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# RULES FOR THE SURVEY AND CONSTRUCTION OF PASSENGER SHIPS

## Part 1 GENERAL

### Chapter 1 GENERAL

#### 1.1 General

##### 1.1.1 Application\*

1 The survey and construction of passenger ships to be registered in accordance with the [Regulations for the Classification and Registry of Ships](#) are to be as prescribed in these Rules. A passenger ship is a ship which carries more than twelve passengers, (hereinafter referred to as “a ship” in the Rules.) and a passenger is every person other than following (1) and (2).

- (1) The master and the crew members or other persons employed or engaged in any capacity on board a ship on the business of that ship
- (2) A child under one *year* of age

2 With respect to the survey and construction of ships to be intended for registry with restricted areas of services, the requirements are to be as prescribed in the relevant Parts of the Rules, although some requirements may be modified where as deemed appropriate by the NIPPON KAIJI KYOKAI (hereinafter referred to as “Society” in the Rules.).

##### 1.1.2 National Regulations

With respect to the survey and construction of ships, attention is to be paid to the compliance with the National Regulations of the country in which the ship is registered or to be registered, in addition to the requirements in the Rules. The Society may make special requirements as instructed by the flag government of ships or the government of sovereign nation in which ships navigate.

##### 1.1.3 Conditions to be Observed by the Ship's Owner or Master etc.

For ships engaged in international voyages, attention is to be paid to the compliance with the conditions to be observed by the ship's owner, ship's master or other person who may concern with the ship's operation which is required by the latest *SOLAS* Convention (International Convention for the Safety of Life at Sea.), (e.g. enter in the logbook, restriction of an area to which no passengers are allowed access.), in addition to the requirements of the Rules.

##### 1.1.4 Ships Employed in Special Trades for the Carriage of Large Numbers of Special Trade Passengers

In the case of ships which are employed in special trades for the carriage of large numbers of special trade passengers, such as the pilgrim trade, the Society may exempt such ships from the requirements of the Rules, provided that the flag government of ships is satisfied that it is impracticable to enforce compliance with such requirements the ships fully comply with the provisions of following (1) and (2)

- (1) The Rules annexed to the Special Trade Passenger Ships Agreement, 1971.
- (2) The Rules annexed to the Protocol on Space Requirements for Special Trade Passenger Ships, 1973.

##### 1.1.5 High Speed Craft and Moored Floating Unit

Notwithstanding the requirements of the Rules, high speed crafts specified in [2.1.2, Part 1 of the Rules for High Speed Craft](#) and moored floating units specified in [1.2.3\(4\), Part P of the Rules for the Survey and Construction of Steel Ships](#) are to be in accordance with the requirements of the [Rules for High Speed Craft](#) and [Part P of the Rules for the Survey and Construction of Steel Ships](#) respectively.

##### 1.1.6 Ships Using Low-flashpoint Fuels\*

Ships using low-flashpoint fuels are to comply with [Part GF of the Rules for the Survey and Construction of Steel Ships](#) and the following (1) to (3). Definitions of the terms specified in the following (1) to (3) are to be in accordance with [Part GF of the Rules for the Survey and Construction of Steel Ships](#).

- (1) Notwithstanding the requirements of **5.3.3(4)** and **5.3.4(5)**, **Part GF of the Rules for the Survey and Construction of Steel Ships**, the boundary of the fuel tank is not to be located closer than  $B'/10$ , but in no case less than 0.8 m, to the shell plating or aft terminal of the ship under any circumstances. This distance, however, need not be greater than  $B'/15$  or 2 m, whichever is less, in cases where the shell plating is located inboard of  $B'/5$  or 11.5 m, whichever is less, as required by **5.3.3(1)**, **Part GF of the Rules for the Survey and Construction of Steel Ships**.
- (2) Notwithstanding the requirements of **5.3.3(7)**, **Part GF of the Rules for the Survey and Construction of Steel Ships**, fuel tanks are to be abaft a transverse plane at  $0.08L_f$ , as measured from the forward perpendicular.
- (3) When applying the requirements of **5.3.4(1)**, **Part GF of the Rules for the Survey and Construction of Steel Ships**, 0.02 is to be used instead of 0.04 for the maximum value of  $f_{CN}$ .

#### 1.1.7 Equivalency

Except for the requirements of **Part GF of the Rules for the Survey and Construction of Steel Ships** applied in accordance with the requirements of **1.1.6**, alternative hull constructions, equipment, materials, arrangements and scantlings will be accepted by the Society, provided that the Society is satisfied that such constructions, equipment, materials, arrangements and scantlings are equivalent to those required in the Rules.

### 1.2 Class Notations

#### 1.2.1 General\*

For ships complying with additional requirements and/or those exempted from any requirements related to the subjects specified in following paragraphs in accordance with the provisions of this Rules, an appropriate notation is affixed to the Classification Characters in accordance with the provisions of **Chapter 2 of the Regulation for the Classification and Registry of Ships** as follows;

NS\* ( **(1)** ) ( **(2)**, **(3)** ) ( **(4)** ) ( **(5)** )

- (1) Restricted services specified in **1.2.2**
- (2) Structural materials for main hull specified in **1.2.3**
- (3) Hull construction and equipment, etc. specified in **1.2.4**
- (4) Strengthening for navigation in ice, etc. specified in **1.2.5**
- (5) Application of special survey scheme specified in **1.2.6**

#### 1.2.2 Restricted Services

For ships classed subject to be engaged in restricted services, an appropriate notation is affixed to the Classification Characters as follows.

- (1) For ships engaged in service restricted only to coastal areas within, in general, 20 miles from the nearest land or areas deemed equivalent by the Society (hereinafter, referred to as coasting service) :

*Coasting Service* (abbreviated to CS)

- (2) For ships engaged in service restricted only to calm water areas, in general, sheltered from the open sea by land or areas deemed equivalent by the Society (hereinafter, referred to as smooth water service) :

*Smooth Water Service* (abbreviated to SWS)

- (3) For ships other than specified in above **(1)** and **(2)** and applied to this Rules subject to be engaged in restricted service deemed necessary by the Society, an appropriate notation may be affixed.

#### 1.2.3 Structural Materials for Main Hull

For ships made of materials other than steel as a structural material for main hull in accordance with the provisions of **2.1.1-2**, **Part 3**, an appropriate notation is affixed to the Classification Characters as follows.

- (1) For ships made of aluminium alloy:

*Aluminium Alloy* (abbreviated to AL)

- (2) For ships other than those specified in **(1)**, a notation deemed appropriate by the Society may be affixed.

#### 1.2.4 Hull Construction and Equipment, etc.\*

**1** For ships complying with the requirements of this Rules, the notation of “*Passenger Ship*” (abbreviated to PS) is affixed to the Classification Characters. For such ships having cargo spaces for carriage of general cargoes, the notation of “*Passenger Ship/General Cargo*” (abbreviated to PS/GC) is affixed.

2 For ships having cargo spaces not normally subdivided in any way and normally extending to either a substantial length or the entire length of the ship in which cargoes can be loaded and unloaded normally in a horizontal direction, and complying with the relevant requirements of this Rules, the notation of “*Passenger Ship/Roll on-Roll off*” (abbreviated to *PS/RORO*) is affixed to the Classification Characters.

3 For ships equipped for the carriage of dangerous goods (refer to **3.2.20, Part R of the Rules for the Survey and Construction of Steel Ships**) in accordance with the provisions of **3.4, Part 6** and **Chapter 19, Part R of the Rules for the Survey and Construction of Steel Ships**, the notation of “*Equipped for Carriage of Dangerous Goods*” (abbreviated to *EQ C DG*) is affixed to the Classification Characters.

4 For ships equipped for the carriage of motor vehicles with fuel in their tanks in accordance with the provisions of **3.2** and **3.3, Part 6** and **Chapter 20, Part R of the Rules for the Survey and Construction of Steel Ships**, the notation of “*Equipped for Carriage of Vehicles*” (abbreviated to *EQ C V*) is affixed to the Classification Characters.

5 For ships complying with the provisions of **3.3.5.3-1, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships** or **22.4.2, Part CS of the Rules for the Survey and Construction of Steel Ships**, by the provision of **1.1.1-4, Part 3**, the notation of “*Performance Standard for Protective Coatings for Dedicated Seawater Ballast Tanks in All Types of Ships and Double-side Skin Spaces of Bulk Carriers*” (abbreviated to *PSPC-WBT*) is affixed to the Classification Characters.

6 For ships complying with the provisions of item 10, **Table B2.11, Part B of the Rules for the Survey and Construction of Steel Ships**, the notation of “*Noise Code*” (abbreviated to *NC*) is affixed to the Classification Characters.

7 Ships complying with the requirements of **Part GF of the Rules for the Survey and Construction of Steel Ships** applied in accordance with the requirements of **1.1.6** are to be in accordance with the requirements of **1.2.4-33, Part A of the Rules for the Survey and Construction of Steel Ships**.

8 For ships having a propeller shaft Kind 1C complying with the provisions of **6.2.11, Part D of the Rules for the Survey and Construction of Steel Ships** applied in accordance with the requirements of **1.1.1-3, Part 5**, the notation of “*1C*” is affixed to the Classification Characters.

9 For ships complying with the provisions of **Chapter 4** and **Chapter 5, Part X of the Rules for the Survey and Construction of Steel Ships**, the notation of “*Cyber Resilience*” (abbreviated to *Cybr*) is affixed to the Classification Characters.

10 Otherwise specified in the above, for ships where deemed necessary by the Society, an appropriate notation may be affixed to the Classification Characters.

#### **1.2.5 Polar Class Ships and Ice Class Ships**

1 For polar class ships in accordance with the provisions of **Chapter 1, Part I of the Rules for the Survey and Construction of Steel Ships**, by the provisions of **1.1.1-6, Part 3**, the following notation corresponding to the classification of ice strengthening specified in **1.2.2, Annex 1 of Part I of the Rules for the Survey and Construction of Steel Ships**, is affixed to the Classification Characters.

- (1) *PC1: Polar Class 1* (abbreviated to *PC1*)
- (2) *PC2: Polar Class 2* (abbreviated to *PC2*)
- (3) *PC3: Polar Class 3* (abbreviated to *PC3*)
- (4) *PC4: Polar Class 4* (abbreviated to *PC4*)
- (5) *PC5: Polar Class 5* (abbreviated to *PC5*)
- (6) *PC6: Polar Class 6* (abbreviated to *PC6*)
- (7) *PC7: Polar Class 7* (abbreviated to *PC7*)

2 For ice class ships in accordance with the provisions of **Chapter 1, Part I of the Rules for the Survey and Construction of Steel Ships**, by the provisions of **1.1.1-6, Part 3**, the following notation corresponding to the classification of ice strengthening specified in **1.2.2, Part I of the Rules for the Survey and Construction of Steel Ships**, is affixed to the Classification Characters.

- (1) *IA Super: Class IA Super Ice Strengthening* (abbreviated to *IA SUPER IS*)
- (2) *IA: Class IA Ice Strengthening* (abbreviated to *IA IS*)
- (3) *IB: Class IB Ice Strengthening* (abbreviated to *IB IS*)
- (4) *IC: Class IC Ice Strengthening* (abbreviated to *IC IS*)
- (5) *ID: Class ID Ice Strengthening* (abbreviated to *ID IS*)

3 For ships operating in polar waters in accordance with the provisions of **Chapter 1, Part I of the Rules for the Survey and**



**Construction of Steel Ships**, by the provisions of **1.1.1-6, Part 3**, the following notation corresponding to the classification of ice strengthening specified in **1.2.1(1)** to **(3)**, **Part I of the Rules for the Survey and Construction of Steel Ships**, is affixed to the Classification Characters.

- (1) *Category A: Polar Code Category A* (abbreviated to *PC A*)
- (2) *Category B: Polar Code Category B* (abbreviated to *PC B*)
- (3) *Category C: Polar Code Category C* (abbreviated to *PC C*)

**4** For ships made of steel corresponding to a design temperature ( $T_D$ ) to operate in water areas with low temperatures (e.g. Arctic or Antarctic waters) in accordance with the provisions of **3.2.2.2-1, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships**, by the provisions of **1.1.1-4, Part 3**, the notation of “*Design Temperature Category: TD*” (abbreviated to *TD*) is affixed to the Classification Characters.

#### **1.2.6 Application of Special Survey Scheme**

**1** The notation “*Propeller Shaft Condition Monitoring System*” (abbreviated as *PSCM*) is affixed to the classification characters of ships whose propeller shafts surveys are carried out based upon the preventive maintenance system specified in the requirements of **8.1.2-1, Part B of the Rules for the Survey and Construction of Steel Ships**, by the provisions of **7.1.1, Part 2**.

**2** The notation “*Propeller Shaft Condition Monitoring System of Shaft Kind 1A*” (abbreviated as *PSCM-1A*) is affixed to the classification characters of ships whose propeller shafts surveys are carried out based upon the preventive maintenance system specified in the requirements of **8.1.2-2, Part B of the Rules for the Survey and Construction of Steel Ships** in accordance with **7.1.1, Part 2**.

## Chapter 2 DEFINITIONS

### 2.1 General

#### 2.1.1 Application

The definitions of terms which appear in the Rules are as specified in this Chapter and [Chapter 2, Part A of the Rules for the Survey and Construction of Steel Ships](#), unless otherwise specified elsewhere.

#### 2.1.2 Compartment

Compartment is a part of the hull formed by shells, decks and bulkheads which are to be watertight as a rule.

#### 2.1.3 Group of Compartment

Group of compartments is a part of the hull formed by two or more compartments which are adjacent with each other.

#### 2.1.4 Length of Ship

1 Except for cases as specified in [Chapter 3](#) to [Chapter 5 of Part 3](#), length is the length for freeboard ( $L_f$ ) specified in [2.1.3, Part A of the Rules for the Survey and Construction of Steel Ships](#). (*SOLAS* Reg. II-1/2.5)

2 Length of ship ( $L$ ) specified in [Chapter 3](#) to [Chapter 5 of Part 3](#) is the distance in *metres* on the designed maximum load line, from the fore side of stem to the aft side of rudder post in case of a ship with rudder post, or to the axis of rudder stock in case of a ship without rudder post. However, in case of a ship with cruiser stern,  $L$  is as defined as above or 96% of the total length on the designed maximum load line, whichever is the greater.

