey type. A short definition of each extent of survey is in the key.

Key:	[ ]	= Item applicable to this survey type (survey required)
	10%	= Item partially applicable to this survey type (a survey of approximately 10% of this item is required)
	25%	= Item partially applicable to this survey type (a survey of approximately 25% of this item is required)
	DCD	= Item partially applicable to this survey type (a survey is required of only items on the watertight deck provided at a location above the submergence limit e.g. damage control deck (DCD))
	NEW / Repair	= Item partially applicable to this survey type (survey required of all items that have either been repaired or are part of an new equipment)
	IF OPEN	= Item partially applicable to this survey type (survey recommended if the tank is open and certified safe to enter)
	If under-taken	= Item partially applicable to this survey type (At surveyors discretion)
	[shaded]	= Item not applicable to this survey type (survey not required)

A6.5 The accompanying check box alongside each item may be used to assist in conducting the survey.

Prior to the Survey

A6.6 Prior to the survey, the surveyor should review any outstanding Conditions of Certification or Memorandum Items.

A6.7 The surveyor should request details of all applicable changes to the design. The surveyor should review this information prior to the survey. Areas that have been modified will require additional attention during the survey.

After the Survey

A6.8 Any defects that are noted as Memorandum Items or are considered to require a Condition of Certification should be recorded as such in the notes section of Survey Record Sheet

General

Plans	**I**	**P**	**R**
Have all the applicable plans been approved?			
Have all the applicable Approved Plans been made available to the surveyor?			
Has a Survey Specification Document been produced and made available to the surveyor?			
Have all changes to the original approved plans (if any) been plan approved?			
Notes			

Materials	**I**	**P**	**R**
Have all plates, sections, forgings and castings been manufactured in accordance with approved processes?		NEW / Repair	NEW / Repair
Have all other parts & equipment of an approved type been manufactured in accordance with approved processes?		NEW / Repair	NEW / Repair
Have the welding consumables been approved?		NEW / Repair	NEW / Repair
Notes			

Construction	I	P	R
Has all welding been undertaken in accordance with the agreed standards?			
Has sufficient Non Destructive Examination been carried out to comply with the agreed standards?			

Notes

General	I	P	R
Have all previously identified defects been mitigated or rectified?			

Notes

Survey Record for Buoyancy & Stability

General Requirements	I	P	R
Check that the condition of the hull and its closing appliances to the submergence limit is satisfactory as far as practicable		25%	
Check the primary watertight boundaries to the submergence limit are watertight		25%	
Check the secondary watertight boundaries to the submergence limit are watertight			25%
Does the current draught exceed the full load draught stated on the certificate			

Notes

Internal Openings in Structure

Watertight Doors	I	P	R
Check watertight door type & structure and chalk test and/or hose test as appropriate			
Check closing device markings where appropriate			
Operationally test watertight door		DCD	
Check watertight door seals		DCD	

Notes

Additional Requirements For Power Operated Watertight Doors Only	I	P	R
Check visible & audible alarm within adjacent spaces during opening / closing of watertight doors			
Check door markings where appropriate			
Check remote operation of watertight doors from bridge			
Check indication for watertight doors on bridge			
Check local operation of watertight doors (including visible/audible operating alarm)			

Notes

Watertight Hatches	I	P	R
Check watertight hatch type & structure and chalk test and/or hose test as appropriate			
Check markings where appropriate			
Check watertight hatch clips		DCD	
Check watertight hatch seals		DCD	

Notes

Watertight Escape Scuttles	I	P	R
Check escape scuttle type & structure and chalk test and/or hose test as appropriate			
Check escape scuttle seals		DCD	

Notes

Penetrations	I	P	R
Check penetrations are of an approved type			
Check all open systems are fitted with isolation capable of being operated from each side of the bulkhead and remotely from on or above the damage control deck		25%	
Check the condition of penetrations through watertight bulkheads is satisfactory		25%	
Check the condition of penetrations through the damage control deck is satisfactory		10%	
Check the condition of penetrations through other decks is satisfactory			25%

