INTERNATIONAL MARITIME ORGANIZATION
4 ALBERT EMBANKMENT
LONDON SE1 7SR

Telephone: 020 7735 7611
Fax: 020 7587 3210
Telex: 23588 IMOLDN G

IMO

E

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GUIDELINES FOR SHIPS OPERATING IN ARCTIC ICE-COVERED WATERS

1 The Maritime Safety Committee, at its seventy-sixth session (2 to 13 December 2002), and the Marine Environment Protection Committee, at its forty-eighth session (7 to 11 October 2002), recognizing the need for recommendatory provisions applicable to ships operating in Arctic ice-covered waters, additional to the mandatory and recommendatory provisions contained in existing IMO instruments, approved Guidelines for ships operating in Arctic ice-covered waters, as set out in the annex.

2 Member Governments are invited to bring the annexed Guidelines to the attention of shipowners, ship designers, shipbuilders, ship repairers, equipment manufactures and installers and all other parties concerned with the operation of ships in Arctic ice-covered waters.

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ANNEX

GUIDELINES FOR SHIPS OPERATING IN ARCTIC ICE-COVERED WATERS

PREAMBLE

P-1 Introduction

P-1.1 Ships operating in the Arctic environment are exposed to a number of unique risks. Poor weather conditions and the relative lack of good charts, communication systems and other navigational aids pose challenges for mariners. The remoteness of the areas makes rescue or clean-up operations difficult and costly. Cold temperatures may reduce the effectiveness of numerous components of the ship, ranging from deck machinery and emergency equipment to sea suctions. When ice is present, it can impose additional loads on the hull, propulsion system and appendages.

P-1.2 These Guidelines for ships operating in Arctic ice-covered waters (hereinafter called "the Guidelines") are intended to address those additional provisions deemed necessary for consideration beyond existing requirements of the SOLAS Convention, in order to take into account the climatic conditions of Arctic ice-covered waters and to meet appropriate standards of maritime safety and pollution prevention.

P-1.3 The Guidelines are recommendatory and their wording should be interpreted as providing recommendations rather than mandatory direction.

P-2 Principles

P-2.1 The Guidelines aim to promote the safety of navigation and to prevent pollution from ship operations in Arctic ice-covered waters.

P-2.2 The Guidelines recognize that this is best achieved by an integrated approach, based on requirements in existing Conventions which cover the design, outfitting, crewing and operation of ships for the conditions which they will encounter.

P-2.3 The Guidelines take into account that Arctic conditions may include sea and glacial ice that can represent a serious structural hazard to all ships. This is the single most significant factor in Arctic operations and is reflected in many of the Guidelines' provisions.

P-2.4 The Guidelines address the fact that the Arctic environment imposes additional demands on ship systems, including navigation, communications, life-saving, main and auxiliary machinery, etc. They emphasize the need to ensure that all ship systems are capable of functioning effectively under anticipated operating conditions and providing adequate levels of safety in accident and emergency situations.

P-2.5 In addition, the Guidelines recognize that safe operation in such conditions requires specific attention to human factors including training and operational procedures.

P-2.6 The basic requirements for structure, stability and subdivision, machinery, life-saving appliances, fire protection, ship routing, navigation systems and equipment, radiocommunication, pollution prevention equipment, liability and safety management systems, as applicable to the different types and sizes of ships which may undertake voyages in Arctic ice-covered waters, are obtained from the relevant conventions. The standards expressed in these Guidelines have been developed to mitigate the additional risk imposed on shipping due to the harsh environmental and climatic conditions existing in Arctic ice-covered waters.

P-2.7 Not all ships which enter the Arctic environment will be able to navigate safely in all areas at all times of the year. A system of Polar Classes has therefore been developed to designate different levels of capability. In parallel to the development of the Guidelines, the International Association of Classification Societies (IACS) has developed a set of Unified Requirements which, in addition to general classification society rules, address all essential aspects of construction for ships of Polar Class.

P-2.8 These Guidelines are not intended to infringe on national systems of shipping control.

GUIDE

G-1 Layout of the Guidelines

G-1.1 The Guidelines include general, construction, equipment and operational parts, presented in that order and subdivided into chapters.

G-1.2 This section provides definitions for important terms that are used exclusively within the Guidelines or where any term has more than one meaning in other applicable conventions. Otherwise, terms have the meanings defined in the convention(s) relevant to each chapter.

G-1.3 All parts and chapters of the Guidelines should be applied to Polar Class ships. All parts and chapters, with the exception of those dealing with purely construction guidelines (Part A), should be applied to non-Polar Class ships. Each chapter notes any additional differentiation of Guidelines between ship classes specific to that chapter.

G-1.4 Guidance provided in Part A of the Guidelines is only intended for new Polar Class ships.

G-1.5 Commonly accepted nominal equivalencies are shown in the following table:

Nominal ship equivalencies

Finnish/Swedish (Baltic)Class*	ASPPR Class	Russian Register Class	Polar Class
IA Super	Type A	UL	PC6
IA	Type B	L1	PC7

*Note: Authorized classification society equivalents to Baltic classes should also be recognized. The classification society equivalents for the Finnish/Swedish ice classes have been issued in the Finnish Maritime Administrations' Bulletin No.16/27.11.2002, which can be found in website www.fma.fi.

G-2 Key provisions

G-2.1 The combination of hull structural design, material quality, subdivision and segregation measures prescribed in the Guidelines and supporting standards should be adequate to reduce the risk of human casualties, pollution incidents or ship losses to acceptably low levels of probability during prudent operations in Arctic ice-covered waters.

G-2.2 No pollutants should be carried directly against the shell in areas at significant risk of ice impact. Operational pollution of the environment should be minimized by equipment selection and operational practice.

G-2.3 Key safety-related, survival and pollution control equipment should be rated for the temperatures and other conditions which may be encountered in the service intended.

G-2.4 Navigation and communications equipment should be suitable to provide adequate performance in high latitudes, areas with limited infrastructure and unique information transfer requirements.

G-2.5 Sea suction(s) should be capable of being cleared of accumulation of slush ice.

G-3 Definitions

For the purpose of these Guidelines, unless expressly provided otherwise, the terms used have the meanings defined in the following paragraphs. Additional definitions are given in the various chapters as required. Terms used, but not defined in these Guidelines, are to be interpreted as they are defined in the relevant Conventions.

G-3.1 "Administration" means the Government of the State whose flag the ship is entitled to fly.