#### 2.1.5 Breadth of Ship

1 Except for cases as specified in [Chapter 3](#) to [Chapter 5 of Part 3](#), breadth of ship is the extreme width (as defined  $B'$ ) from outside of frame to outside of frame at or below the deepest subdivision draught. (*SOLAS* Reg. II-1/2.8)

2 Breadth of ship ( $B$ ) specified in [Chapter 3](#) to [Chapter 5 of Part 3](#), is the horizontal distance in *metres* from outside of frame to outside of frame measured at the broadest part of the hull, unless otherwise specified.

#### 2.1.6 Subdivision Length of the Ship (*SOLAS* Reg. II-1/2.1)\*

Subdivision length of the ship ( $L_s$ ) is the greatest projected moulded length of that part of the ship at or below deck or decks limiting the vertical extent of flooding with the ship at the deepest subdivision draught.

#### 2.1.7 Aft Terminal (*SOLAS* Reg. II-1/2.3)

Aft terminal is the aft limit of  $L_s$ .

#### 2.1.8 Forward Terminal (*SOLAS* Reg. II-1/2.4)

Forward terminal is the forward limit of  $L_s$ .

#### 2.1.9 Forward Perpendicular (*SOLAS* Reg. II-1/2.7)

Forward perpendicular is the perpendicular measured vertically to the longitudinal direction and measured in the direction of ship's depth at forward end of  $L_f$

#### 2.1.10 Deepest Subdivision Draught (*SOLAS* Reg. II-1/2.10)

Deepest subdivision draught is the summer load line draught of the ship.

#### 2.1.11 Light Service Draught (*SOLAS* Reg. II-1/2.11)

Light service draught ( $d_l$ ) is the service draught corresponding to the lightest anticipated loading and associated tankage, including, however, such ballast as may be necessary for stability and/or immersion. Passenger ships should include the full complement of passengers and crew on board.

#### 2.1.12 Partial Subdivision Draught (*SOLAS* Reg. II-1/2.12)

Partial subdivision draught ( $d_p$ ) is the draught which corresponds to the summation of light service draught specified in [2.1.11](#) above and 60% of the difference between light service draught and the deepest subdivision draught.

#### 2.1.13 Draught (*SOLAS* Reg. II-1/2.9)

Draught ( $d'$ ) is the vertical distance in *metres* from keel line to the water line in question at the midpoint of  $L_s$ .

#### 2.1.14 Amidships (*SOLAS* Reg. II-1/2.2)

Amidships is at the middle of the length for freeboard ( $L_f$ ).

**2.1.15 Load Draught and Designed Maximum Load Draught**

Load Draught and Designed Maximum Load Draught specified in [Chapter 3](#) to [Chapter 5](#) of [Part 3](#) are the followings respectively.

- (1) Load draught is the vertical distance in *metres* from the top of keel plate to the load line measured at the middle of  $L_f$  (refer to [2.1.3, Part A of the Rules for the Survey and Construction of Steel Ships](#)).
- (2) Designed maximum load draught ( $d$ ) is the vertical distance in *metres* from the top of keel plate to the designed maximum load line measured at the middle of  $L$ .

**2.1.16 Trim (SOLAS Reg. II-1/2.13)**

Trim is the difference between the draught forward and the draught aft, where the draughts are measured at the perpendiculars for the forward and aft ends of the length for freeboard ( $L_f$ ), disregarding any rake of keel.

**2.1.17 Permeability (SOLAS Reg. II-1/2.14)\***

Permeability of a space is the percentage of that space which can be occupied by water.

**2.1.18 Machinery Spaces**

**1** Except for cases as specified in [Chapter 6](#) and [Chapter 7](#) of [Part 3](#) and [Part 4](#), machinery spaces are all machinery spaces of category A and all other spaces containing propelling machinery, boilers, oil fuel units, steam and internal combustion engines, generators and major electrical machinery, oil filling stations, refrigerating, stabilizing, ventilation and air conditioning machinery, and similar spaces, and trunks to such spaces. (SOLAS Reg. II-1/3.16, Reg. II-2/3.20)

**2** Machinery spaces specified in [Chapter 6](#) and [Chapter 7](#) of [Part 3](#), and [Part 4](#) are spaces between the watertight boundaries of a space containing the main and auxiliary propulsion machinery, including boilers, generators and electric motors primarily intended for propulsion. In the case of unusual arrangements, the Society may define the limits of the machinery spaces. (SOLAS Reg. II-1/2.15)

**2.1.19 Weathertight (SOLAS Reg. II-1/2.16)**

Weathertight means that in any sea conditions water will not penetrate into the ship.

**2.1.20 Watertight (SOLAS Reg. II-1/2.17)**

Watertight means having scantlings and arrangements capable of preventing the passage of water in any direction under the head of water likely to occur in intact and damaged conditions. In the damaged condition, the head of water is to be considered in the worst situation at equilibrium, including intermediate stages of flooding.

**2.1.21 Bulkhead Deck (SOLAS Reg. II-1/2.19)**

Bulkhead deck in a passenger ship means the uppermost deck to which the main bulkheads and the ship's shell are carried watertight. The bulkhead deck may be a stepped deck.

**2.1.22 Keel Line (SOLAS Reg. II-1/2.25)**

Keel line is a line parallel to the slope of the keel passing amidships through the top of the keel at the centreline or at the line of intersection of the inside of a shell plating with the keel if a bar keel extends below that line, on a ship with a metal shell.

**2.1.23 Control Stations (SOLAS Reg. II-1/3.18)**

Control stations are those 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 centralized.

**2.1.24 Main Source of Electrical Power (SOLAS Reg. II-1/3.7)**

Main source of electrical power is a source intended to supply electrical power to the main switchboard for distribution to all services necessary for maintaining the ship in normal operational and habitable conditions.

**2.1.25 Emergency Switchboard (SOLAS Reg. II-1/3.11)**

Emergency switchboard is a switchboard which in the event of failure of the main electrical power supply system is directly supplied by the emergency source of electrical power or the transitional source of emergency power and is intended to distribute electrical energy to the emergency services.

**2.1.26 Emergency Source of Electrical Power (SOLAS Reg. II-1/3.12)**

Emergency source of electrical power is a source of electrical power, intended to supply the emergency switchboard in the event of failure of the supply from the main source of electrical power.

**2.1.27 Main Vertical Zones (SOLAS Reg. II-2/3.32)**

Main vertical zones are those sections into which the hull, superstructure, and deckhouses are divided by "A" class divisions,

the mean length of which on any deck does not in general exceed 40m.

#### **2.1.28 Vehicle Spaces (SOLAS Reg. II-2/3.49)**

Vehicle spaces are cargo spaces intended for carriage of motor vehicles with fuel in their tanks for their own propulsion.

#### **2.1.29 Special Category Spaces (SOLAS Reg. II-2/3.46)**

Special category spaces are those enclosed vehicle spaces above and below the bulkhead deck, into and from which such vehicles can be driven and to which passengers 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 m.

#### **2.1.30 Ro-ro Spaces (SOLAS Reg. II-2/3.41)**

Ro-ro spaces are 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 or on rail or road cars, vehicles (including road or rail tankers), 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.

#### **2.1.31 Ro-ro Passenger Ship (SOLAS Reg. II-1/2.23, Reg. II-2/3.42)**

Ro-ro passenger ship means a passenger ship with ro-ro spaces or special category spaces.

#### **2.1.32 Central Control Station (SOLAS Reg. II-2/3.9)**

Central control station is a control station in which the following control and indicator functions are centralized.

- (1) Fixed fire detection and alarm systems
- (2) Automatic sprinklers, fire detection and alarm systems
- (3) Fire door indicator panels
- (4) Fire door closures
- (5) Watertight door indicator panels
- (6) Watertight door closures
- (7) Ventilation fans
- (8) General/fire alarms
- (9) Communication systems including telephones
- (10) Microphones to public address systems

#### **2.1.33 Continuously Manned Central Control Station (SOLAS Reg. II-2/3.17)**

Continuously manned central control station is a central control station which is continuously manned by a responsible member of the crew.

#### **2.1.34 Low Flame Spread (SOLAS Reg. II-2/3.29)**

Low flame spread means that the surface thus described will adequately restrict the spread of flame, this being determined in accordance with the *Fire Test Procedures Code*.

#### **2.1.35 Rooms Containing Furniture and Furnishings of Restricted Fire Risk (SOLAS Reg. II-2/3.40)**

Rooms containing furniture and furnishings of restricted fire risk are those rooms containing furniture and furnishings of restricted fire risk (whether cabins, public spaces, offices or other types of accommodation) in which:

- (1) All case furniture such as desks, wardrobes, dressing tables, bureaux, dressers, is constructed entirely of approved non-combustible materials, except that a combustible veneer not exceeding 2mm may be used on the working surface of such articles
- (2) All free-standing furniture such as chairs, sofas, tables, is constructed with frames of non-combustible materials
- (3) All draperies, curtains and other suspended textile materials have qualities of resistance to the propagation of flame not inferior to those of wool of mass  $0.8\text{kg/m}^2$ , which are determined in accordance with the *Fire Test Procedures Code*.
- (4) All floor coverings have low flame spread characteristics.
- (5) All exposed surfaces of bulkheads, linings and ceilings have low flame-spread characteristics.
- (6) All upholstered furniture has qualities of resistance to the ignition and propagation of flame, this being determined in accordance with the *Fire Test Procedures Code*.
- (7) All bedding components have qualities of resistance to the ignition and propagation of flame, which are determined in accordance with the *Fire Test Procedures Code*.

#### **2.1.36 Short International Voyage (SOLAS Reg. III/3.22)**

Short international voyage is an international voyage in the course of which a ship is not more than 200 miles from a port or

place in which the passengers and crew could be placed in safety. Neither the distance between the last port of call in the country in which the voyage begins and the final port of destination nor the return voyage shall exceed 600 *miles*. The final port of destination is the last port of call in the scheduled voyage at which the ship commences its return voyage to the country in which the voyage began.

### 2.1.37 Criterion of Service Numeral (SOLAS Reg. III/35-1.3.2)

Criterion of service numeral is to be given by the following formula:

- (1) When  $P_1$  is greater than  $P$ :

$$72 \frac{M + 2P_1}{V + P_1 - P}$$

$P_1$ : As given by the following formula:

$$0.056L_fN$$

$L_f$ : Length ( $m$ ) for freeboard specified in **2.1.3, Part A of the Rules for the Survey and Construction of Steel Ships**

$N$ : Number of passengers for which the ship is to be certified

However, where the value of  $P_1$  is greater than the sum of  $P$  and the whole volume of the actual passenger spaces above the bulkhead deck, the figure to be taken as  $P_1$  is that sum or  $2/3$  times  $0.056L_fN$ , whichever is the greater.

$P$ : Whole volume ( $m^3$ ) of passenger and crew space below the bulkhead deck, which are provided for the accommodation and use of passengers and crew, excluding baggage, store, provision and mail room

$M$ : Volume ( $m^3$ ) of machinery space specified in **2.1.18-2**, that is below the bulkhead deck; with the addition thereto of the volume of any permanent oil fuel bunkers which may be situated above the inner bottom and forward of, or abaft, the machinery space

$V$ : Whole volume ( $m^3$ ) of the ship below the bulkhead deck

- (2) When  $P_1$  is not greater than  $P$ :

$$72 \frac{M + 2P}{V}$$

### 2.1.38 Ships Using Low-flashpoint Fuels

Ships using low-flashpoint fuels mean ships which use low-flashpoint fuels as defined in **2.2.1-28, Part GF of the Rules for the Survey and Construction of Steel Ships**.

## Part 2 CLASS SURVEY

### Chapter 1 GENERAL

#### 1.1 Surveys

##### 1.1.1 Classification Surveys\*

**1** The ships intended to be classed with the Society are to be subjected to Classification Surveys by the Surveyor in accordance with the requirements in **Chapter 2** of this Part.

**2** Classification Surveys are composed of following Surveys.

- (1) Classification Survey during Construction
- (2) Classification Survey of Ships not Built under Survey

**3** Surveyors are to confirm that materials which contain asbestos are not being used.

##### 1.1.2 Class Maintenance Surveys\*

**1** Ships classed with the Society are to be subjected to Class Maintenance Surveys by the Surveyor in accordance with the requirements specified in **Chapter 3** through **Chapter 8** of this Part as appropriate.

**2** Class Maintenance Surveys consist of Periodical Surveys, Surveys under the Planned Machinery Surveys, Occasional Surveys and Unscheduled Surveys, which are as specified in the following **(1)** to **(4)**. At each of these surveys, inspections, tests or examinations are to be carried out for the purpose of verification of the compliance with the relevant requirements.

##### (1) Periodical Surveys

###### (a) Intermediate Surveys

The surveys consist of general examinations of hull, machinery, equipment, fire-fighting equipment, etc. and detailed examinations of a certain part of them as specified in **Chapter 3** of this Part.

###### (b) Special Surveys

The surveys consist of detailed examinations of hull, machinery, equipment, fire-fighting equipment, etc. as specified in **Chapter 4** of this Part.

###### (c) Docking Surveys

The surveys consist of bottom inspections normally carried out in a dry-dock or on slip-way as specified in **Chapter 5** of this Part.

###### (d) Boiler Surveys

The surveys consist of open-up examinations and performance tests of boilers as specified in **Chapter 6** of this Part.

###### (e) Propeller Shaft and Stern Tube Shaft Surveys

The surveys consist of open-up examinations etc. of propeller shafts and the stern tube shafts as specified in **Chapter 7** of this Part.

##### (2) Planned Machinery Survey

The surveys consist of open-up examinations of machinery and equipment as specified in **Chapter 8** of this Part.

##### (3) Occasional Surveys

The surveys consist of examinations of hull, machinery and equipment including damaged part and of works for repairs, modifications or conversions, which are carried out separately from **(1)** and **(2)** above.

##### (4) Unscheduled Surveys

The surveys consist of examinations of the status of hull, machinery and equipment which are carried out separately from **(1)** to **(3)** above.

##### 1.1.3 Intervals of Class Maintenance Surveys\*

**1** Periodical Surveys are to be carried out in accordance with the requirements specified in **(1)** through **(5)** below.

**(1) Intermediate Surveys**

Intermediate Surveys are to be carried out as prescribed in **(a)** or **(b)** below.

- (a) Within 3 *months* before each anniversary date (the day corresponding to the expiry date of the Classification Certificate, excluding the expiry date of the Classification Certificate) for ships engaged in international voyages.
- (b) Within 3 *months* before or after each anniversary date for ships other than ships specified in **(a)** above.

**(2) Special Surveys**

Special Surveys are to be carried out within 3 *months* before the date of expiry of the Classification Certificate.

**(3) Docking Surveys**

Docking Surveys are to be concurrently carried out with Intermediate Surveys and Special Surveys.