Notes

External Openings in Structure below the submergence limit

Watertight Doors	I	P	R
Check watertight door type & structure and chalk test and/or hose test as appropriate			
Check markings where appropriate			
Operationally test watertight door			
Check watertight door seals			

Notes

Watertight Hatches	I	P	R
Check watertight hatch type & structure and chalk test and/or hose test as appropriate			
Check markings where appropriate			
Check watertight hatch clips			
Check watertight hatch seals			

Notes

Downflooding	I	P	R
Check and test the operation of hatch and vent covers		25%	
Check fixed hatch covers, coamings and gaskets			25%
Check the condition of vents, air pipes and their closing arrangement			25%

Notes

Bow, Stern or Side Doors	I	P	R
Operation of doors and power units witnessed and found satisfactory			
Door structure and surrounding ship structure examined and found satisfactory			25%
The door sealing arrangements including gaskets and retaining bars found to be satisfactory			
The door cleating, locking and securing arrangements are complete, have been examined and operate satisfactorily			
The door hinging arrangements have been examined and found to be satisfactory			
The local and/or remote operation of securing devices/cleats found to be satisfactory			
All equipment associated with the opening, closing and securing of the doors, that is wire ropes, chains, sheaves, rollers, guides, shackles etc. examined and found to be satisfactory			
The tightness of the doors has been confirmed and chalk test and/or hose test as appropriate			
The remote control panels and associated indicator lights, closed circuit television system, water leakage indicator lights and alarm systems have been examined and found to operate satisfactorily			

Notes

Discharges and Inlets	I	P	R
Check scuppers			50%
Check salvage discharges			50%
Check sanitary discharges			50%
Check inlets			50%

Notes

External Openings in Structure above the submergence limit

Watertight/Weathertight Doors	I	P	R
Check watertight/weathertight door type & structure and chalk test and/or hose test as appropriate			
Operationally test watertight door			
Check watertight door seals			
Notes			

Watertight Hatches	I	P	R
Check watertight hatch type & structure and chalk test and/or hose test as appropriate			
Check watertight hatch clips			
Check watertight hatch seals			
Notes			

Cargo Hatches	I	P	R
Check cargo hatch type & structure			
Check cargo hatch seals			
Examine condition of cargo hatch covers			
Examine condition of cargo hatch cover closing appliances			
Perform hose test if deemed necessary			
Notes			

Downflooding	I	P	R
Check and test the operation of hatch and vent covers			
Check fixed hatch covers, coamings and gaskets			10%
Check the condition of vents, air pipes and their closing arrangement.			10%
Check all other closing devices			10%
Examine the condition of service hatches			25%
Examine condition of machinery casing openings			25%

Notes

Loading or Stability Computer	I	P	R
Check the operation of the loading computer			
Check the Lightship data against the latest incline			
Check Loading Computer Users' Manual is onboard			
Check Loading Computer redundancy			

Notes

Operator Guidance	I	P	R
Check the approved Stability guidance is on board and in-date			
Check the approved Collision Avoidance & Dynamic Motions Guidance is on board			
Check the approved Docking Plan is on board			

Notes

Safety of Persons on Board	**I**	**P**	**R**
Check the guardrails, handrails, and safety points			
Load test the guardrails, handrails, and safety points as appropriate			

Notes

Experiments, Trials and Tests

Watertight Integrity	**I**	**P**	**R**
Witness hose testing of watertight closures			If under-taken

Notes

Reserve of Buoyancy	**I**	**P**	**R**
Witness Inclining Experiment			If under-taken
Witness Displacement Check			If under-taken

Notes

Collision Avoidance Trials	**I**	**P**	**R**
Witness Collision Avoidance Trials (Zig-zag and Spiral Manoeuvre)			

Notes

Dynamic Motion Trials (If Applicable)	**I**	**P**	**R**
Witness dynamic motion trials	If under-taken		

Notes

The Chairman of the Specialist Team on Naval Ship Safety and Classification thanks all those in Navies and in Classification Societies who have contributed to the development of this Naval Ship Code.

It is hoped that the adoption, application and continued development of this publication will improve the assurance of safety of naval ships.
All comments gratefully received.
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