G-3.2 "Arctic ice-covered waters" – solely for the purposes of these Guidelines, means those waters which are both:

.1 located north of a line from the southern tip of Greenland and thence by the southern shore of Greenland to Kape Hoppe and thence by a rhumb line to latitude 67º03'9 N, longitude 026º33'4 W and thence by a rhumb line to Sørkapp, Jan Mayen and by the southern shore of Jan Mayen to the Island of Bjørnøya, and thence by a great circle line from the Island of Bjørnøya to Cap Kanin Nos and thence by the northern shore of the Asian Continent eastward to the Bering Strait and thence from the Bering Strait westward to latitude 60º North as far as Il'pyrskiy and following the 60th North parallel eastward as far as and including Etolin Strait and thence by the northern shore of the North American continent as far south as latitude 60º North and thence eastward to the southern tip of Greenland (see figure 1); and

.2 in which sea ice concentrations of 1/10 coverage or greater are present and which pose a structural risk to ships.

G-3.3 "COLREG" means the International Regulations for Preventing Collisions at Sea, 1972, as amended.

G-3.4 "Company" means the owner of the ship or any other organization or person such as the manager, or the bareboat charterer, who has assumed the responsibility for operation of the ship from the ship owner.

G-3.5 "Conning position" means the stations in which the ship's control devices for ahead or astern operations are located.

G-3.6 "Escort" means any ship with superior ice capability in transit with another ship.

G-3.7 "Escorted operation" means any operation in which a ship's movement is facilitated through the intervention of an escort.

G-3.8 "Guidelines" means the IMO recommendatory Guidelines for ships operating in Arctic ice-covered waters.

G-3.9 "IACS" means the International Association of Classification Societies.

G-3.10 "Ice Navigator" means any individual who, in addition to being qualified under the STCW Convention, is specially trained and otherwise qualified to direct the movement of a ship in ice-covered waters.

G-3.11 "Icebreaker" means any ship whose operational profile may include escort or ice management functions, whose powering and dimensions allow it to undertake aggressive operations in ice-covered waters.

G-3.12 "International voyages" means voyages in international waters, as defined in chapter I of the SOLAS Convention.

G-3.13 "ISM Code" means the International Management Code for the Safe Operation of Ships and for Pollution Prevention, as amended.

G-3.14 "LL Convention" means the International Convention on Load Lines, 1966, as amended.

G-3.15 "MARPOL Convention" means the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the 1978 Protocol relating thereto (MARPOL 73/78), as amended.

G-3.16 "Organization" means the International Maritime Organization.

G-3.17 "Polar Class" means the class assigned to a ship based upon IACS Unified Requirements.

G-3.18 "Polar Class ship" means a ship for which a Polar Class has been assigned.

G-3.19 "Pollutant" means the substances defined as oil, oily mixture and oil fuel in Annex I; noxious liquid substances in Annex II; and solids when carried in bulk, which are also identified as harmful substances in Annex III of the MARPOL Convention.

G-3.20 "Port State" means a State whose area of jurisdiction includes any destination port of a ship where such port lies within Arctic ice-covered waters.

G-3.21 "Recognized organization" means an organization recognized by an Administration in accordance with IMO resolutions A.739(18) and A.789(19).

G-3.22 "Ship" means any vessel covered by the SOLAS Convention.

G-3.23 "SOLAS Convention" means the International Convention for the Safety of Life at Sea, 1974, as amended.

G-3.24 "STCW Convention" means the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978/1995, as amended.

G-3.25 "Unified Requirements" means the IACS Unified Requirements for Polar Class ships*.

G-3.26 "WMO" means the World Meteorological Organization.

G-3.27 "Working liquid" means any oil or oily substance used for the operation of the ship's machinery.

* Under development.

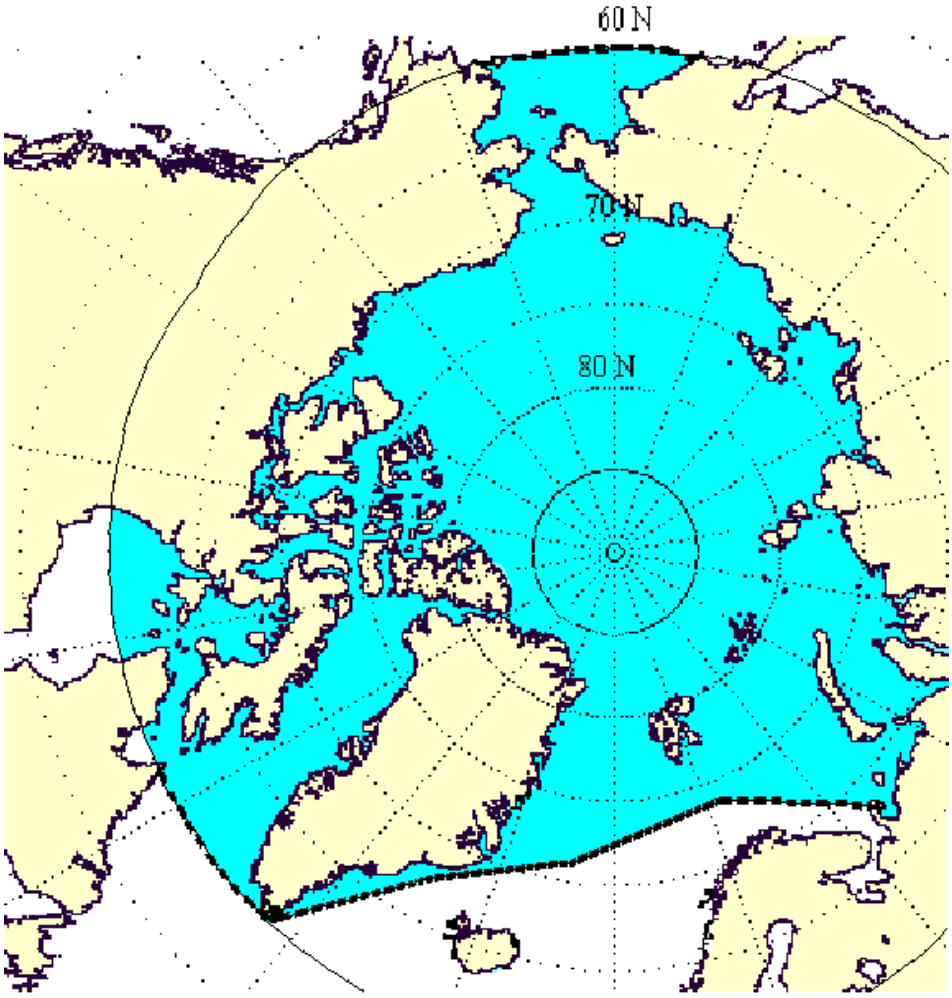

Figure 1 – Maximum extent of application (see paragraph G-3.2.1)

CHAPTER 1

GENERAL

1.1 Application

1.1.1 These Guidelines provide guidance for ships while operating in Arctic ice-covered waters as defined in paragraph G-3.2 and while engaged in international voyages.