**(4) Boiler Surveys**

Boiler Surveys are to be carried out at intervals specified in **1.1.3-1(5), Part B of the Rules for the Survey and Construction of Steel Ships**.

**(5) Propeller Shaft and Stern Tube Shaft Surveys**

Propeller Shaft and Stern Tube Shaft Surveys are to be carried out at intervals specified in **Chapter 8, Part B of the Rules for the Survey and Construction of Steel Ships**.

**2** Planned Machinery Surveys are to be carried out at intervals specified in **1.1.3-2, Part B of the Rules for the Survey and Construction of Steel Ships**.

**3** Occasional Surveys are to be carried out on the occasions specified in **1.1.3-3, Part B of the Rules for the Survey and Construction of Steel Ships**.

**4** Unscheduled Surveys may be carried out in the cases specified in **1.1.3-4, Part B of the Rules for the Survey and Construction of Steel Ships**.

**1.1.4 Periodical Surveys Carried Out in Advance\***

**1** Special Surveys may be carried out in advance of the due dates of the Special Survey upon application by the Owner.

**2** Intermediate Surveys may be carried out in advance of the due dates of the Intermediate Survey upon application by the Owner. In this case, one or more additional Intermediate Surveys are to be carried out in accordance with the provisions specified otherwise by the Society.

**3** Where a Special Survey is carried out in advance at the due time of the Intermediate Survey, the Intermediate Survey may be dispensed with.

**1.1.5 Postponement of Periodical Surveys\***

**1** For ships engaged in international voyages, Intermediate Surveys, Special Surveys, Docking Surveys, Boiler Surveys carried out concurrently with Special Surveys and Ordinary Surveys for Propeller shafts Kind 2 carried out concurrently with Special Surveys may be postponed as specified in **(1)** or **(2)** below subject to the approval by the Society in advance.

- (1) Maximum 3 *months* for the purpose of allowing the ship to complete its voyage to the port in which it is to be surveyed.
- (2) Maximum 1 *month* for the ship engaged on short voyages.

**2** For ships other than those specified in **-1** above, Special Surveys, Docking Surveys carried out concurrently with Special Surveys, Boiler Surveys carried out concurrently with Special Surveys and Ordinary Surveys for Propeller shafts Kind 2 carried out concurrently with Special Surveys may be postponed not exceed 1 *month* subject to the approval by the Society in advance.

**1.1.6 Modification of the Requirements\***

**1** At the Periodical Surveys and Planned Machinery Surveys, the Surveyor may modify the requirements specified in **Chapter 3** through **Chapter 8** of this Part having regard to the size, service engaged, construction, age, service performance, results of previous surveys and actual condition of the ship.

**2** When the results of a Periodical Survey suggest the likelihood of heavy corrosion, defects etc., and the Surveyor considers it necessary, close-up surveys, pressure tests or thickness measurements are to be carried out. Thickness measurement procedures and submission of gauging results are to be in accordance with the requirements of **5.2.6-1, Part B of the Rules for the Survey and Construction of Steel Ships**.

**3** For tanks and cargo holds where effective coatings are found to be in a good condition, the extent of internal examination, close-up surveys or thickness measurements may be specially considered at the discretion of the Surveyor.

#### 4 Continuous Hull Surveys

For ships where approved by the Society, at the request of the owner, internal examinations, thickness measurements and pressure tests of tanks and compartments to be carried out at Special Surveys may be dispensed with at the discretion of the Surveyor provided that those examinations and tests have been carried out successively by the relevant Special Surveys (hereinafter, referred to as “Continuous Hull Survey”). If the examination during Continuous Hull Surveys reveals any defects, the Surveyor may require further tanks and compartments to be examined precisely. The Society may, where considered necessary, require the Continuous Hull Survey to be carried out by a method other than specified above.

##### 1.1.7 Laid-up Ships\*

1 Laid-up ships are not subject to Class Maintenance Surveys specified in 1.1.2. However, Occasional Surveys may be carried out at the request of the owner.

2 When laid-up ships are about to be re-entering their services, the following surveys and the surveys for the specific matters which have been postponed due to being laid-up, if any, are to be carried out.

(1) When any Periodical Survey or Planned Machinery Survey designated before lay-up has not been due, surveys equivalent to the Intermediate Surveys specified in **Chapter 3 of this Part**, corresponding to the age of the ship, are to be carried out.

(2) When Periodical Surveys or Planned Machinery Surveys designated before lay-up have already become due, these Periodical Surveys or Planned Machinery Surveys are, in principle, to be carried out. However in case where two or more kinds of the Periodical Surveys have already become due, the Special Survey is to be carried out.

3 If the survey to be carried out under the requirements of -2(2) above is a Special Survey, either the overdue Special Survey or the next due Special Survey is to be carried out. In such cases, the validity of the Classification Certificate is to be in accordance with the requirements of **4.1.3-4, Guidance for the Classification and Registry of Ships** corresponding to the Special Survey to be carried out.

##### 1.1.8 Machinery Verification Runs

1 At the time of a special survey, a dock trial in the presence of the attending surveyor is to be carried out to confirm the satisfactory operation of main and auxiliary machinery. If significant repairs have been carried out to main or auxiliary machinery or steering gear, the Surveyor may deem a sea trial necessary.

2 At the time of extended drydocking, a dock trial may be required at the discretion of the attending surveyor to confirm the satisfactory operation of main and auxiliary machinery. If significant repairs have been carried out to main or auxiliary machinery or steering gear, the Surveyor may deem a sea trial necessary.

#### 1.2 Ships, Installations, Apparatus, etc. for Special Purposes

##### 1.2.1 Incinerators of Waste Oil and Waste Substance

Where incinerators of waste oil and waste substance are installed on board, they are to be examined to the satisfaction of the Surveyor.

#### 1.3 Definition

The definitions of terms, which appear in this Part, are to be in accordance with those specified in **1.3, Part B of the Rules for the Survey and Construction of Steel Ships**.

#### 1.4 Preparation for Surveys and Others\*

The preparation for Surveys and others are to be in accordance with those specified in **1.4, Part B of the Rules for the Survey and Construction of Steel Ships**.



## 1.5 Others

### 1.5.1 Portable Atmosphere Testing Instruments for Enclosed Spaces

Ships engaged on international voyages, irrespective of tonnage including ships of less than 500 *gross tonnage*, are to be provided with portable atmosphere testing instruments for enclosed spaces specified in **1.5.1, Part B of the Rules for the Survey and Construction of Steel Ships**.

### 1.5.2 Class Survey by Means of Remote Survey

Although the survey method for class maintenance survey is generally attendance on site by a Surveyor, the Society may approve survey methods different from the traditional ordinary survey with attendance by a Surveyor, provided that survey is carried out in accordance with the requirements specified in **Annex 1.5.3 “CLASS MAINTAINANCE SURVEY BY MEANS OF REMOTE SURVEY”, Part B of the Rules for the Survey and Construction of Steel Ships**. However, in the case of matters stipulated in international conventions or instructions from Administrations, this may only be done with Administration acceptance.

## Chapter 2 CLASSIFICATION SURVEYS

### 2.1 Classification Survey during Construction

#### 2.1.1 General\*

In the Classification Survey during Construction, the hull and its equipment, machinery, fire protection and detection, means of escape, fire extinction, electrical installations, computer-based systems, stability and load lines are to be examined in detail in order to ascertain that they meet the relevant requirements in the Rules.

#### 2.1.2 Submission of Plans and Documents

**1** With respect to ships intended to undergo the Classification Survey during Construction, the plans and documents indicated in the following **(1)** to **(7)** are to be submitted to the Society for approval, prior to the commencement of the works:

**(1) Hull**

- (a) Plans specified in **2.1.3-1(1), Part B of the Rules for the Survey and Construction of Steel Ships.**
- (b) A diagram for ventilation (showing air conditioners, ventilators, smoke extraction system of atriums, ducts including their insulation, dampers, operating positions of fans and dampers etc.)
- (c) Arrangements and constructions of watertight doors, openings, side scuttles, etc. (showing the margin line)
- (d) Arrangements and constructions of bilge keels, if fitted
- (e) Arrangements and details of the installation of fin-stabilizers, if fitted (Construction of fin-stabilizers in submitted for reference)
- (f) Arrangements and details of the installation of thrusters (including the hull structure of their vicinity), if fitted
- (g) Calculation sheets for subdivision load lines
- (h) Plans showing arrangement of ship's identification number specified in **1.1.5, Part 3 of the Rules**

**(2) Machinery**

Plans and data specified in **2.1.3-1(2), Part B of the Rules for the Survey and Construction of Steel Ships.**

**(3) Stability**

- (a) A stability information booklet (including the calculation sheets for intact stability, damage stability, etc.)
- (b) A damage control plan
- (c) Cross-flooding arrangements (including information to the master of the ship concerning the operation of cross-flooding arrangements)

**(4) Constructions of fire protection, means of escape and fire extinguishing systems**

- (a) Constructions of fire protection (showing main vertical zones, horizontal zones, fire protected divisions, fire protected doors, fire protected windows, draft stops, etc., and lists of the materials for fire protection)
- (b) Means of escape (indicating escape routes, width of access routes, arrangements of low location lighting, the embarkation deck and the muster station)
- (c) Fire extinguishing arrangements (showing the arrangement, type, volume, number, etc. of fire extinguishing systems, fire extinguishers, fire pumps, hydrants, fire hoses, fireman's outfits, etc. and the arrangement of fire detecting system and alarm system)

**(5) A loading manual (for ships to be required in accordance with the requirements of **3.8.1.1, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships.**)**

**(6) For ships using low-flashpoint fuels, the plans and documents specified in **2.1.3-1(5), Part B of the Rules for the Survey and Construction of Steel Ships****

**(7) Submission of other plans and documents than those specified in **(1)** to **(6)** may be required where deemed necessary by the Society.**

**2** The plans mentioned in **-1** above are to indicate in detail the quality of materials used, scantlings and arrangements of structural members, their attachments, the clearance between the bottom of boilers and the top of floors, and other particulars necessary for examinations of proposed constructions.

3 For dedicated seawater ballast tanks of ships of not less than 500 *gross tonnage* engaged on international voyages, the Coating Technical File is to be submitted for reviewed by the Society.

4 For ships using low-flashpoint fuels, the operational procedures and emergency procedures specified in **17.2.2-3** and **17.2.2-4, Part GF of the Rules for the Survey and Construction of Steel Ships** are to be submitted for Society approval.

#### **2.1.3 Submission of Other Plans and Documents\***

With respect to ships intended to undergo the Classification Survey during Construction, the following plans and documents are to be submitted for reference, in addition to the plans and documents specified in **2.1.2**:

- (1) Plans and documents specified in item 1, 2, 3, 5, 6, 20, 47, 56, 59, 60 and 88, **Table B2.1, Part B of the Rules for the Survey and Construction of Steel Ships**.
- (2) Calculation sheets for the equalization time for cross-flooding arrangements, if fitted
- (3) Calculation sheets for the volume of combustible materials in accommodation spaces and service spaces
- (4) Calculation sheets for the width of stairs, access routes and the exit of escape routes
- (5) Qualitative failure analysis of the systems related to propulsion and steering and the reports on the results of such analysis.
- (6) For ships using low-flashpoint fuels, the plans and documents specified in **2.1.3-1(5), Part B of the Rules for the Survey and Construction of Steel Ships**
- (7) Asbestos-free declarations and supporting documents
- (8) Technical specification documents for the mooring lines (**14.4.4.4, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships**)
- (9) Submission of other plans and documents than those specified in (1) to (7) may be required where deemed necessary by the Society.

#### **2.1.4 Presence of Surveyors\***

1 In the Classification Survey during Construction, inspections are to be carried out at necessary stages of the work from its commencement until its completion.

2 Presence of the Surveyor is required at necessary stages specified in **2.1.7, Part B of the Rules for the Survey and Construction of Steel Ships**. To implement surveys of items specified otherwise by the Society, in lieu of traditional ordinary surveys where the Surveyor is in attendance, the Society may approve survey methods which it considers to be appropriate.

3 For ships using low-flashpoint fuels, the presence of the Surveyor is required for tests specified in **Part GF of the Rules for the Survey and Construction of Steel Ships**, in addition to the tests specified in **-1** and **-2**. To implement surveys, in lieu of traditional ordinary surveys where the Surveyor is in attendance, the Society may approve other survey methods which it considers to be appropriate.

4 For the tests specified in **-2** and **-3**, the applicant is to prepare test plans for review by the Society prior to testing. Test records and/or measurement records are to be submitted to the Society, as required.

#### **2.1.5 Hydrostatic and Watertight Tests**

In the Classification Survey during Construction, hydrostatic tests, watertight tests, etc. are to be carried out in accordance with the requirements of item 10, **Table B2.7, Part B of the Rules for the Survey and Construction of Steel Ships**.

#### **2.1.6 Documents to be Maintained On Board\***

1 At the completion of a classification survey, the Surveyor confirms that the following drawings, plans, manuals, lists, etc., as applicable, of finished version are on board.