1.1.2 Part A of the Guidelines provides guidance for Polar Class ships as defined in paragraph G-3.18.

1.1.3 Parts B and C of these Guidelines provide guidance for Polar Class and Non-Polar Class ships.

Table 1.1 - Class descriptions

(It should be noted that the IACS Unified Requirements which these class descriptions are based on are not yet completed and are subject to change)

POLAR CLASS	GENERAL DESCRIPTION
PC 1	Year-round operation in all Arctic ice-covered waters
PC 2	Year-round operation in moderate multi-year ice conditions
PC 3	Year-round operation in second-year ice which may include multi-year ice inclusions
PC 4	Year-round operation in thick first-year ice which may include old ice inclusions
PC 5	Year-round operation in medium first-year ice which may include old ice inclusions
PC 6	Summer/autumn operation in medium first-year ice which may include old ice inclusions
PC 7	Summer/autumn operation in thin first-year ice with which may include old ice inclusions

Note: Ice descriptions follow WMO Sea Ice Nomenclature.

1.1.4 All Polar Class ships and the equipment to be carried in accordance with these Guidelines should be designed, constructed and maintained in compliance with applicable national standards of the Administration or the appropriate requirements of a recognized organization which provide an equivalent level of safety* for its intended service.

1.1.5 The structures, equipment and arrangements essential for the safety and operation of the ship should take account of the expected air temperatures.

* Refer to SOLAS regulation II-1/3-1 and to the proposed IACS Unified Requirements for Polar Ships.

1.1.6 The life-saving and fire-extinguishing equipment specified in part B of the Guidelines, when stored or located in an exposed position, should be of a type that is rated to perform its design functions at a minimum air temperature of -30°C, or at any appropriate lower temperature in accordance with paragraph 1.1.5. In particular, attention is drawn to the inflation of life-saving equipment and the starting of engines in lifeboats and rescue boats.

1.1.7 Operations in Arctic ice-covered waters should take due account of factors such as: ship class, environmental conditions, icebreaker escort, prepared tracks, short or local routes, crew experience, support technology and services such as ice-mapping, communications, safe ports, repair facilities and other ships in convoy.

1.1.8 The provisions of these Guidelines do not apply to any warship, naval auxiliary, other vessels or aircraft owned or operated by a State and used, for the time being, only on government non-commercial service. However, each State should ensure, by the adoption of appropriate measures not impairing operations or operational capabilities of such vessels or aircraft owned or operated by it, that such vessels or aircraft act in a manner consistent, so far as is reasonable and practicable, with these Guidelines.

1.2 Ice Navigator

1.2.1 All ships operating in Arctic ice-covered waters should carry at least one Ice Navigator qualified in accordance with chapter 14.

1.2.2 Continuous monitoring of ice conditions by an Ice Navigator should be available at all times while the ship is underway and making way in the presence of ice.

PART A - CONSTRUCTION PROVISIONS

CHAPTER 2

STRUCTURES

2.1 General

2.1.1 All ships should have structural arrangements adequate to resist the global and local ice loads characteristic of their Polar Class*.

2.1.2 Each area of the hull and all appendages should be strengthened to resist design structure/ice interaction scenarios applicable to each case.

2.1.3 Structural arrangements should aim to limit damage resulting from accidental overloads to local areas.

2.1.4 Polar Class ships may experience in-service structural degradation at an accelerated rate. Structural surveys should, therefore, cover areas identified as being at high risk of accelerated degradation, and areas where physical evidence such as coating breakdown indicates a potential for high wastage rates.

* Refer to the proposed IACS Unified Requirements for Polar Ships.

2.2 Materials

2.2.1 Materials used in ice-strengthened and other areas of the hull should be suitable for operation in the environment that prevails at their location.

2.2.2 Materials used in ice-strengthened areas should have adequate ductility to match the selected structural design approach.

2.2.3 Abrasion and corrosion resistant coatings and claddings used in ice-strengthened areas should be matched to the anticipated loads and structural response.

CHAPTER 3

SUBDIVISION AND STABILITY

3.1 Intact stability in ice

3.1.1 Account should be taken of the effect of icing in the stability calculations.[*]

3.1.2 Suitable calculations should be carried out and/or tests conducted to demonstrate the following:

.1 the ship, when operated in ice within approved limitations, during a disturbance causing roll, pitch, heave or heel due to turning or any other cause, should maintain sufficient positive stability; and

.2 ships of Polar Classes 1 to 3 and icebreakers of all classes, when riding up in ice and remaining momentarily poised at the lowest stem extremity, should maintain sufficient positive stability.

3.1.3 Sufficient positive stability in paragraphs 3.1.2.1 and 3.1.2.2 means that the ship is in a positive state of equilibrium with a positive metacentric height of at least 150 mm, and a line 150 mm below the edge of the freeboard deck as defined in the applicable LL Convention, is not submerged.

3.1.4 For performing stability calculations on ships that ride up onto the ice, the ship should be assumed to remain momentarily poised at the lowest stem extremity as follows:

.1 for a regular stem profile, at the point at which the stem contour is tangent to the keel line;

.2 for a stem fitted with a structurally defined skeg, at the point at which the stem contour meets the top of the skeg;

.3 for a stem profile where the skeg is defined by shape alone, at the point at which the stem contour tangent intersects the tangent of the skeg; or

.4 for a stem profile of novel design, the position should be specially considered.

[*] Refer to resolution A.749(18), Code on Intact Stability for All Types of Ships Covered by IMO Instruments.

3.2 Stability in damaged conditions

3.2.1 All Polar Class ships should be able to withstand flooding resulting from hull penetration due to ice damage of the extent set out in paragraph 3.2.2 and location set out in paragraph 3.2.3, and should remain in a satisfactory condition of equilibrium after such damage, as defined by the IMO instruments applicable to the ship.

3.2.2 The dimensions of an ice damage penetration should be taken as:

.1 longitudinal extent 0.045 of deepest ice waterline length if centred forward of the point of maximum beam on the waterline, and 0.015 of waterline length otherwise;

.2 depth 760 mm measured normal to the shell over the full extent of the damage; and

.3 vertical extent the lesser of 0.2 of deepest ice draft, or of longitudinal extent.

3.2.3 The centre of the ice damage may be located at any point between the keel and 1.2 times the deepest ice draft. The vertical extent of damage may be assumed to be confined between the keel and 1.2 times the deepest ice draft. For ships of Polar Classes 5, 6 and 7 not carrying polluting or hazardous cargoes, damage may be assumed to be confined between watertight bulkheads, except where such bulkheads are spaced at less than the damage dimension.

3.3 Subdivision

3.3.1 Subject to paragraphs 3.3.2 and 3.3.3, no Polar Class ship should carry any pollutant directly against the outer shell. Any pollutant should be separated from the outer shell of the ship by double skin construction of at least 760 mm in width.

3.3.2 All Polar Class ships should have double bottoms over the breadth and the length between forepeak and afterpeak bulkheads. Double bottom height should be in accordance with the rules of the classification societies in force. Double bottoms should not be used for the carriage of pollutants except where a double skin construction complying with paragraph 3.3.1 is provided, or where working liquids, are carried in way of main machinery spaces in tanks not exceeding 20 m^3 individual volume.