- (1) Documents approved by the Society or their copies
  - (a) Loading manuals (**1.1.1-4, Part 3**)
  - (b) Operating and maintenance manuals for the door and inner door (**7.1.1-1** and **7.4.3-4, Part 3**)
  - (c) Damage control plans (**3.2.1, Part 4**)
  - (d) Stability information booklets (**4.3, Part 4**)
  - (e) Plans and documents for in-water surveys (**5.1.2, Part 2**)
  - (f) Coating Technical File (**1.1.1-4, Part 3**)
  - (g) Operational procedures for ships using low-flashpoint fuels (**17.2.2-3, Part GF of the Rules for the Survey and Construction of Steel Ships**)
  - (h) Emergency procedures for ships using low-flashpoint fuels (**17.2.2-4, Part GF of the Rules for the Survey and Construction of Steel Ships**)

### Construction of Steel Ships)

- (i) Zones and conduit diagram (2.2.3-3(4), Part X of the Rules for the Survey and Construction of Steel Ships)
- (j) Cyber security design description (2.2.3-3(5), Part X of the Rules for the Survey and Construction of Steel Ships)
- (k) Vessel asset inventory (2.2.3-3(6), Part X of the Rules for the Survey and Construction of Steel Ships)
- (l) Risk assessment for the exclusion of computer-based systems (2.2.3-3(7), Part X of the Rules for the Survey and Construction of Steel Ships)
- (m) Description of compensating countermeasures (2.2.3-3(8), Part X of the Rules for the Survey and Construction of Steel Ships)
- (n) Ship cyber resilience test procedure (2.2.3-4(2), Part X of the Rules for the Survey and Construction of Steel Ships)
- (2) Other manuals, etc.
  - (a) Operation manuals for the loading computer (1.1.1-4, Part 3)
  - (b) Towing and mooring fitting arrangement plans (1.1.1-4, Part 3)
  - (c) Booklets for the damage control (3.2.2, Part 4)
  - (d) Operating and maintenance instructions for ship machinery and equipment (1.1.1-3, Part 5)
  - (e) Fire Control Plans, Fire Safety Operational Booklets, Training manuals and Maintenance plans (5.1.1, Part 7)
  - (f) Operation manuals for the helicopter facilities (5.1.1, Part 7)
  - (g) Emergency Towing Procedures (1.1.1-4, Part 3)
  - (h) Operation manuals for the stability computer (2.5.1(2), Part 4)
  - (i) A copy of the *IGF* Code or national regulations incorporating the provisions of the *IGF* Code (17.2.2-1, Part GF of the Rules for the Survey and Construction of Steel Ships)
  - (j) Polar water operational manual (1.1.1-6, Part 3)
  - (k) Total Harmonic Distortion (THD) calculation report (1.1.6, Part H of the Rules for the Survey and Construction of Steel Ships)
  - (l) Harmonic filter operation guide (1.1.6, Part H of the Rules for the Survey and Construction of Steel Ships)
  - (m) Operation and maintenance procedures for windlasses (16.2.2(2)(e), Part D of the Rules for the Survey and Construction of Steel Ships)
  - (n) Manuals for flooding detection systems (2.4.1, Part 5)
  - (o) Watertight cable penetration register
  - (p) Management plans for inspection and maintenance of mooring equipment including mooring lines (1.1.1-4, Part 3)
  - (q) Technical specification documents for the mooring lines (14.4.4.4, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships)
- (3) Finished plans specified in 2.1.7-1

**2** For ships engaged on international voyages, the Surveyor confirms that the Ship Construction File contains the necessary documents from the following drawings, plans, manuals and documents, and that the Construction File is on board the ship. Duplicate documents as in -1 are not required.

- (1) Finished plans of hull structural drawings specified in 2.1.7-1
- (2) The following manuals and documents
  - (a) Operating and maintenance manuals for the door and inner door (7.1.1-1 and 7.4.3-4, Part 3)
  - (b) Damage control plans (3.2.1, Part 4)
  - (c) Stability information booklets (4.3, Part 4)
- (3) Copies of certificates of forgings and castings welded into the hull structures
- (4) Plans showing locations, sizes and details of equipment forming part of the watertight and weather-tight integrity of the ship, including piping (2.1.2-1(1)(a))
- (5) Corrosion prevention scheme (2.1.3(1))
- (6) Plans and documents for in-water surveys (5.1.2, Part 2)
- (7) Docking plan including locations and other necessary information of all penetrations
- (8) Plans and documents for Anti-Fouling Systems (2.2.2, Rules for Anti-Fouling Systems on Ships)
- (9) Test plans, test records, measurements records, etc.

(10) Watertight cable penetration register

3 Where deemed necessary by the Society considering the purpose, characteristics, etc. of the ship, the submission of additional documents may be required.

4 For ships engaged on international voyages, it is recommended that all documents listed in -1 above are marked with the *IMO* ship identification number.

5 At the completion of classification surveys, Surveyors confirm that certificates showing that the following devices have passed all required examinations or tests are maintained on board.

- (1) Fire pumps (including emergency fire pumps)
- (2) Fire hoses and nozzles
- (3) Fire extinguishers (including spare charges)
- (4) Fire-fighter's outfits
- (5) Emergency escape breathing devices
- (6) Fixed fire-extinguishing systems
- (7) Fire dampers and power-operated closing doors
- (8) Fixed fire detection and fire alarm systems and automatic sprinkler systems
- (9) Fire protection materials
- (10) Additional equipment required for ships carrying dangerous goods (electrical equipment of an explosion-proof type, detection systems, full protective clothing, portable fire extinguishers and water spraying systems)
- (11) Watertight doors below the freeboard deck
- (12) Side scuttles

#### 2.1.7 Finished Plans

1 At the completion of a classification survey, an applicant of the classification of the ship is to prepare finished plans regarding the following drawings, etc., and submit to the Society.

- (1) General arrangement
- (2) Midship section, scantling plans (construction profile), deck plans, shell expansion, transverse bulkheads, plans for rudder and rudder stock, and plans for cargo hatch covers
- (3) Bilge and ballast piping diagrams
- (4) Fire protection plans
- (5) Fire extinguishing appliances arrangement
- (6) Plans and data showing the navigation bridge visibilities

2 For ships that are required to maintain a Ship Construction File on board in accordance with 2.1.6-2, the documents contained in the Ship Construction File are also to be submitted to the Society. However, it is not necessary to submit duplicates of any of the documents specified in -1 above and 2.1.6-1.

#### 2.1.8 Verification of Coating Application\*

The following will be carried out by the Society prior to reviewing the Coating Technical File for the coatings of internal spaces subject to 3.3.5.3, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships in accordance with 1.1.1-4, Chapter 1, Part 3:

- (1) Check that the Technical Data Sheet and Statement of Compliance or Type Approval Certificate comply with "PERFORMANCE STANDARD FOR PROTECTIVE COATINGS FOR DEDICATED SEAWATER BALLAST TANKS IN ALL TYPE OF SHIPS AND DOUBLE-SIDE SKIN SPACES OF BULK CARRIERS" (*IMO Performance Standard for Protective Coatings / IMO resolution MEPC.215(82)* as may be amended), however, the Statement of Compliance or Type Approval Certificate is to be a certificate deemed appropriate by the Society;
- (2) Check that the coating identification on representative containers is consistent with the coating identified in the Technical Data Sheet and Statement of Compliance or Type Approval Certificate in (1) above;
- (3) Check that the inspector is qualified in accordance with the qualification standards deemed appropriate by the Society;
- (4) Check that the inspector's reports of surface preparation and the coating's application indicate compliance with the manufacturer's Technical Data Sheet and Statement of Compliance or Type Approval Certificate in (1) above; and
- (5) Monitor implementation of the coating inspection requirements deemed appropriate by the Society.

## **2.2 Classification Survey of Ships Not Built under Survey**

### **2.2.1 General**

**1** The Classification Survey of Ships not built under Survey is to be carried out in accordance with the requirement in **2.2.1, Part B of the Rules for the Survey and Construction of Steel Ships** corresponding to the ship's age for the hull and its equipment, machinery, fire protection and detection, means of escape, fire extinction, electrical installations, computer-based systems, stability and load lines.

**2** For ships using low-flashpoint fuels, the operational procedures and emergency procedures specified in **-3 and -4 of 17.2.2, Part GF of the Rules for the Survey and Construction of Steel Ships** are to be submitted for Society approval.

### **2.2.2 Hydrostatic and Watertight Tests**

Hydrostatic tests, watertight tests, etc. are to be carried out in accordance with the requirement of item 10, **Table B2.7, Part B of the Rules for the Survey and Construction of Steel Ships**.

### **2.2.3 Documents to be Maintained On Board**

At the completion of a classification survey, the Surveyor confirms that documents specified in **2.1.6** are on board the ship.

## **2.3 Sea Trials and Stability Experiments**

### **2.3.1 Sea Trials**

Sea trials are to be carried out in accordance with the requirement of **2.1.7-7, Part B of the Rules for the Survey and Construction of Steel Ships**.

### **2.3.2 Stability Experiments**

Stability experiments are to be carried out in accordance with the requirement of **2.1.7-8, Part B of the Rules for the Survey and Construction of Steel Ships**. Omission of such experiments is not allowed.

## **2.4 Alterations**

### **2.4.1 Examinations of Altered Parts**

The examinations of altered parts are to be in accordance with those specified in **2.3.1, Part B of the Rules for the Survey and Construction of Steel Ships**.

## Chapter 3 INTERMEDIATE SURVEYS

### 3.1 General

#### 3.1.1 Application

1 At Intermediate Surveys, the surveys required for general cargo ships specified in **Chapter 4, Part B of the Rules for the Survey and Construction of Steel Ships** are to be carried out.

2 For ships using low-flashpoint fuels, the examinations specified in **4.6, Part B of the Rules for the Survey and Construction of Steel Ships** are to be carried out.

3 For ships affixed with the notation “*Cybr*”, the examinations specified in **4.9, Part B of the Rules for the Survey and Construction of Steel Ships** are to be carried out.

4 In addition to those specified in **-1, -2** and **-3** above, the surveys specified in **3.2** and **3.3** are to be carried out.

### 3.2 Hull, Equipment and Fire Extinguishing Systems

#### 3.2.1 Hull

At Intermediate Surveys for hull and its equipment, the following requirements are to be complied with. However, watertight tests, weathertight tests and overhaul examinations may be dispensed with provided the Surveyor is satisfied with the result of the general inspection.

- (1) General inspections of the piping and valves of cross-flooding arrangements and operation tests of its remote control system, and valves for significant use are to be overhauled and examined.
- (2) Overhaul examinations of bulkhead valves at the collision bulkhead and its remote operation tests from the bulkhead deck.
- (3) General inspections of watertight doors including confirmation of the caution plates and following operation tests.
  - (a) Open-close of doors (at door and remote control)
  - (b) Door indicators
  - (c) Alarm system
  - (d) Change over of mode at the central control console
- (4) General inspections of side scuttles, gangways, cargo and coal ports and other openings in the shell plating, and watertight tests for these openings below the bulkhead deck or weathertight tests for these openings above the bulkhead deck and operation tests of door indicators and water leakage detectors of shell doors.
- (5) General inspections of discharge pipes with their valves attached to shell platings below the bulkhead deck, and also overhaul inspections of the valves.
- (6) General inspections of the inboard openings of ash-shoots and rubbish-shoots, and watertight tests and overhaul inspections of automatic non-return valves where the inboard openings are below the bulkhead deck
- (7) General inspections of watertightness at the fixing parts of fin-stabilizers.

#### 3.2.2 Fire Protection, Means of Escape and Fire Extinguishing System\*

At Intermediate Surveys for fire protection, means of escape and fire extinguishing system, the following requirements are to be complied with. However, pressure tests may be dispensed with provided the Surveyor is satisfied with the result of general inspections.

- (1) General inspections of closing appliances for openings (skylights, funnels and ventilators) of machinery spaces and operation tests of their fire-dampers
- (2) General inspections and operation tests of doors in machinery spaces
- (3) General inspections and operation tests of fire dampers fitted to the ducts whose sectional area is  $0.075m^2$  and more
- (4) General inspections of openings (penetration of cables, pipes, ducts, girders, etc.) of “A” class or “B” class divisions
- (5) General inspections of electric-radiators and waste-receptacles
- (6) General inspections of the fire protection of the divisions inside the main vertical zones and the divisions forming the

boundaries of the main vertical zones, horizontal zones and stairway enclosures.

- (7) General inspections and operation tests of “A” class fire doors and “B” class fire doors including tests of both remote closing and self closing systems and general inspections of fire windows and side scuttles
- (8) General inspections of draft stops, ceilings and linings
- (9) Operation tests of the sprinkler system, pressure tests of pressure tanks, and operation tests of alarm systems by both main and emergency sources of power
- (10) General inspections of lockable screw-down non-return valves of sprinkler systems at the connection with the fire main line, and general inspections of spare sprinkler heads.
- (11) Tests of continuation of the output of water by the automatic starting of fire pumps.
- (12) General inspections of fire protection, fire extinguishing systems, fire detecting systems, fire alarm systems, ventilation systems, and bilge systems in the special category spaces, and operation tests of these systems
- (13) Operation tests of the alarm systems to summon the crew
- (14) Operation tests of the public address systems
- (15) General inspections of fire protection, fire extinguishing systems, fire detecting systems, ventilation systems and bilge systems in spaces carrying dangerous goods and operation tests of these systems
- (16) General inspections of means of escape including those from the radio room and special category spaces
- (17) General inspections of closing arrangements of ventilation ducts and operation tests of fire dampers
- (18) General inspections and operation tests of smoke dampers

### **3.3 Machinery**

#### **3.3.1 Machinery\***

At Intermediate Surveys for machinery, the following requirements are to be complied with.

- (1) Performance tests of electrical installations for main propulsion use in accordance with the approved test procedures
  - (2) Operation tests of the emergency lighting (including supplementary emergency lighting and low location lighting)
  - (3) General inspections of electrical cables penetrating through the divisions forming the boundaries of the main vertical zones
  - (4) Performance tests for verification of the ability of the machinery to reverse the direction of the thrust of the propellers in sufficient time, including the effectiveness of any supplementary means of manoeuvring or stopping the ship, as far as practicable.
  - (5) Sea trial
- Sea trials may be required, if deemed necessary by the Society.



## Chapter 4 SPECIAL SURVEYS

### 4.1 General

#### 4.1.1 Application

- 1 At Special Surveys, the surveys required for general cargo ships specified in **Chapter 5, Part B of the Rules for the Survey and Construction of Steel Ships** are to be carried out.
- 2 For ships using low-flashpoint fuels, the examinations specified in **5.6, Part B of the Rules for the Survey and Construction of Steel Ships** are to be carried out.
- 3 For ships affixed with the notation “*Cybr*”, the examinations specified in **5.9, Part B of the Rules for the Survey and Construction of Steel Ships** are to be carried out.
- 4 In addition to those specified in **-1, -2** and **-3** above, the surveys specified in **4.2** and **4.3** are to be carried out.

### 4.2 Hull, Equipment and Fire Extinguishing Systems

#### 4.2.1 Hull\*

At Special Surveys for hull and its equipment, the following requirements are to be complied with.

- (1) Tests and inspections are to be carried out in accordance with the requirements of **3.2.1**
- (2) The light weight of the ship is to be checked. Where the lightweight is different by 2% or more from the previous record, or where the longitudinal center of gravity is different by 1% or more of  $L_f$  from the previous records, the inclining experiments are to be carried out and the stability information is to be corrected in accordance with the result of the experiments.

#### 4.2.2 Fire Protection, Means of Escape and Fire Extinguishing System

At Special Surveys for fire protection, means of escape and fire extinguishing system, tests and inspections are to be carried out in accordance with the requirements of **3.2.2**.

### 4.3 Machinery

#### 4.3.1 Machinery\*

At Special Surveys for machinery, tests and inspections are to be carried out in accordance with the requirements of **3.3.1**.

## Chapter 5 DOCKING SURVEYS

### 5.1 Docking Surveys

#### 5.1.1 Surveys in Dry Dock or on Slipway

At Docking Surveys, examinations listed in [Table B6.1, Part B of the Rules for the Survey and Construction of Steel Ships](#) are to be carried out in a dry dock or on a slipway after cleaning of the outer shell.

#### 5.1.2 In-water Surveys\*

In-water Surveys may be accepted in lieu of the Surveys specified in [5.1.1](#) subject to the prior approval by the Society. However, any two consecutive Docking Surveys are not to be carried out in water.

#### 5.1.3 Others

For each ship adopting the preventive maintenance system for the propulsion shafting system in accordance with the requirements specified in [8.1.2, Part B of the Rules for the Survey and Construction of Steel Ships under provisions of Chapter 7](#), general examinations of the shafting system and review of all condition monitoring data available on board the ship on the system are to be carried out in order to ascertain that the system is well maintained.

## **Chapter 6      BOILER SURVEYS**

### **6.1      Boiler Surveys**

#### **6.1.1      General**

Boiler Surveys are to be carried out in accordance with the requirements of [Chapter 7, Part B of the Rules for the Survey and Construction of Steel Ships](#).

## **Chapter 7      PROPELLER SHAFT AND STERN TUBE SHAFT SURVEYS**

### **7.1      Propeller Shaft and Stern Tube Shaft Surveys**

#### **7.1.1      General**

Propeller shaft and stern tube shaft surveys are to be carried out in accordance with the requirements of [Chapter 8, Part B of the Rules for the Survey and Construction of Steel Ships](#).

## **Chapter 8      PLANNED MACHINERY SURVEYS**

### **8.1      Planned Machinery Surveys**

#### **8.1.1      General**

Planned Machinery Surveys are to be carried out in accordance with the requirements of [Chapter 9, Part B of the Rules for the Survey and Construction of Steel Ships](#).

## Part 3 HULL CONSTRUCTION AND EQUIPMENT

### Chapter 1 GENERAL

#### 1.1 General

##### 1.1.1 Application\*

1 The requirements in this Part are framed for hull construction and equipment of ships intended for unrestricted service as passenger ships.

2 Hull construction and equipment of ships to be classed for special restricted service may be partly modified the application of requirements in this Part.

3 The requirements in this Part are framed for multi-deck ships having double bottoms and decks and bottoms with longitudinal framing, and whose freeboard deck is a lower deck other than the strength deck.

4 The relevant requirements of **Part C** and **Part CS of the Rules for the Survey and Construction of Steel Ships** are framed for ships not less than 90 *m* in length and ships less than 90 *m* in length respectively, except for the requirements in this part.

5 In the application of the relevant provisions in this part to ships which are not applied the requirements in **Part 8**,  $L_f$  is to be read as  $L$  and  $B_f$  as  $B$ .

6 The ships intended to be registered as ships operating in polar waters, polar class ships or ice class ships stated in **Chapter 1, Part I of the Rules for the Survey and Construction of Steel Ships** are to be accordance with the provisions of **Part I of the Rules for the Survey and Construction of Steel Ships**.

7 In cases where **3.3.5.3-1, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships**, referred to in -4 above, is applied, the following tanks are not considered to be dedicated seawater ballast tanks, provided the coatings applied in the tanks described in (2) below are confirmed by the coating manufacturer to be resistant to the media stored in the tanks, and are applied and maintained according to the coating manufacturer's procedures.

- (1) Tanks identified as "Spaces included in Net Tonnage" in the 1969 ITC Certificate
- (2) Sea water ballast tanks also designated for the carriage of grey water or black water

##### 1.1.2 Special Cases in Application

In ships of which length is specially long or in ships to which requirements in this Part, for some special reasons, are not directly applicable, hull construction, equipment, arrangement and scantlings are to be at the Society's discretion, notwithstanding the provisions in **1.1.1**.

##### 1.1.3 Stability

The requirements in this Part are framed for ships having appropriate stability in all conceivable conditions. The Society emphasizes that the special attention is to be paid to the stability by the builders in design and construction stage and by the masters while in service.

##### 1.1.4 Direct Calculations\*

1 Where approved by the Society, direct calculations may be used to determine the scantlings of structural members and structural details for joints and discontinuities of structural members. In this case, if the scantlings which are determined by the reference of results of the direct calculations are not less than the scantlings of each provisions in this chapter, the scantlings are not to be less than the scantlings which are determined by the reference of results of the direct calculations.

2 In case of utilizing the direct calculations, the data necessary for the calculation are to be submitted to the Society.

##### 1.1.5 Ship Identification Number

For ships not less than 100 *gross tonnage* engaged on international voyages, the ship's identification number is to be permanently marked in accordance with **14.2.1, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships**. In this case, in addition to the places specified in **14.2.1.1(1), Part 1, Part C of the Rules for the Survey and Construction of Steel Ships**,

a place on a horizontal surface visible from the air may be acceptable.

## Chapter 2 MATERIALS AND WELDING

### 2.1 Materials

#### 2.1.1 Application\*

1 The requirements in this Part are based upon the use of materials which comply with the requirements in **Part K of the Rules for the Survey and Construction of Steel Ships**, unless otherwise specified.

2 In case of utilizing material except for steel provided in **Part K of the Rules for the Survey and Construction of Steel Ships** as principle structural member of hull, the structural arrangements and the scantlings are to be determined based upon the material characteristics following the provision in this part.

3 The application of steels and special requirements for ships intended to operate for longer period in areas with low temperatures are to be in accordance with the requirements in **3.2.2.1** and **3.2.2.2, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships**.

### 2.2 Welding

#### 2.2.1 Application

Welding to be used in hull construction and important equipment is to be in accordance with the requirements in **Part M of the Rules for the Survey and Construction of Steel Ships** as well as those in **2.2**, this Part.

#### 2.2.2 Arrangements

1 Special attention is to be paid to the arrangements of hull structural members so that welding may be carried out without much difficulty.

2 Welding joints are to be properly shifted from places where the stresses may highly concentrate.

#### 2.2.3 Details of Joints

Details of joints are to be in accordance with the requirements in **12.2.1.2** and **12.2.1.3, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships**.



## Chapter 3 LONGITUDINAL STRENGTH

### 3.1 Bending Strength

#### 3.1.1 Bending Strength at the Midship Part\*

1 Bending strength at the midship part is to be in compliance with **5.2.1, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships**. The section modulus of the transverse sections of hull considers all longitudinal members contributed at longitudinal strength below strength deck. In case of calculating section modulus of the transverse sections of hull, openings on deck except for strength deck are to be handled as well as openings on strength deck.

2 Bending strength at the midship of ships having long multi-deckhouses on strength deck is to be at the Society's discretion.

3 Where the staircase including atrium and elevator is placed concentrated in midship deck of hull, bending strength around openings is to be separately examined.

### 3.2 Buckling Strength

#### 3.2.1 Compressive Buckling Strength\*

1 All effective shell plating, deck and longitudinal bulkhead including longitudinal stiffener at the longitudinal strength under strength deck are to be examined compressive buckling strength by longitudinal bending, according to the requirements in **5.3, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships**.

2 In case of ships having long multi-deckhouses on the strength deck, the examination of compressive buckling strength by longitudinal bending at these structural members is to be at the Society's discretion.

3 Where the staircase including atrium and elevator is placed concentrated in midship deck of hull, bending strength around openings is to be separately examined.

## Chapter 4 DOUBLE BOTTOM CONSTRUCTION

### 4.1 Arrangement

#### 4.1.1 Arrangement (SOLAS Chap.II-1 Reg.9) \*

1 A watertight double bottom is to be fitted extending from the fore peak bulkhead to the after peak bulkhead.

2 A double bottom need not be fitted in way of watertight tanks, including dry tanks of moderate size, provided the safety of the ship is not impaired in the event of bottom or side damage.

3 Where a double bottom is required to be fitted, the inner bottom plating is to be continued out to the ship's sides in such a manner as to protect the bottom to the turn of the bilge. Such protection will be deemed satisfactory if the inner bottom is not lower at any part than a plane parallel with the keel line and which is located not less than a vertical distance  $h$  measured from the keel line specified in 2.1.22, Part 1, as calculated by the formula.

$$h = B'/20$$

However, in no case is the value of  $h$  to be less than  $0.76m$ , and need not be taken as more than  $2.0m$ .

4 Small wells constructed in the double bottom in connection with drainage arrangements is not to extend downwards more than necessary. The vertical distance from the bottom of such a well to a plane coinciding with the keel line is not to be less than  $0.5h$  ( $h$  is specified in -3 above) or  $500\text{ mm}$ , whichever is greater, or as deemed appropriate by the Society. Outer wells (e.g., for lubricating oil under main engines) may be permitted by Society if satisfied that the arrangements give protection equivalent to that afforded by a double bottom complying with this regulation.

5 In case of large lower holds in passenger ships, the Society may require an increased double bottom height of not more than  $B'/10$  or  $3m$ , whichever is less, measured from the keel line specified in 2.1.22, Part 1.

#### 4.1.2 Transmission of the Pillar Load

In case where the deck load supported by deck girder construction is transmitted to a double bottom through the pillar finally, the deck load provides double bottom members with high shearing stress and high bending stress. Therefore, the double bottom is to be sufficiently reinforced by the installation of additional floor and partial vertical girder, exclusion of openings, etc.

## Chapter 5      SIDE SHELL CONSTRUCTION

### 5.1      General

#### 5.1.1      Application

The upper part of watertight bulkhead and superstructure, which extremely decreased the transverse bulkhead in order to load a ship with wheeled vehicles by means of the roll-on roll-off system, are to be provided with sufficient transverse rigidity by installing web frames or partial bulkheads in the positions such as may be considered necessary, in order to prevent racking deformation.

### 5.2      Transverse Frames below the Lowest Deck

#### 5.2.1      Scantlings of Transverse Frames below the Lowest Deck

1 The section modulus of transverse frames below the lowest deck is not to be less than that obtained from the following formula according to the location of the transverse frames under consideration.

- (1) Transverse frames below the lowest deck between  $0.15L$  from the fore end and the after peak bulkhead;

$$KC_0CSl^2 \text{ (cm}^3\text{)}$$

where:

$K$  : The value in proportion to the material strength of steel regulated by [Chapter 3, Part K of the Rules for the Survey and Construction of Steel Ships](#). The value in using the high tensile steel except for the following, however, are to be at the Society's discretion.

1.0 : where mild steels  $KA$ ,  $KB$ ,  $KD$  and  $KE$  regulated by [Chapter 3, Part K of the Rules for the Survey and Construction of Steel Ships](#) are used.

0.78 : where high tensile steels  $KA32$ ,  $KD32$ ,  $KE32$  and  $KF32$  regulated by [Chapter 3, Part K of the Rules for the Survey and Construction of Steel Ships](#) are used.

0.72 : where high tensile steels  $KA36$ ,  $KD36$ ,  $KE36$  and  $KF36$  regulated by [Chapter 3, Part K of the Rules for the Survey and Construction of Steel Ships](#) are used.

0.68 : where high tensile steels  $KA40$ ,  $KD40$ ,  $KE40$  and  $KF40$  regulated by [Chapter 3, Part K of the Rules for the Survey and Construction of Steel Ships](#) are used.

$S$  : Frame spacing ( $m$ )

$l$  : The value obtained from the requirements in [6.4.3.2, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships](#)

$C_0$  : Coefficient obtained from the following formula, but not to be less than 0.85:

$$1.25 - 2 \frac{e}{l}$$

$C$  : Coefficient obtained from the following formula:

$$C_1 + C_2$$

$$C_1 = 2.34 - 1.29 \frac{l}{h}$$

$$C_2 = 4.52k\alpha \frac{d}{h}$$

$h$  : Vertical distance from the lower end of  $l$  at the place of measurement to a point of  $d + 0.038L'$  above the top of keel ( $m$ )

$L'$  : Length of ship ( $m$ ). Where, however,  $L$  exceeds  $230m$ ,  $L'$  is to be taken as  $230m$ .

$e$  : Height ( $m$ ) of the tank side bracket measured from the lower end of  $l$

$k$  : Coefficient given below according to the number of layers of deck:

13 (For single deck systems)

21 (For double deck systems)

50 (For triple deck systems)

Where  $B/l$  exceeds the following value according to the deck systems, the value of  $k$  is to be suitably increased:

2.8 (For single deck systems)

4.2 (For double deck systems)

5.0 (For triple deck systems)

$\alpha$ : Coefficient given in **Table 3.5.1**

For intermediate values of  $B/l_H$ ,  $\alpha$  is to be obtained by linear interpolation.

(2) Transverse frames below the lowest deck between  $0.15L$  from the fore end and the fore peak bulkhead;

$$1.3KC_0CS hl^2 \text{ (cm}^3\text{)}$$

where:

$K$ ,  $C$ ,  $C_0$ ,  $S$ ,  $h$  and  $l$  : Values stipulated in **(1)**

Table 3.5.1 Coefficient  $\alpha$

$B/l_H$	0.5 and under	0.6	0.8	1.0	1.2	1.4 and over
$\alpha$	0.023	0.018	0.010	0.006	0.0034	0.002

**2** The section modulus of transverse frames below the lowest deck supporting deck transverse of longitudinal system is also not to be less than the value obtained from the following formula;

$$K \left\{ 4.62 - 4.42 \frac{l}{h} + 0.17n \frac{h_1}{h} \left( \frac{l_1}{l} \right)^2 \right\} S hl^2 \text{ (cm}^3\text{)}$$

where:

$n$  : Ratio of the transverse web beam spacing to the frame spacing.

$h_1$  : Deck load stipulated in **4.4.2.7** and **4.4.2.8, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships** for the deck beam at the top of frame ( $kN/m^2$ ).

$l_1$  : Horizontal distance from ship's side to deck girder supporting deck transverse, bulkhead or pillar ( $m$ ).

$K$ ,  $S$ ,  $l$  and  $h$  : Values stipulated in **-1**.

### 5.3 Tween Deck Frames

#### 5.3.1 Scantlings of Tween Deck Frames

**1** The section modulus of tween deck frames is not to be less than the following formula;

$$5.3KCShl^2 \text{ (cm}^3\text{)}$$

where:

$K$  : The value obtained from requirements in **5.2.1-1(1)**.

$S$  : Frame spacing ( $m$ ).

$l$  : Tween deck height ( $m$ ). Where, however, frames is fitted at shell plating with a remarkable inclination,  $l$  is to be taken as the unsupported length of frame.

$h$  : Vertical distance from the middle of  $l$  to the point  $d + 0.038L'$  above top of keel ( $m$ ). Where, however,  $h$  is to be greater than the following value according to the location of tween deck frame.

$0.03L$  ( $m$ ) : where the tween deck frame is located below freeboard deck.