3.3.3 Double bottoms in ships of Polar Classes 6 and 7 may be used for the carriage of any working liquids where the tanks are aft of midships and within the flat of bottom.

3.3.4 All Polar Class ships with icebreaking bow forms and short forepeaks may dispense with double bottoms up to the forepeak bulkhead in the area of the inclined stem, provided that the watertight compartments between the forepeak bulkhead and the bulkhead at the junction between the stem and the keel are not used to carry pollutants.

CHAPTER 4

ACCOMMODATION AND ESCAPE MEASURES

4.1 General

4.1.1 All personnel accommodations should be designed and arranged to protect the occupants from unfavourable environmental conditions and minimize risk of injury during normal (including ice transiting or icebreaking) operations and emergency conditions.

4.1.2 All personnel accommodations, public spaces and the equipment installed in them should be designed so that each person making proper use of them will not suffer injury during normal open water operations, designed ice transiting modes of operation, and emergency manoeuvring conditions.

4.1.3 Ships of Polar Classes 1 to 5 inclusive should have sufficiently available and reliable facilities to maintain a life sustaining environment in the event of an emergency and/or of extended ice entrapment.

4.2 Public address systems and other safety items

4.2.1 The public address system and the general emergency alarm system should be audible over the loudest ambient noise level occurring during ice transiting, ice breaking or ramming.

4.2.2 Ships of Polar Classes 1 to 3 inclusive, icebreakers and ships intended to be used in the ramming mode should be designed with adequate provisions to ensure the safety of personnel using shower facilities. Such facilities should include non-slip decking, three rigid sides, handholds and insulation from exposed hot water pipes.

4.2.3 Galley facilities should be provided with grab rails projecting from the front on cooking equipment for use by the crew during ice operations.

4.2.4 Equipment designed to heat oil for cooking purposes such as deep fat fryers should be located in a position suitably separated from hotplates or other hot surfaces. Such appliances should also be secured to the deck or other fixed structure and provided with an oil tight lid or closure to prevent splashing or spillage during ice operations.

4.3 Escape measures

4.3.1 All means of escape from accommodation or interior working spaces should not be rendered inoperable by ice accretion or by malfunction due to low external ambient air temperatures.

4.3.2 All escape routes should be dimensioned so as not to hinder passage for persons wearing suitable Polar clothing.

4.3.3 Escape routes should be designed to minimize the distance between their exit to an open deck and the survival equipment to which they lead.

CHAPTER 5

DIRECTIONAL CONTROL SYSTEMS

General

5.1 All Polar Class ships should be provided with directional control systems of adequate strength and suitable design to enable efficient operation in Arctic ice-covered waters.

5.2 For the purpose of this chapter, a directional control system includes any device or devices intended either as a primary or auxiliary means of steering the ship. The directional control system includes all associated power sources, linkages, controls and actuating systems.

5.3 Attention is drawn to the possibility of interaction between directional control systems and propulsion systems. Where such interaction occurs or where dual purpose components are fitted, the provisions of chapters 7 and 8 should also be complied with, as applicable.

CHAPTER 6

ANCHORING AND TOWING ARRANGEMENTS

6.1 General

All Polar Class ships navigating in Arctic ice-covered waters should be capable of anchoring and providing limited assistance in the case of debilitating damage or breakdown, towards the prevention of a catastrophic loss or pollution incident. The capability of ships to provide assistance should be considered of prime importance, having due regard to the lack of repair facilities, the limited number of dedicated towing ships available and the response time that may be required by a dedicated towing ship to be able to provide effective assistance in Arctic ice-covered waters.

6.2 Anchoring arrangements

6.2.1 Ships of Polar Classes 1 to 5 inclusive and icebreakers of all classes should, as far as practicable, be designed to protect the anchor from being dislodged from its stowed position and from jamming or damaging the hull by direct impact with ice.

6.2.2 Anchoring systems should be provided with an independent means of securing the anchor so that the anchor cable can be disconnected for use as an emergency towing bridle.

6.3 Towing arrangements

6.3.1 All Polar Class ships designed to perform dedicated towing operations and all icebreakers should be equipped with line throwing apparatus in addition to that required for life-saving. This apparatus should be capable of delivering messenger lines for the transfer of towing equipment. Such line throwing apparatus should not be of the powder/rocket type, in order that it may be safely used to make a transfer to a tanker.

6.3.2 All Polar Class ships designed to perform dedicated towing operations should be provided with a quick release system, operable from the conning position.

6.3.3 Where fitted, close coupled bow to stern towing arrangements should comprise strengthened bow plating on the towed ship, appropriate towing slings, non-interfering positioning of bower anchors and disallowance of bulbous bows. In this case, arrangements should be provided for securing the anchor in the stowed position.

6.4 Emergency towing arrangements

6.4.1 All Polar Class ships should be capable of receiving emergency towing assistance.

6.4.2 Where appropriate towing arrangements should facilitate connection and release of a towline and provide bollards, fairleads, and other components suitable for the size of ship on which they are fitted.

CHAPTER 7

MAIN MACHINERY

7.1 General

7.1.1 The design, rating, installation, operation and maintainability of shipboard engineering systems should be suitable for navigation in Arctic ice-covered waters*.

7.1.2 In the event of damage, malfunction or failure of any machinery component, means should be provided to control and limit any resulting emission of pollutants to within the confines of the ship's hull.

7.1.3 The layout and construction of machinery essential for the safe operation of the ship should be such that repairs which can be affected using the resources on board may be completed safely and effectively. Ventilation systems should provide sufficient air at an appropriate temperature for the operation of machinery.

7.1.4 For Polar Class ships which may be laid up in Arctic ice-covered waters, materials for all systems with the potential of polluting should be suitable for preventing pollution at the lowest ambient temperatures to which they may be subjected and should be suitable to avoid pollution and ensure safe operation on re-activation of the systems.

7.2 Main propulsion systems

7.2.1 The main propulsion machinery should be designed so that the effects of loads with the potential to damage the system are limited to those components which can be readily repaired, replaced or reset. The reliability and availability of the equipment and systems should be considered.

7.2.2 Main propulsion machinery and all auxiliary machinery essential to the propulsion system, should be:

* Refer to the proposed IACS Unified Requirements for Polar Ships.

.1 designed for loads and vibrations resulting from propeller/hull/rudder-ice interactions;

.2 located to provide protection from freezing spray, ice and snow; and

.3 designed to operate when the ship is inclined at any combined angle of heel or trim that may be expected during operations in ice.

7.2.3 Sterntube bearings, seals and main propulsion components located outside the hull should not leak pollutants. Non-toxic, biodegradable lubricants are not considered to be pollutants.

7.2.4 The installed propulsive power should be sufficient to ensure that the ship can navigate safely and without risk of pollution under the design ice, weather and operational conditions.

7.2.5 Piping and intake systems associated with the main propulsion plant should be designed so as not to be affected by the impact of the Arctic environment.

CHAPTER 8

AUXILIARY MACHINERY SYSTEMS

8.1 General

8.1.1 Equipment and systems should be designed so that personnel exposure to cold temperatures and other environmental hazards during normal operations including routine maintenance is minimized.

8.1.2 Ventilation systems should provide sufficient air for the operation of auxiliary machinery, air conditioning and heating purposes.

8.2 Materials

8.2.1 Materials used in equipment and systems should be suitable for operation in the environment which prevails at their location. In particular, equipment or systems which are essential for preventing pollution or for safe operation of the ship when:

.1 located outside and above the waterline in any ship operating condition; or

.2 in unheated locations inside;

should not be susceptible to brittle fracture within the range of operating conditions.

8.2.2 Essential equipment or systems required for the safe operation of the ship or systems required for preventing pollution, located within spaces which, upon failure of the primary heating system, could be subject to outside ambient air temperatures should be:

.1 provided with an independent source of heat; and

.2 fabricated from materials that will not be susceptible to brittle fracture under the anticipated loads and temperatures.

8.2.3 For Polar Class ships which may be laid up in Arctic ice-covered waters, materials for all systems with the potential of polluting should be suitable for preventing pollution at the lowest ambient temperatures to which they may be subjected and should be suitable to avoid pollution and ensure safe operation on re-activation of the systems.

CHAPTER 9

ELECTRICAL INSTALLATIONS

9.1 Electrical installations should be subject to the provisions listed in chapters 4, 7 and 8 regarding design for operation in Arctic ice-covered waters and for the provision of emergency heat and power.

9.2 Precautions should be taken to minimize risk of supplies to essential and emergency services being interrupted by the inadvertent or accidental opening of switches or circuit breakers due to vibrations or accelerations during icebreaking operations.

9.3 Emergency power for communications equipment provided by battery should be provided with a means whereby the batteries are protected from extreme low temperatures.

9.4 Emergency power batteries, including those stored in deck boxes, should be secured in a position where excessive movement is prevented during ice-transiting operations and explosive gas ventilation is not restricted by the accumulation of ice or snow.

9.5 Control systems based on computers and other electronic hardware installations necessary for the proper functioning of essential equipment should be designed for redundancy and resistance to vibration, dampness and low humidity.

PART B - EQUIPMENT

CHAPTER 10

FIRE SAFETY

10.1 Fuel and other flammable fluid tanks and systems

Refuelling of ships should be carried out taking into account the special conditions imposed by low temperatures.

10.2 Ventilation

Closing apparatus for ventilation inlets and outlets should be designed and located to protect them from ice or snow accumulation that could interfere with the effective closure of such systems.

10.3 Fire detection and extinguishing systems

10.3.1 Fire-extinguishing systems should be designed or located so that they are not made inaccessible or inoperable by ice or snow accumulation or low temperature such that:

.1 equipment, appliances, systems and extinguishing agents should be protected from freezing for minimum temperature for the intended voyage, as specified in paragraph 1.1.6;

.2 precautions should be taken to prevent nozzles, piping and valves of any fire-extinguishing system from becoming clogged by impurities, corrosion or ice build up; and

.3 exhaust gas outlets and pressure vacuum arrangements should be protected from ice build up that could interfere with effective operation.

10.3.2 Water or foam extinguishers should not be located in any position that is exposed to freezing temperatures. These locations should be provided with extinguishers capable of operation under such conditions.

10.3.3 Fire pumps and associated equipment (Polar Class ships)

10.3.3.1 Where a fixed fire-extinguishing system or alternative fire-extinguishing system situated in a space separate from the compartment containing the main fire pumps utilizes its own independent sea suction, this sea suction should be capable of being cleared of accumulations of slush ice.

10.3.3.2 Fire pump(s) including emergency fire pump(s) should, wherever reasonable and practicable, be installed in heated compartment(s) and in any event should be adequately protected from freezing for minimum temperature for the intended voyage, as specified in paragraph 1.1.6.

10.3.3.3 Isolating valves should be located so that they are accessible. Any isolating valves located in exposed positions should not be subject to icing from freezing spray. The fire main should be arranged so that external sections can be isolated and draining devices should be provided.

10.3.3.4 Hydrants should be positioned or designed to remain operable under all anticipated temperatures. Ice accumulation and freezing should be taken into account.

10.3.3.5 All hydrants should be equipped with an efficient two-handed valve handle.

10.4 Protection against ice build-up

Components of the fire-fighting system which may be exposed to icing which could interfere with the proper functioning of that component should be adequately protected.

10.5 Fire fighter's outfits

10.5.1 Sufficient fire fighter's outfits should be readily available to the accommodation area and elsewhere as appropriate. Such fireman's outfits should be stored in positions as widely separated as practical.

10.5.2 In addition to the fire fighter's outfits provided in accordance with paragraph 10.5.1, one spare fireman's outfit should be provided. The spare outfit should be stored in a warm location on the ship.

CHAPTER 11

LIFE-SAVING APPLIANCES AND SURVIVAL ARRANGEMENTS

11.1 General

11.1.1 Adequate supplies of protective clothing and thermal insulating materials should be provided in all ships operating in Arctic ice-covered waters for all persons on board at any time.

11.1.2 Training in the use of all emergency equipment should be included as an element of the operating procedures and drills described in chapter 13. Where appropriate, dedicated training equipment should be carried to avoid compromising the performance of the emergency equipment itself.

11.2 Categories of life-saving equipment

11.2.1 Ships operating in Arctic ice-covered waters should carry life-saving appliances and survival equipment according to their environmental conditions of operation, as indicated in paragraph 1.1.6.

11.2.2 Personal survival kits (PSKs) as described in section 11.3 should be carried whenever a voyage is expected to encounter mean daily temperatures below 0°C.

11.2.3 Group survival kits (GSKs) as described in section 11.4 should be carried whenever a voyage is expected to encounter ice conditions which may prevent the lowering and operation of survival craft.

11.2.4 Sufficient PSKs and GSKs (as applicable) should be carried to cover at least 110% of the rated complement of the ship.

11.2.5 Personal survival kits should be stored so that they may be easily retrieved in an emergency situation. Arrangements such as storage in cabins or in dedicated lockers near the assembly stations may be considered.

11.2.6 Group survival kits should be stored so that they may be easily retrieved in an emergency situation. The containers should be located adjacent to the survival craft and liferafts and be stowed on cradles. Containers should be designed so that they may be easily moved over the ice and be floatable.