$0.03L \sqrt{\frac{D}{D+2h_s}}$  ( $m$ ) : Where the tween deck frame is located at the superstructure side shell plating until the level at a height of  $2h_s$  above the freeboard deck.

$0.03L \sqrt{\frac{D}{D_s}}$  ( $m$ ) : Where the tween deck frame is located at the superstructure side shell plating until the level at a height of  $2h_s$  above the freeboard deck below the strength deck.

$L'$  : The value stipulated in 5.2.1-1(1).

$h_s$  : Where  $L_f$  is not greater than 75m,  $h_s$  is to be taken as 1.80, and where  $L_f$  is not less than 125m,  $h_s$  is to be taken as 2.30. For intermediate value of  $L_f$ ,  $h_s$  is to be obtained by interpolation.

$C$  : Coefficient obtained from the following;

1.0 : where tween deck frames are located under the freeboard deck, and where they are located between superstructure decks excluding the followings.

1.30 : where tween deck frames are located between superstructure deck for 0.125L from aft end.

1.68 : where tween deck frames are located between superstructure deck for 0.125L from fore end.

1.68 : where tween deck frames are located for four frame spaces at the ends of detached superstructures within 0.5L amidships.

1.68 : where tween deck frames are located in cant frames at stern.

2 Where decks are supported by longitudinal beams and web beams, the section modulus of tween deck frames supporting web beams is not to be less than that obtained from the following formula, in addition to those in -1.

$$4.17K \left\{ 1.10 + 0.56n \frac{h_1}{h} \left( \frac{l_1}{l} \right)^2 \right\} S h l^2 \quad (cm^3)$$

Where :

$n$  : Ratio of spacing of web beams to tween deck frame spacing.

$h_1$  : Deck load stipulated in 8.1 for the deck beam at the top of frame ( $kN/m^2$ ).

$l_1$  : Horizontal distance from ship's side to deck girder supporting deck transverse, bulkhead or pillar (m).

$h$  : Vertical distance from the middle of  $l$  to the point  $d + 0.038L'$  above top of keel (m). Where, however,  $h$  is to be greater than the following value according to the location of tween deck frame.

0.03L (m) : where the tween deck frame is located below freeboard deck.

$0.03L \sqrt{\frac{D}{D+2h_s}}$  (m) : Where the tween deck frame is located at the superstructure side shell plating until the level at a height of  $2h_s$  above the freeboard deck.

$0.03L \sqrt{\frac{D}{D_s}}$  (m) : Where the tween deck frame is located at the superstructure side shell plating until the level at a height of  $2h_s$  above the freeboard deck below the strength deck.

$K$ ,  $h_s$ ,  $S$  and  $l$  : Values stipulated in -1.

## Chapter 6 WATERTIGHT BULKHEAD AND THE OPENING

### 6.1 General

#### 6.1.1 Application

In applying the requirement in **1.1.1-4**, the list angle of 30 degrees referred to in **2.2.2.4-1, Part 1, Part C** and **13.3.4-1, Part CS of the Rules for the Survey and Construction of Steel Ships** is to be read as 15 degrees.

### 6.2 Watertight Bulkhead and Tunnel

#### 6.2.1 Collision Bulkhead (*SOLAS Chap.II-1 Reg.12.1, 12.2, 12.3, 12.4, 12.7, 12.8 and 12.9*)\*

**1** A collision bulkhead is to be fitted and is to be watertight up to the bulkhead deck. This collision bulkhead is to be located at a distance from the forward perpendicular of not less than 5% of the length for freeboard of the ship or 10m, whichever is the less and not more than 8% of the length for freeboard of the ship or 3m plus 5% of the length for freeboard of the ship, whichever is the greater.

**2** The factor  $s_i$  calculated in accordance with **2.3.6, Part 4** will not be less than 1 at the deepest subdivision draught loading condition, level trim or any forward trim loading conditions, if any part of the ship forward of the collision bulkhead is flooded without vertical limits.

**3** Where any part of the ship below the water-line extends forward of the forward perpendicular, e.g. a bulbous bow, the distances specified in **-1** are to be measured from a point either:

- (1) at the mid-length of such extension; or
  - (2) at a distance 1.5% of the length for freeboard of the ship forward of the forward perpendicular; or
  - (3) at a distance 3m forward of the forward perpendicular;
- whichever gives the smallest measurement.

**4** Where a long forward superstructure is fitted, the collision bulkhead is to be extended weathertight to the next full deck above the bulkhead deck. The extension need not be fitted directly above the bulkhead below provided that all parts of the extension, including any part of the ramp attached to it are located within the limits specified in **-1** or **-3** and that the part of the deck which forms the step is made effectively weathertight. The extension is to be so arranged as to preclude any possibility of the bow door or ramp, where fitted, causing any damage to it in the case of damage to, or detachment of, a bow door or any part of the ramp.

**5** Where bow doors are fitted and a sloping loading ramp forms part of the extension of the collision bulkhead above the bulkhead deck, the ramp is to be weathertight over its complete length. Ramps not meeting the above requirement are to be disregarded as an extension of the collision bulkhead.

**6** The bulkhead may have steps or recesses provided they are within the limits specified in **-1** or **-3**.

**7** The number of openings in the extension of the collision bulkhead above the freeboard deck is to be restricted to the minimum compatible with the design and normal operation of the ship. All such openings are to be capable of being closed weathertight.

#### 6.2.2 Machinery Space Bulkhead (*SOLAS Chap.II-1 Reg.12.9*)

Bulkheads dividing the machinery space from the cargo and passenger spaces forward and aft are to be fitted and made watertight up to the bulkhead deck.

#### 6.2.3 After Peak Bulkhead (*SOLAS Chap.II-1 Reg.12.9*)\*

An after peak bulkhead is to be fitted and made watertight up to the bulkhead deck. However, the aft peak bulkhead may terminate at a deck above the designed maximum load line provided that this deck is made watertight to the stern of the ship.

#### 6.2.4 Tunnel (*SOLAS Chap.II-1 Reg.12.10*)\*

In all cases stern tubes are to be enclosed in watertight spaces of moderate volume. The stern gland is to be situated in a watertight shaft tunnel or other watertight space separate from the stern tube compartment and of such volume that, if flooded by leakage through the stern gland, the bulkhead deck will not be submerged.

### 6.3 Openings of Watertight Bulkhead

**6.3.1 Arrangement of Openings (SOLAS Chap. II-1 Regs. 12.4, 12.5, 12.6, 12.8, 13.1, 13.2, 13.3, 13.4 and 15.8.5)\***

1 The number of openings in watertight boundaries is to be reduced to the minimum compatible with the design and proper working of the ship, and the closing appliances for closing these openings such as manholes and watertight doors are to be provided.

2 No doors, manholes, or access openings are permitted:

- (1) in the collision bulkhead below the bulkhead deck;
- (2) in watertight transverse bulkheads dividing a cargo space from an adjoining cargo space, except as provided in paragraphs 6.4.6-1 and -3.

3 Except as provided in paragraph -4, the collision bulkhead may be pierced below the bulkhead deck by not more than one pipe for dealing with fluid in the forepeak tank, provided that the pipe is fitted with a remotely controlled valve capable of being operated from above the bulkhead deck. The valve is to be normally closed. If the remote control system failure during operation of the valve, the valve is to be close automatically or be capable of being closed manually from a position above the bulkhead deck. The valve is to be located at the collision bulkhead on either the forward or aft side, provided the space on the aft side is not a cargo space.

4 If the fore peak is divided to hold two different kinds of liquids, the Society may allow the collision bulkhead to be pierced below the margin line by two pipes, each of which is fitted a screw down valve required by paragraph -3, provided the Society is satisfied that there is no practical alternative to the fitting of such a second pipe and that, having regard to the additional subdivision provided in the fore peak, the safety of the ship is maintained.

5 Subject to paragraph 6.5.2, not more than one door, apart from the doors to shaft tunnels, may be fitted in each main transverse bulkhead within spaces containing the main and auxiliary propulsion machinery including boilers serving the needs of propulsion and all permanent bunkers. Where two or more shafts are fitted, the tunnels are to be connected by an intercommunicating passage. These are to be only one door between the machinery space and the tunnel spaces where two shafts are fitted and only two doors where there are more than two shafts. All these doors are to be of the sliding type and are to be so located as to have their sills as high as practicable. The hand gear for operating these doors from above the bulkhead deck is to be situated outside the spaces containing the machinery.

**6.3.2 Pipes and Penetrations (SOLAS Chap. II-1 Regs. 13.2 and 15.8.5)\***

1 Where pipes, scuppers, electric cables, etc., are carried through watertight subdivision boundaries, arrangements are to be made to ensure the watertight integrity of boundaries for design pressure by using weld and sleeve or penetration metallic material.

2 Valves not forming part of a piping system are not to be permitted in watertight subdivision boundaries, even if the operation is possible from the above of bulkhead deck.

3 Lead or other heat sensitive materials are not to be used in systems which penetrate watertight subdivision boundaries, where deterioration of such systems in the event of fire would impair the watertight integrity of the boundaries.

4 The valve installed in the pipe penetrating the collision bulkhead is to be made from steel, bronze and the ductile material approved by the Society, except for the valve made from normal cast iron or resemblance.

**6.4 Watertight Door****6.4.1 General (SOLAS Chap. II-1 Regs. 13.5, 13.6.4 and 16.1.3)\***

1 Watertight doors, except as provided in paragraphs 6.4.6-1 or -3, are to be power-operated sliding doors complying with the requirements of paragraphs 6.4.2 and 6.4.3.

2 The means of operation whether by power or by hand of any power-operated sliding watertight door is to be capable of closing the door with the ship listed to 15 degrees either way. Consideration is also to be given to the forces which may act on either side of the door as may be experienced when water is flowing through the opening applying a static head equivalent to a water height of at least 1m above the sill on the centreline of the door.

3 Watertight door controls, including hydraulic piping and electric cables, is to be kept as close as practicable to the bulkhead in which the doors are fitted, in order to minimize the likelihood of them being involved in any damage which the ship may sustain. The positioning of watertight doors and their controls are to be such that if the ship sustains damage within one fifth of the breadth of the ship, as defined in Part 4, such distance being measured at right angles to the centreline at the level of the deepest subdivision load line, the operation of the watertight doors clear of the damaged portion of the ship is not impaired.

4 Control handles are to be provided at each side of the bulkhead at a minimum height of 1.6 m above the floor and are to be so

arranged as to enable persons passing through the doorway to hold both handles in the open position without being able to set the power closing mechanism in operation accidentally. The direction of movement of the handles in opening and closing the door is to be in the direction of door movement and is to be clearly indicated.

5 The frames of vertical watertight doors are to have no groove at the bottom in which dirt might lodge and prevent the door closing properly.

#### **6.4.2 Power-operated Sliding Watertight Door (SOLAS Chap. II-1 Regs. 13.6.1 and 22.2)\***

Each power-operated sliding watertight door:

- (1) is to have a vertical or horizontal motion;
- (2) is to, subject to the requirement in 6.5.2, be normally limited to a maximum clear opening width of 1.2 *m*. The Society may permit larger doors only to the extent considered necessary for the effective operation of the ship provided that other safety measures, including the following, are taken into consideration:
  - (a) special consideration is to be given to the strength of the door and its closing appliances in order to prevent leakages;
  - (b) the door is to be located inboard the damage zone *B/5*;
  - (c) watertight doors located below the bulkhead deck having a maximum clear opening width of more than 1.2 *m* is to be kept closed when the ship is at sea;
- (3) is to be fitted with the necessary equipment to open and close the door using electric power, hydraulic power, or any other adequate form of power;
- (4) is to be provided with an individual hand-operated mechanism. It is to be possible to open and close the door by hand at the door itself from either side, and in addition, close the door from an accessible position above the bulkhead deck with an all round crank motion or some other movement providing the same degree of safety acceptable to the Society. Direction of rotation or other movement is to be clearly indicated at all operating positions. The time necessary for the complete closure of the door, when operating by hand gear, is not to exceed 90 *seconds* with the ship in the upright position. Visual indicators to show whether the door is open or closed are to be provided at the accessible position above the bulkhead deck;
- (5) is to be provided with controls for opening and closing the door by power from both sides of the door and also for closing the door by power from the central operating console(s) specified in 6.4.4;
- (6) is to be provided with an audible alarm, distinct from any other alarm in the area, which will sound whenever the door is closed remotely by power and which is to sound for at least 5 *seconds* but no more than 10 *seconds* before the door begins to move and is to continue sounding until the door is completely closed. In the case of remote hand operation it is sufficient for the audible alarm to sound only when the door is moving. Additionally, in passenger areas and areas of high ambient noise are to have the audible alarm to be supplemented by an intermittent visual signal at the door; and
- (7) is to have an approximately uniform rate of closure under power. The closure time, from the time the door begins to move to the time it reaches the completely closed position, is to in no case be less than 20 *seconds* or more than 40 *seconds* with the ship in the upright position.

#### **6.4.3 Power Control System (SOLAS Chap. II-1 Regs. 13.6.2, 13.6.3 and 13.6.5 to 13.6.8) (See Table 3.6.1)\***

1 Power-operated sliding watertight doors are to have either power system specified in the following (1) to (3). In addition, power systems for power-operated sliding watertight doors are to be separate from any other power system. A single failure in the electric or hydraulic power-operated systems excluding the hydraulic actuator is not to prevent the hand operation of any door.

- (1) A centralized hydraulic system with two independent powers sources each consisting of a motor and pump capable of simultaneously closing all doors. In this case, the following requirements are to be supplied;
  - (a) There are to be for the whole installation hydraulic accumulators of sufficient capacity to operate all the doors at least three times, i.e. closed-open-closed, against an adverse list of 15 *degrees*. This operating cycle is to be capable of being carried out when the accumulator is at the pump cut-in pressure;
  - (b) The fluid used is to be chosen considering the temperatures liable to be encountered by the installation during its service.
  - (c) The power operating system is to be designed to minimize the possibility of having a single failure in the hydraulic piping adversely affect the operation of more than one door.
  - (d) The hydraulic system is to be provided with a low-level alarm for hydraulic fluid reservoirs serving the power-operated system and a low gas pressure alarm or other effective means of monitoring loss of stored energy in hydraulic accumulators. These alarms are to be audible and visual and are to be situated on the central operating console(s) specified in 6.4.4; or



- (2) An independent hydraulic system for each door with each power source consisting of a motor and pump capable of opening and closing the door. In this case, the following requirements are to be complied with:
  - (a) There is to be a hydraulic accumulator of sufficient capacity to operate the door at least three times, i.e. closed-open-closed, against an adverse list of 15 *degrees*. This operating cycle is to be capable of being carried out when the accumulator is at the pump cut-in pressure.
  - (b) The used fluid is to be chosen considering the temperatures liable to be encountered by the installation during its service.
  - (c) A low gas pressure group alarm, a low fluid level alarm for operating the oil tank of the accumulator, or other effective means of monitoring loss of stored energy in hydraulic accumulators are to be provided at the central operating console(s) specified in 6.4.4. Such alarms are to be both audible and visible. Loss of stored energy indication at each local operating position is also to be provided; or
- (3) An independent electrical system and motor for each door with each power source consisting of a motor capable of opening and closing the door. In this case, the power source is to be capable of being automatically supplied by the transitional source of emergency electrical power as required by 2.3.4, Part 6 in the event of failure of either the main or emergency source of electrical power and with sufficient capacity to operate the door at least three times, i.e. closed-open-closed against an adverse list of 15 *degrees*.