11.3 Personal survival kit (PSK)

11.3.1 A Personal survival kit should consist of the items listed in table 11.1 or appropriate alternatives.

Table 11.1

Contents of the personal survival kits

Equipment	Quantity
Clothing	
Head protection (VP)*	1
Neck and face protection (VP)	1
Hand protection – Mitts (VP)	1 pair
Hand protection - Gloves (VP)	1 pair
Foot protection - Socks (VP)	1 pair
Foot protection – Boots	1 pair
Insulated suit (VP)	1
Approved immersion suit	1
Thermal underwear (VP)	1 set
Miscellaneous	
Handwarmers	240 hours
Sunglasses	1 pair
Survival candle	1
Matches	2 boxes
Whistle	1
Drinking mug	1
Pen knife	1
Handbook (Arctic Survival)	1
Carrying bag	1

*VP means vacuum packed

11.3.2 The following notice should be displayed wherever personal survival kits are stored:

NOTICE
CREW MEMBERS AND PASSENGERS ARE REMINDED THAT THEIR PERSONAL SURVIVAL KIT IS FOR EMERGENCY SURVIVAL USE ONLY. NEVER REMOVE ITEMS OF SURVIVAL CLOTHING OR TOOLS FROM THE PERSONAL SURVIVAL KIT CARRYING BAG - YOUR LIFE MAY DEPEND ON IT.

11.3.3 Personal survival kits should not be opened for training purposes. Equipment for training purposes should be provided in accordance with paragraph 11.1.2.

11.4 Group survival kit (GSK)

11.4.1 The contents of the group survival kit should include those items defined in table 11.2 or appropriate alternatives.

Table 11.2

Contents of the group survival kits (GSK)

Equipment	Quantity
Group equipment	
Tents	1 per 6 persons
Air mattresses	1 per 2 persons
Sleeping bags (VP)*	1 per 2 persons
Stove	1 per tent
Stove fuel	0.5 litres per person
Fuel paste	2 tubes per stove
Matches	2 boxes per tent
Pan (with sealing lid)	1 per stove
Fortified health drinks	5 packets per person
Flashlights	1 per tent
Candles and holders	5 per tent
Snow shovel	1 per tent
Snow saw and snow knife	1 per tent
Tarpaulin	1 per tent
Foot protection – Booties	1 per person
GSK container	1
Spare personal equipment	(1 set per GSK container)
Head protection (VP)	1
Neck and face protection (VP)	1
Hand protection - Mitts (VP)	1 pair
Hand protection - Gloves (VP)	1 pair
Foot protection - Socks (VP)	1 pair
Foot protection - Boots (VP)	1 pair
Insulated suit (VP)	1
Thermal underwear	1 pair
Handwarmers	1 set
Sunglasses	1
Whistle	1
Drinking mug	1

*VP means vacuum packed

11.4.2 Where a shot gun or hunting rifle is provided to protect survivors from wildlife, it should be stored in a secure location readily available in an emergency.

11.5 Lifeboats

11.5.1 All lifeboats carried by Polar Class ships should be of the fully enclosed type to provide adequate shelter from the environment. Other ships which are equipped with open or partially enclosed boats should carry tarpaulins of sufficient size to provide complete coverage of the lifeboats, and suitable structure to support them.

11.5.2 The capacity of lifeboats should be evaluated with regard to operability, accessibility, seating capacity and overall space considering the needs of personnel wearing suitable Polar clothing.

11.5.3 Ice accretion should be regularly removed from the lifeboats and launching equipment to ensure ease of launching when required. An icing removal mallet should be available in the vicinity of the lifeboats.

11.5.4 All lifeboat engines should be equipped with a means to ensure they will start readily when required at the minimum anticipated operating temperature.

11.5.5 The lifeboat engine fuel oil should be suitable for operation in the minimum anticipated operating temperature.

11.5.6 Drinking water should be stored in containers that allow for expansion due to freezing.

11.5.7 Consideration should be given to the provision of additional emergency rations to account for high rates of energy expenditure under Arctic conditions.

11.6 Liferafts

11.6.1 Ice accretion should be regularly removed from the liferafts, cradles and launching equipment to ensure ease of launching and inflation when required. An icing removal mallet should be available in the vicinity of the liferafts.

11.6.2 Ships should carry in a warm space in the vicinity of the liferafts manual inflation pumps that are proven to be effective in the expected air temperatures.

11.6.3 Air or other proven cold temperature gas should be used for the inflation of lifesaving equipment according to their environmental conditions of operation, as indicated in paragraph 1.1.6.

11.6.4 Consideration should be given to the provision of additional emergency rations to account for high rates of energy expenditure under Arctic conditions.

CHAPTER 12

NAVIGATIONAL EQUIPMENT

12.1 Application

It should be noted that the provisions prescribed in this chapter are not to be considered in addition to the requirements of SOLAS chapter V. Rather, any equipment fitted or carried in compliance with the requirements of SOLAS chapter V may be considered as part of the recommended equipment complement detailed in this chapter. Unless specifically provided in this chapter, the performance standards and other applicable guidance for equipment and systems contained in this chapter should be applied *mutatis mutandis* as per SOLAS chapter V.

12.2 Compasses

12.2.1 Magnetic variations in high latitudes may lead to unreliable readings from magnetic compasses.

12.2.2 Gyro-compasses may become unstable in high latitudes and may need to be shut down.

12.2.3 Companies should ensure that their systems for providing reference headings are suitable for their intended areas and modes of operation, and that due consideration has been given to the potential effects noted in paragraphs 12.2.1 and 12.2.2. For operations in Arctic ice-covered waters, ships should be fitted with a total of at least two gyro-compasses.

12.3 Speed and distance measurement

12.3.1 All Polar Class ships should be fitted with a total of at least two speed and distance measuring devices[*]. Each device should operate on a different principle, and at least one device should be capable of being operated in both the sea and the ground stabilized mode.

12.3.2 Speed and distance measuring devices should provide each conning position with a speed indication at least once per second.

12.3.3 Speed and distance measurement device sensors should not project beyond the hull and should be installed to protect them from damage by ice.

12.4 Depth sounding device

All Polar Class ships should be fitted with a total of at least two independent echo-sounding devices which provide indication of the depth of water under the keel. Due account should be taken of the potential for ice interference or damage to any device designed to operate below the waterline.

12.5 Radar installations

12.5.1 All Polar Class ships should be fitted with a total of at least two functionally independent radar systems. One of these should operate in the 3 GHz (10 cm, S-band) frequency range.

12.5.2 Radar plotting systems that may be installed should have the capability of operating in both the sea and the ground stabilized mode.

12.6 Electronic positioning and electronic chart systems

12.6.1 All Polar Class ships should be provided with an electronic position fixing system.

12.6.2 A satellite system (GPS or GLONASS or equivalent) should be fitted on any ship intending to navigate in areas outside of reliable coverage by a terrestrial hyperbolic system.

12.6.3 Systems described in paragraphs 12.6.1 and 12.6.2 should provide input to allow for continuous representation of the ship's speed provided by a speed and distance measuring device according to paragraph 12.3, and the ship's course provided by a compass according to paragraph 12.2.[**]

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[*] Refer to resolution A.824(19) on Recommendation on Performance Standards for Devices to Indicate Speed and Distance.

[**] Refer to the proposed Performance Standards for Course and Speed Indication for Electronic Positioning and Satellite Systems.

12.6.4 Where fitted, electronic charting systems should be able to use position input from systems compliant with paragraphs 12.6.1 and 12.6.2.

12.7 Automatic identification system (AIS)

All Polar Class ships should be provided with and automatic identification system (AIS)[†] for ships using the broadcast mode.

12.8 Rudder angle indicator

12.8.1 Separate rudder angle indicators should be provided for each rudder on ships with more than one rudder.

12.8.2 In ships without a rudder, indication should be given of the direction of steering thrust.

12.9 Searchlights and visual signals

12.9.1 Ships of Polar Classes 1 to 5 inclusive and all ships intended to operate in periods of prolonged darkness should be equipped with at least two suitable searchlights which should be controllable from conning positions.

12.9.2 The searchlights described in paragraph 12.9.1 should be installed to provide, as far as is practicable, all-round illumination suitable for docking, astern manoeuvres or emergency towing.

12.9.3 The searchlights described in paragraph 12.9.1 should be fitted with an adequate means of de-icing to ensure proper directional movement.

12.9.4 Ships of Polar Classes 1 to 5 inclusive, all icebreakers and all ships that may be involved in an escort of more than one ship following in an ice track should be equipped with a manually operated flashing red light visible from astern to indicate when the ship is stopped. This should be capable of use from any location from which the ship can be manoeuvred. The flashing light should have a range of visibility of at least two (2) nautical miles. The colour and frequency of the flashing light should be according to standards given in COLREG. The horizontal and vertical arcs of visibility of the flashing light should be as specified for stern lights in COLREG.

12.10 Vision enhancement equipment

12.10.1 All Polar Class ships should be fitted with a suitable means to de-ice sufficient conning position windows to provide unimpaired forward and astern vision from conning positions.

12.10.2 The windows described in paragraph 12.10.1 should be fitted with an efficient means of clearing melted ice, freezing rain, snow, mist and spray from outside and accumulated condensation from inside. A mechanical means to clear moisture from the outside face of a window should have operating mechanisms protected from freezing or the accumulation of ice that would impair effective operation.

[†] Refer to guidelines on the operation of AIS on ships (to be developed).

12.10.3 All persons engaged in navigating the ship should be provided with adequate protection from direct and reflected glare from the sun.

12.10.4 All indicators providing information to the conning positions should be fitted with means of illumination control to ensure readability under all operating conditions.

12.11 Voyage data recorder

Ships of Polar Classes 1 to 5 inclusive should be fitted with a voyage data recorder.*

12.12 Ice routing equipment

12.12.1 All ships should be provided with equipment capable of receiving ice and weather information charts.

12.12.2 Ships of Polar Classes 1 to 3 inclusive should be fitted with equipment capable of receiving and displaying ice imagery.

PART C - OPERATIONAL

CHAPTER 13

OPERATIONAL GUIDELINES

13.1 Documentation

All ships operating in Arctic ice-covered waters should carry on board at all times an operating manual and training manual for all Ice Navigators on board the ship.

13.2 Ship operational control

The ship should not be operated outside the worst intended conditions and design limitations.

13.3 Operating and training manuals

Operating manual

13.3.1 The operating manual, or supplementary manual in the case of ships not normally operating in Arctic ice-covered waters, should contain at least the following information on issues directly related to operations in such waters. With respect to contingency planning in the event that the ship suffers ice damage, the manual should conform to guidelines developed by the Organization**:

* Refer to resolution A.861(20) on Recommendation on Performance Standards for Voyage Data Recorders (VDRs).

** Refer to resolution A.852(20) on Guidelines for the Structure of an Integrated System of Contingency Planning for Shipboard Emergencies.

Normal operation

.1 principal particulars of the ship;

.2 loading procedures and limitations including any applicable recommendations against carrying pollutants in tanks and compartments against the hull envelope, maximum operational weight, position of centre of gravity and distribution of load necessary for operation in Arctic ice-covered waters;

.3 acknowledgment of changes in standard operating procedures for radio equipment and navigational aids applicable to Arctic operations;

.4 information regarding the handling of the ship as determined in accordance with chapter 16 of these Guidelines (Environmental protection and damage control);

.5 maximum towing speeds and towing loads where applicable;

Risk management

.6 procedures for checking the integrity of hull structure;

.7 description and operation of fire detection and fire-extinguishing equipment in a Arctic environment; and

for Polar Class ships, the operating manual should include the following supplementary information, in clearly defined chapters specified by the Administration:

.8 operating limitations for the ship and essential systems in anticipated ice conditions and temperatures;

.9 details arising from the standards of chapter 3 of these Guidelines (Subdivision and stability) likely to be of direct practical use to the crew in an emergency;

.10 passage planning procedures accounting for anticipated ice conditions;

.11 deviations in standard operating procedures associated with operation of propulsion and auxiliary machinery systems, remote control and warning systems and electronic and electrical systems made necessary by operations in Arctic ice-covered waters;

.12 deviations in standard damage control procedures made necessary by operations in Arctic ice-covered waters; and

.13 evacuation procedures into water, onto ice, or into a combination of the two, with due regard to chapter 11 of these Guidelines.

13.3.2 Regarding information on machinery or system failures, guidance should take into account the results of any risk or failure analysis reports developed during the ship design.

Training manual

13.3.3 The training manual should cover all aspects of ship operation in Arctic ice-covered waters listed below plus other related information considered necessary by the Administration:

.1 summary of the Guidelines for ships operating in Arctic ice-covered waters;

.2 ice recognition;

.3 navigation in ice; and

.4 escorted operation.

Instructions for drills and emergency instructions as detailed in section 13.4 should be incorporated as annexes to the manual.

13.3.4 The Company should ensure that any additional documentation referenced in the training manual and required to provide a full understanding of its contents is on board the ship for all operations in Arctic ice-covered waters.

13.4 Drills and emergency instructions

13.4.1 On board instruction and operation of the ship's evacuation, fire and damage control appliances and systems should include appropriate cross training of crew members with appropriate emphasis to changes to standard procedure made necessary by operations in Arctic ice-covered waters.

13.4.2 Evacuation

13.4.2.1 Evacuation drill scenarios should be varied so that different emergency conditions are simulated, including abandonment into the water, onto the ice, or a combination of the two.

13.4.2.2 Each evacuation craft drill should include:

.1 exercises in passenger control in cold temperatures as appropriate;

.2 checking that all personnel are suitably dressed;

.3 donning of immersion suits or thermal protective clothing by appropriate crew members;

.4 testing of emergency lighting for assembling and abandonment; and

.5 giving instructions in the use of the ship's life-saving appliances and in survival at sea, on the ice or a combination of both.