2 The electrical power required for power-operated sliding watertight doors is to be supplied from the emergency switchboard either directly or by a dedicated distribution board situated above the bulkhead deck. The associated control, indication and alarm circuits are to be supplied from the emergency switchboard either directly or by a dedicated distribution board situated above the bulkhead deck and be capable of being automatically supplied by the transitional source of emergency electrical power required by 2.3.4, Part 6 in the event of failure of either the main or emergency source of electrical power.

3 As far as practicable, electrical equipment and components for watertight doors are to be situated above the bulkhead deck and outside hazardous areas and spaces.

4 The enclosures of electrical components necessarily situated below the bulkhead deck are to provide suitable protection against the ingress of water.

5 Electric power, control, indication and alarm circuits are to be protected against fault in such a way that a failure in one door circuit will not cause a failure in any other door circuit. Short circuits or other faults in the alarm or indicator circuits of a door are not to result in a loss of power operation of that door. Arrangements are to be such that leakage of water into the electrical equipment located below the bulkhead deck will not cause the door to open.

6 A single electrical failure in the power operating or control system of a power-operated sliding watertight door is not to result in a closed door opening. Availability of the power supply is to be continuously monitored at a point in the electrical circuit as near as practicable to each of the motors required by paragraph -1. Loss of any such power supply is to activate an audible and visual alarm at the central operating console(s) specified in 6.4.4.

Table 3.6.1 The Requirement for Watertight Power-control System

		Concentration hydraulic method	Hydraulic method	Electro motion system
Driving force		(Electric motor and hydraulic pump)×2	(Electric motor and hydraulic pump)×each door	(Electric motor)×each door
Supply power source	Power source system	Main power supply and emergency power supply		Main power supply, emergency power supply and temporary emergency power supply
	Operation, Display, Alarm device	Main power supply, emergency power supply and temporary emergency power supply		
	Blackout alarm device	○ (Center console of the safety centre)		
Hydraulic accumulator	Number of hydraulic accumulator (close-open-close, three batches)	2 pieces	Each door	(Temporary emergency power supply)
	Low pressure visible and audible alarm system	○ (Central operating console at the safety centre)	○(Either an alarm or another effective means) (Central operating console at the safety centre)	—
	A low-level alarm for operating oil tank	○ (Central operating console at the safety centre)		—
Open operation of the door	Door side (＊1) (＊2)			
Close operation of the door	Door side (＊2) and central operating console at the safety centre (＊3)			
Door closure visible and audible alarm device	Door side (＊4)			
Switching display unit	Central operating console at the safety centre			

Notes:

(\* 1) : The doors are to be operated only at the door side.

(\* 2) : The operation is to be carried out both by “local control mode” and by “doors closed mode”.

(\* 3) : The doors are to be operated only by “doors closed mode”.

(\* 4) : In the high noise level spaces like a machinery room, the blinking visual indicators are to be situated.

#### 6.4.4 Remote Control System (SOLAS Chap. II-1 Reg. 13.7)\*

1 A central operating console for all power-operated sliding watertight doors is to be located in the safety centre in accordance with Regulation 23, Chapter II-2, SOLAS Convention. If the safety centre is located in a separate space adjacent to the navigation bridge, a central operating console is also to be located on the navigation bridge. The central operating console(s) is to have a “master mode” switch with two modes of control: a “local control” mode which is to allow any door to be locally opened and locally closed after use without automatic closure, and a “doors closed” mode which is to automatically close any door that is open in not more than 60 seconds with the ship in an upright position. The “doors closed” mode is to permit doors to be opened locally and shall automatically

re-close the doors upon release of the local control mechanism. The “master mode” switch is to normally be in the “local control” mode. The “doors closed” mode is to only be used in an emergency or for testing purposes. Signboards or instructions are to be placed in way of the door advising how to act when the door is in the “doors closed” mode.

2 The central operating console(s) is to be provided with a diagram showing the location of each power-operated sliding watertight door, with visual indicators to show whether each door is open or closed. A red light is to indicate a door is fully open and a green light shall indicate a door is fully closed. When the door is closed remotely the red light is to indicate the intermediate position by flashing. The indicating circuit is to be independent of the control circuit for each door. Indication is also to be provided to the onboard stability computer, if installed in accordance with 2.5.1, Part 4.

3 It is not to be possible to remotely open any door from the central operating console.

#### **6.4.5 Opening and Closing of Watertight Doors (SOLAS Chap.II-1 Reg.22.1 and 22.3)**

1 All watertight doors are to be kept closed during navigation except that they may be opened during navigation as specified in the following paragraph -2. Watertight doors of width of more than 1.2m in machinery spaces as permitted by paragraph 6.5.2 may only be opened in the circumstances detailed in that paragraph. Any door which is opened in accordance with this paragraph is to be ready to be immediately closed.

2 A watertight door may be opened during navigation to permit the passage of passengers or crew, or when work in the immediate vicinity of the door necessitates it being opened. The door must be immediately closed when transit through the door is complete or when the task which necessitated it being open is finished. Such a watertight door may be opened during navigation subject to authorized by the Administration with careful consideration of the impact on ship operations and survivability. A watertight door permitted to be opened during navigation is to be clearly indicated in the ship’s stability information and is always to be ready to be immediately closed.

#### **6.4.6 Watertight Door in Cargo Space (SOLAS Chap. II-1 Regs. 13.8.1, 13.8.2, 14 and 22.5)\***

1 If the Society is satisfied that such doors are essential, watertight doors having strength not less effective than the boundary members of the doors which are provided with the openings may be fitted in watertight bulkheads dividing cargo spaces on tween decks. Such doors may be hinged, rolling or sliding doors but are not to be remotely controlled. They are to be fitted at the highest level and as far from the shell plating as practicable, but in no case is to the outboard vertical edges be situated at a distance from the shell plating which is less than one fifth of the breadth of the ship, as defined in Part 1, such distance being measured at right angles to the centreline at the level of the deepest subdivision draught.

2 Such doors are to be closed before the voyage commences and are to be kept closed during navigation. Should any of the doors be accessible during the voyage, they are to be fitted with a device which prevents unauthorized opening. When it is proposed to fit such doors, the number and arrangements are to receive the special consideration.

3 The provisions in this paragraph apply to passenger ships designed or adapted for the carriage of goods vehicles and accompanying personnel. If in such a ship the total number of passengers which include personnel accompanying vehicles does not exceed  $N = 12 + A_d / 25$ , where  $A_d$  = total deck area (square metres) of spaces available for the stowage of goods vehicles and where the clear height at the stowage position and at the entrance to such spaces is not less than 4m, watertight doors may be fitted in accordance with -1 and -2. However, watertight doors may be fitted at any level in watertight bulkheads dividing cargo spaces. Additionally, indicators are required on the navigation bridge to show automatically when each door is closed and all door fastenings are secured.

4 The ship may not be certified for a higher number of passengers than assumed in -3 above, if a watertight door has been fitted in accordance with -3 above.

### **6.5 Trunk and Miscellaneous**

#### **6.5.1 Trunk (SOLAS Chap. II-1 Regs. 13.10 and 16-1)\***

1 Where trunkways or tunnels for piping, or for any other purpose are carried through watertight bulkheads, they are to be watertight and in accordance with the requirements in -4 to -6. The access to at least one end of each such tunnel or trunkway, if used as a passage at sea, is to be through a trunk extending watertight to a height sufficient to permit access above the bulkhead deck. The access to the other end of the trunkway or tunnel may be through a watertight door. Such trunkways or tunnels are not to extend through the first subdivision bulkhead abaft the collision bulkhead.

2 Where it is proposed to fit tunnels piercing watertight bulkheads, these are to receive the special consideration of the Society.

3 Where trunkways in connection with refrigerated cargo and ventilation or forced draught trunks are carried through more than one watertight bulkhead, the means of closure at such openings is to be operated by power and be capable of being closed from a central position situated above the bulkhead deck.

4 Where a ventilation trunk passing through a structure penetrates for the bulkhead deck, the trunk is to be capable of withstanding the water pressure that may be present within the trunk, after having taken into account the maximum heel angle during flooding, in accordance with the requirements in **2.3.6, Part 4**.

5 In ro-ro passenger ships, where the all or part of the penetration of the bulkhead deck is on the main Ro-Ro deck, the trunk is to be capable of withstanding impact pressure due to internal water motion of water trapped on the Ro-Ro deck.

6 After completion, a hose test is to be applied to watertight trunks, tunnels and ventilators.

#### **6.5.2 Portable Plates on Bulkhead (SOLAS Chap. II-1 Regs. 13.9 and 22.4)\***

Portable plates on bulkheads are not to be permitted except in machinery spaces. Such plates always are to be in place before the voyage commences and are not to be removed during navigation except in case of urgent necessity at the discretion of the master. When any such portable plates are removed and replaced, the necessary precautions are to be taken in replacing them to ensure that the joints are watertight. The Society may permit not more than one power-operated sliding watertight door larger than those specified in paragraph **6.4.2(2)** to be substituted for these portable plates in each watertight bulkhead, provided these doors are closed before the voyage commences and remain closed during navigation except in case of urgent necessity at the discretion of the master. These doors need not meet the requirements of paragraph **6.4.2(4)** regarding complete closure by hand-operated gear in 90 *seconds*. Power-operated sliding watertight doors permitted in machinery spaces in accordance with the provisions under this paragraph is to be closed before the voyage commences and is to remain closed during navigation except in case of urgent necessity at the discretion of the master.

## Chapter 7 OPENINGS IN THE SHELL PLATING AND THE WATERTIGHT INTEGRITY

### 7.1 General

#### 7.1.1 Application

1 The requirements of valve, pipe and garbage shoot, except for the requirements in this chapter, are to be applied the requirements in **2.2, Part 5** respectively.

2 If watertight doors are to be fitted, they are to be in accordance with IACS Unified Interpretation SC156 (as amended), unless otherwise specified in this chapter.

### 7.2 Openings below the Bulkhead Deck

#### 7.2.1 Arrangement (*SOLAS Chap.II-1 Reg.15.1 and 15.2*)

1 The number of openings in the shell plating is to be reduced to the minimum compatible with the design and proper working of the ship.

2 The arrangement and efficiency of the means for closing any opening in the shell plating are to be consistent with its intended purpose and the position in which it is fitted.

#### 7.2.2 Side Scuttle (*SOLAS Chap. II-1 Regs. 15.3 to 15.6, 22.6 and 22.13 to 22.15*)\*

1 Subject to the requirements of the International Convention on Load Lines in force, no side scuttle is to be fitted in such a position that its sill is below a line drawn parallel to the bulkhead deck at side and having its lowest point 2.5% of the breadth of the ship above the deepest subdivision draught, or 500mm, whichever is the greater.

2 All side scuttles the sills of which are below the bulkhead deck, as permitted by paragraph -1 are to be of such construction as will effectively prevent any person opening them without the consent of the master of the ship.

3 Where in a between decks, the sills of any of the side scuttles referred to in paragraph -2 are below a line drawn parallel to the bulkhead deck at side and having its lowest point 1.4m plus 2.5% of the breadth of the ship above the water when the voyage commences, all the side scuttles in that between decks are to be closed watertight and locked before the voyage commences, and they are not to be opened before the ship arrives at the next port.

4 For any ship that has one or more side scuttles so placed that the requirements of paragraph -3 would apply when it was floating at its deepest subdivision draught, the Society may indicate the limiting mean draught at which these side scuttles will have their sills above the line drawn parallel to the bulkhead deck at side, and having its lowest point 1.4m plus 2.5% of the breadth of the ship above the water-line corresponding to the limiting mean draught, and at which it will therefore be permissible for the voyage to commence without them being closed and locked and to be opened during navigation on the responsibility of the master during navigation. In tropical zones as defined in the International Convention on Load Lines in force, this limiting draught may be increased by 0.3m.

5 Efficient hinged inside dead lights so arranged that they can be easily and effectively closed and secured watertight, are to be fitted to all side scuttles except that abaft one-eighth of the ship's length from the forward perpendicular and above a line drawn parallel to the bulkhead deck at side and having its lowest point at a height of 3.7m plus 2.5% of the breadth of the ship above the deepest subdivision draught, the dead lights may be portable in passenger accommodation, unless the dead lights are required by the International Convention on Load Lines in force to be permanently attached in their proper positions. Such portable dead lights are to be stowed adjacent to the side scuttles they serve.

6 Side scuttles and their dead lights which will not be accessible during navigation are to be closed and secured before the voyage commences.

7 No side scuttles are to be fitted in any spaces which are appropriated exclusively to the carriage of cargo.

8 Side scuttles may, however, be fitted in spaces appropriated alternatively to the carriage of cargo or passengers, but they are to be of such construction as will effectively prevent any person opening them or their dead lights without the consent of the master.

9 If cargo is carried in the spaces provided in paragraph -8, the side scuttles and their dead lights are to be closed watertight and

locked before the cargo is shipped.

**10** Automatic ventilating side scuttles are to not be fitted in the shell plating below the bulkhead deck.

### **7.2.3 Gangway and Cargo Ports, etc. (SOLAS Chap. II-1 Regs. 15.10 and 22.7)\***

**1** Gangway, cargo and fuelling ports fitted below the bulkhead deck and all watertight hatches are to be effectively closed and secured watertight before the voyage commences, and are to be kept closed during navigation. However, the master may permit a watertight hatch to be opened during navigation for a limited period of time sufficient to permit passage or for access. It is then to be closed.