13.4.2.3 Rescue boat drills should be conducted as follows:

.1 As far as is reasonable and practicable, rescue boats should be launched each month as part of the evacuation drill with their assigned crew aboard and manoeuvred in the water, with due consideration of the dangers of launching into Arctic ice-covered waters if applicable.

.2 If rescue boat launching drills are carried out with the ship making headway, such drills should be practiced in sheltered waters only and under the supervision of an officer experienced in such drills.*

13.4.2.4 Individual instructions may cover different parts of the ship's life-saving system, but all the ship's life-saving equipment and appliances should be covered within any period of one month on passenger ship and two months on cargo ship. Each member of the crew should be given instructions which should include but not necessarily be limited to:

.1 problems of hypothermia, first-aid treatment of hypothermia and other appropriate first-aid procedures; and

.2 special instructions necessary for use of the ship's life-saving appliances in severe weather and severe sea conditions on the ice or in a combination of water and ice cover.

13.4.3 Fire drills

13.4.3.1 Fire drill scenarios should vary each week so that emergency conditions are simulated for different ship compartments, with appropriate emphasis on those changes to standard procedure made necessary by operations in Arctic ice-covered waters and low temperatures.

13.4.3.2 Each fire drill should include elements required by the SOLAS Convention plus additional elements made necessary by operation in an Arctic environment.

13.4.4 Damage control

Damage control drill scenarios should vary each week so that emergency conditions are simulated for different damage conditions with appropriate emphasis to those conditions resultant from operations in Arctic ice-covered waters.

13.4.5 Survival kits

13.4.5.1 Where fitted, the master should ensure that sufficient PSKs and GSKs are available, in full working order, and ready for immediate use, to meet the standards set forth in paragraph 11.2.4.

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* Refer to resolution A.624(15) on Guidelines for Training Crews for the Purpose of Launching Lifeboats and Rescue Boats from Ships Making Headway Through the Water.

13.4.5.2 The master should keep spare personal survival equipment on board for the purpose of providing replacements for missing or damaged items of equipment in those personal survival kits issued to the complement. In addition, a number of sewing kits and replacement parts (buttons, boot laces etc.) should be kept on board for the purpose of minor repair to personal survival kit items of clothing.

13.4.5.3 Group survival kit inspections should be carried out no less frequently than on an annual basis at the beginning of each operating season.

CHAPTER 14

CREWING

14.1 General

14.1.1 The crewing of all ships in Arctic ice-covered waters should take account of the provisions listed in this chapter, and also of the relative lack of shore and support infrastructure which may be available to assist in any operations.

14.1.2 Ice Navigators should be provided as noted in chapter 1.

14.1.3 All of the ship's officers and crew should be made familiar with cold weather survival by training or self-study of course material or publications addressing the measures set forth in section 13.4.

14.1.4 As many as possible of the ship's deck and engine officers should be trained in ship operations in ice-covered waters.

14.2 Ice Navigator qualifications and training

The Ice Navigator should have documentary evidence of having satisfactorily completed an approved training program in ice navigation. Such a training program should provide knowledge, understanding and proficiency required for operating a ship in Arctic ice-covered waters, including recognition of ice formation and characteristics; ice indications; ice manoeuvring; use of ice forecasts, atlases and codes; hull stress caused by ice; ice escort operations; ice-breaking operations and effect of ice accretion on vessel stability.

14.3 Supplementary provisions

14.3.1 Where firearms are carried in accordance with paragraph 11.4.2, a minimum of two crew members should be cognizant of current firearm regulations and guidelines and be trained in the use of shotguns or hunting rifles.

14.3.2 A minimum of two crew members should be trained in the use of low frequency radio equipment where fitted.

CHAPTER 15

EMERGENCY EQUIPMENT

15.1 Medical equipment

15.1.1 All ships should be provided with an adequate number of first-aid kits and equipment with contents suitable to the on board location and recognized provisions for personnel safety hazards of such locations.

15.1.2 With respect to the nature of the voyage, ship operations and the ability to communicate and obtain timely assistance of medical aid or medical evacuation, exemptions of certain medical equipment, medicaments and facilities may be considered unreasonable or unnecessary.

15.1.3 Crews operating in Arctic ice-covered waters should be provided with appropriate equipment and training to safely evacuate an individual in a medical emergency from the ship.

15.2 Reserve supplies

15.2.1 Special consideration should be given to the reserve supply of fuel and lubricants taking into account the effect of heavy ice on fuel consumption.

15.2.2 Single screw ships may require special consideration (redundancy) in remote areas where conditions impose a risk of damage to machinery components.

15.3 Damage control and repair equipment

15.3.1 All icebreakers should carry the following emergency equipment:

.1 portable gas welding equipment for welding and cutting with a reserve of electrodes; and

.2 portable electro-submersible pump of 100 t/h capacity with a set of hoses.

15.3.2 Where built-up propellers are used, consideration should be given to the carriage of spare blades and of equipment facilitating removal and replacement.

PART D – ENVIRONMENTAL PROTECTION AND DAMAGE CONTROL

CHAPTER 16

ENVIRONMENTAL PROTECTION AND DAMAGE CONTROL

16.1 General

16.1.1 The following provisions concerning environmental protection and damage control equipment are made with due regard to the lack of waste reception and repair facilities, communications limitations, unique navigational and environmental hazards and limited response capabilities of available assistance in Arctic ice-covered waters.

16.1.2 Procedures for the protection of the environment under normal operations should be included in the ship's operating manual as described in chapter 13, and those under accident conditions into the Shipboard Oil Pollution Emergency Plan (SOPEP) according to the MARPOL Convention.

16.1.3 Training and drills covering environmental protection and damage control procedures should be provided for crew members as specified in chapter 13.

16.2 Equipment and materials

16.2.1 All ships navigating in Arctic ice-covered waters should be adequately equipped and their crews properly trained to provide effective damage control and minor hull repair. All ships should have the capability to contain and clean up minor deck and over side spills.

16.2.2 Damage control equipment, provided in accordance with paragraph 16.2.1, should be sufficient to enable a ship, as far as practicable, to make temporary repairs to a minor hull breach or to take precautionary measures to prevent escalation of damage or flooding, so that the ship may proceed to a location where more substantial repairs can be affected.

16.2.3 Icebreakers and ships of Polar Classes 1 to 4 inclusive should be provided with material, tools and equipment capable of effecting more substantial repairs and damage control activities, as described in chapter 15.

16.2.4 Hoses and pipelines should be manufactured out of materials retaining adequate strength and elasticity characteristics at the minimum anticipated operating temperature.

16.2.5 All hoses used to transfer pollutant cargoes from the ship to another ship or to shore should have the connection between the hose and the hose couplings made in an efficient and strong fashion to minimize the possibility of pollution due to failure of this connection. Couplings between hose sections should be capable of being securely locked together to prevent inadvertent disconnection.

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