**2** Cargo ports and other similar openings (e.g. gangway and fuelling ports) in the side of ships below the bulkhead deck are to comply with following **(1)** to **(3)**:

- (1) They are to be fitted with doors so designed as to ensure the same watertightness and structural integrity as the surrounding shell plating. Unless otherwise granted by the Society, these openings are to open outwards;
- (2) The number of such openings are to be the minimum compatible with the design and proper working of the ship;
- (3) In no case are these openings to be so fitted as to have their lowest point below the deepest subdivision draught.

### **7.2.4 Moving Parts Penetrating the Shell Plating (SOLAS Chap.II-1 Reg.15.8.4)**

Moving parts penetrating the shell plating below the deepest subdivision draught specified in [2.1.6](#), [Part 1](#), are to be fitted with a watertight sealing arrangement acceptable to the Society. The inboard gland is to be located within a watertight space of such volume that, if flooded, the bulkhead deck is not to be submerged. The Society may require that if such a compartment is flooded, essential or emergency power and lighting, internal communication, signals or other emergency devices remain available in other parts of the ship.

## **7.3 Watertight Integrity and Openings above Bulkhead Deck**

### **7.3.1 Watertight Integrity above Bulkhead Deck (SOLAS Chap. II-1 Regs. 17.2 to 17.3)**

**1** The internal watertight subdivision arrangements to limit the entry and spread of water above the bulkhead deck is to be in accordance with the design arrangements necessary for compliance with the stability requirements in parts B-1, and B-2, Chapter II-2, SOLAS Convention if applicable. Where pipes, scuppers, electric cables, etc. are carried through internal watertight boundaries that are immersed at any intermediate or final stage of flooding in damage cases that contribute to the attained subdivision index (*A*), arrangements are to be made to ensure their watertight integrity.

**2** Doors in internal watertight subdivision arrangements above the bulkhead deck, and also above the worst intermediate or final stage of flooding waterlines, are to be capable of preventing the passage of water when immersed in the required range of positive stability for any damage cases contributing to the attained subdivision index (*A*). These doors may remain open provided they can be remotely closed from the navigation bridge. They are always to be ready to be immediately closed.

**3** All openings in the exposed weather deck are to have coamings of ample height and strength and are to be provided with efficient means for expeditiously closing them weathertight. Freeing ports, open rails and scuppers are to be fitted as necessary for rapidly cleaning the weather deck of water under all weather conditions.

**4** Air pipes terminating within a superstructure which are not fitted with watertight means of closure are to be considered as unprotected openings when applying [2.3.6-6](#), [Part 4](#).

### **7.3.2 Openings above Bulkhead Deck (SOLAS Chap. II-1 Regs. 17.6, 17.7, 22.7 and 22.8)**

**1** Side scuttles, gangway, cargo ports and other means for closing openings in the shell plating above the bulkhead deck are to be of efficient design and construction and of sufficient strength having regard to the spaces in which they are fitted and their positions relative to the deepest subdivision draught.

**2** Efficient inside dead lights, so arranged that they can be easily and effectively closed and secured watertight, are to be provided for all side scuttles to spaces below the first deck above the bulkhead deck.

**3** The following doors, located above the draught, are to be closed and locked before the voyage commences and are to remain closed and locked until the ship is at its next berth. Provided that where a door cannot be opened or closed while the ship is at the berth such a door may be opened or left open while the ship approaches or draws away from the berth, but only so far as may be necessary to enable the door to be immediately operated. In any case, the inner bow door must be kept closed;

- (1) cargo loading doors in the shell or the boundaries of enclosed superstructures;

- (2) bow visors fitted in positions as indicated in paragraph (1);
- (3) cargo loading doors in the collision bulkhead;
- (4) ramps forming an alternative closure to those defined in paragraphs (1) to (3) inclusive.

## **7.4 Watertight Integrity of Ro-ro Passenger Ships**

### **7.4.1 Watertight Integrity from the Ro-ro Deck (Bulkhead Deck) to Spaces below (SOLAS Chap. II-1 Regs. 17-1.1 and 23.3)\***

**1** In Ro-Ro passenger ships, all access from the ro-ro deck that leads to spaces below the bulkhead deck are to have a lowest point which is not less than 2.5 m above the bulkhead deck, unless the access is covered by the provisions of subparagraphs (1) or (2).

- (1) Where vehicle ramps are installed to give access to spaces below the bulkhead deck, their openings are to be able to be closed weathertight to prevent ingress of water below and fitted with alarms and open/close indicators on the navigation bridge. The means of closure is to be watertight if the deck is intended as a watertight horizontal in accordance with 2.3.6-6, Part 4;
- (2) Subject to the following -2, the Society may permit the fitting of particular accesses to spaces below the bulkhead deck provided they are necessary for the essential working of the ship, e.g. the movement of machinery and stores, and subject to such accesses being made watertight, fitted with alarms and open/close indicators on the navigation bridge;

**2** All accesses from the Ro-Ro deck and vehicle ramps that lead to spaces below the bulkhead deck are to be closed before the voyage commences and is to remain closed until the ship is at its next berth.

### **7.4.2 Closure of the Ro-ro Deck (SOLAS Chap.II-1 Reg.23.1 and 23.7)**

**1** Special category spaces and Ro-Ro cargo spaces are to be continuously patrolled or monitored by effective means, such as television surveillance, so that movement of vehicles in adverse weather and unauthorized access by passengers can be observed during navigation.

**2** All transverse or longitudinal bulkheads which are taken into account as effective to confine the seawater accumulated on the Ro-Ro deck are to be in place and secured before the voyage commences and remain in place and secured until the ship is at its next berth.

### **7.4.3 Openings in the Shell Plating (SOLAS Chap.II-1 Reg.17-1.2, 17-1.3 and 23.2)\***

**1** Indicators are to be provided on the navigation bridge for all shell doors, loading doors and other closing appliances which, if left open or not properly secured, could, in the opinion of the Society, lead to flooding of a special category space or Ro-Ro cargo space. The indicator system is to be designed on the fail-safe principle and is to show by visual alarms if the door is not fully closed or if any of the securing arrangements are not in place and fully locked and by audible alarms if such door or closing appliances become open or the securing arrangements become unsecured.

**2** The indicator panel on the navigation bridge is to be equipped with a mode selection function “harbour/sea voyage” so arranged that an audible alarm is given on the navigation bridge if the ship leaves harbour with the bow doors, inner doors, stern ramp or any other side shell doors not closed or any closing device not in the correct position. The power supply for the indicator system is to be independent of the power supply for operating and securing the doors.

**3** Television surveillance and a water leakage detection system are to be arranged to provide an indication to the navigation bridge and to the engine control station of any leakage through inner and outer bow doors, stern doors or any other shell doors which could lead to flooding of special category spaces or Ro-Ro cargo spaces.

**4** Documented operating procedures for closing and securing all shell doors, loading doors and other closing appliances which, if left open or not properly secured, could, in the opinion of the Society, lead to flooding of a special category space or Ro-Ro cargo space, are to be kept on board and posted at an appropriate place.

## **Chapter 8      DECK**

### **8.1      Deck Load**

#### **8.1.1      Deck Load of Closing Accommodation Space**

Deck load of all of closing accommodation space may be  $4.51\text{ kN/m}^2$ , provided that special heavy cargo is not arranged in this space.

#### **8.1.2      Deck Girder Construction and Pillar Load**

Deck load supported by deck girder is to be specially considered, since it is again transmitted to lower deck girder, pillar and bulkhead through shell plating, bulkhead and pillar, when the deck load practically transmitted from upper layer of each deck girder, bulkhead and pillar is calculated.



## **Part 4 SUBDIVISION AND STABILITY**

### **Chapter 1 GENERAL**

#### **1.1 General**

##### **1.1.1 Application\***

**1** The requirements for subdivision and stability in this part apply to passenger ships registered for unrestricted service.

**2** For ships registered for restricted service, the requirements for subdivision and stability in this part may be modified appropriately.

##### **1.1.2 Special Cases in Application**

In ships of unusual form or purpose etc. which requirements in this part are not directly applicable, the requirements for subdivision or stability are to be at Society's discretion, notwithstanding the provisions in [1.1.1](#).

## Chapter 2 SUBDIVISION

### 2.1 General

#### 2.1.1 Application\*

The requirements in this chapter are applied only to passenger ships registered for unrestricted service. However, a part of those may be applied to Ro-Ro passenger registered for restricted service.

### 2.2 Length of Compartments

#### 2.2.1 Degree of Subdivision (*SOLAS* Chap.II-1 Reg.4.3)

Ships are to be as efficiently subdivided as is possible having regard to the nature of the service for which they are intended. The degree of subdivision is to vary with the subdivision length ( $L_s$ ) of the ship and with the service, in such manner that the highest degree of subdivision corresponds with the ships of greatest subdivision length ( $L_s$ ), primarily engaged in the carriage of passengers or cargoes.

### 2.3 Damage Stability

#### 2.3.1 Calculation of Damage Stability (*SOLAS* Chap.II-1 Reg.4.4)

Where it is proposed to fit decks, inner skins or longitudinal bulkheads of sufficient tightness to seriously restrict the flow of water, proper consideration is to be given to beneficial or adverse effects of such structures in the calculations.

#### 2.3.2 Permeabilities of Compartments (*SOLAS* Chap.II-1 Reg.7-3)\*

For the purpose of the subdivision and damage stability calculations, the permeability of each general compartment or part of a compartment is to be in accordance with [Table 4.2.1](#) in general. Where substantiated by calculations, other figures for permeability specified in [Table 4.2.1](#) may be used notwithstanding the provision above.

Table 4.2.1 Permeability of Compartments

Spaces	Permeability
Appropriated to cargo or stores	0.60
Occupied by accommodation	0.95
Occupied by machinery	0.85
Void spaces	0.95
Intended for liquids	0 or 0.95*

\* Whichever results in the more severe requirements.

#### 2.3.3 Unsymmetrical Flooding (*SOLAS* Chap.II-1 Reg.7-2.5)

1 Unsymmetrical flooding is to be kept to a minimum consistent with efficient arrangements.

2 Where it is necessary to correct large angles of heel, the means adopted is to be self-acting, where practicable. But in any case where controls to equalization devices are provided they are to be operable from above the bulkhead deck. These fittings together with their controls are to be acceptable to the Society.

#### 2.3.4 Subdivision Index (*SOLAS* Chap.II-1 Reg.6 and 7)\*

1 For passenger ships to which the damage stability requirements of this chapter apply, the value of the Required Subdivision Index ( $R$ ) is to be given by [Table 4.2.2](#):

Table 4.2.2 Value of  $R$ 

Persons on board	$R$
$N < 400$	$R = 0.722$
$400 \leq N \leq 1,350$	$R = \frac{N}{7580} + 0.66923$
$1,350 < N \leq 6,000$	$R = 0.0369 \ln(N + 89.048) + 0.579$
$6,000 < N$	$R = 1 - \frac{852.5 + 0.03875N}{N + 5000}$

Where:

$N$  = total number of persons on board

2 The Attained Subdivision Index ( $A$ ) for ship is to be not less than the Required Subdivision Index ( $R$ ), calculated in accordance with -1 above.  $A$  is obtained by the summation of the partial indices  $A_s$ ,  $A_p$  and  $A_l$ , weighted as shown and calculated for the draughts  $d_s$ ,  $d_p$  and  $d_l$  specified in 2.1.10 to 2.1.12, Part 1 in accordance with the following formula:

$$A = 0.4A_s + 0.4A_p + 0.2A_l$$

Each partial index is a summation of contributions from all damage cases taken in consideration, using the following formula:

$$A_x = \sum p_i \cdot s_i$$

Where, each partial index is not less than  $0.9R$ .

$A_x$ : Each partial index correspond to draughts,  $d_s$ ,  $d_p$  and  $d_l$  specified in 2.1.10 to 2.1.12, Part 1.

$p_i$ : Probability that only a compartment or a group of compartments in question may be flooded (hereinafter referred to as “compartment flooding probability”), which is to be in accordance with the requirements in 2.3.5.

$s_i$ : Probability of survival after flooding a compartment or a group of compartments in question (hereinafter referred to as “survival probability”), which is to be in accordance with the requirements in 2.3.6.

$i$  : Indication of each compartment or group of compartments in question.

$\Sigma$ : Summation of all cases of loading in which a compartment or a group of compartments is involved.

3 Partial index ( $A_x$ ) is to be calculated under the following conditions:

- (1) As a minimum, the calculation of  $A$  is to be carried out at level trim for the deepest subdivision draught and the partial subdivision draught. The estimated service trim may be used for the light service draught. Where any anticipated service condition within the draught range from  $d_s$  to  $d_l$ , the trim variation in comparison with the calculated trim is greater than  $0.005L_f$ , one or more additional calculations of  $A$  are to be performed for the same draughts but including sufficient trims to ensure that, for all intended service conditions, the difference in trim in comparison with the reference trim used for one calculation will be not more than  $0.005L_f$ . Each additional calculation of  $A$  is to comply with -2 above.
- (2) All flooding cases for a compartment and a group of compartments over the ship's subdivision length are to be taken into account.
- (3) Assumed extent of hull damage is the following:
  - (a) Vertical extent is to extend upwards  $d' + 12.5$  (m) from baseline. However, if a lesser extent will give a more severe result, such extent is to be assumed.
  - (b) Horizontal extent of damage is measured inboard from Ship's side, at a right angle to the centreline at the level of the deepest subdivision draught and damage of the transverse extent greater than half breadth ( $B'/2$ ) of the ship may be exempted. In case that the ship has a compartment formed by longitudinal watertight bulkheads which are not in the ship's centreline, all damages which extend from the outmost compartment (hereinafter referred to as “wing compartment”) to the ship's centreline are to be assumed.
- (4) In the flooding calculations carried, only one breach of the hull damage need to be assumed and only one free surface need to be considered.
- (5) In the case of unsymmetrical arrangements, the calculated  $A$  value is to the mean value obtained from calculations involving both sides. Alternatively, it is to be taken as that corresponding to the side which evidently gives the least favourable result.
- (6) When determining the positive righting lever ( $GZ$ ) of the residual stability curve in the intermediate and final equilibrium stages of flooding, the displacement for the intact loading condition is to be used. All calculations are to be done with the ship freely

trimming.

4 If pipes, ducts or tunnels are situated within the assumed extent of damage, arrangements are to be made to ensure that progressive flooding cannot thereby extend to compartments other than those than assumed flooded. However, the Society may permit minor progressive flooding if it is demonstrated that its effects can be easily controlled and the safety of the ship is not impaired.

### 2.3.5 Compartment Flooding Probability ( $p_i$ ) (SOLAS Chap.II-1 Reg.7-1)\*

1 The Compartment Flooding Probability ( $p_i$ ) for a compartment or group of compartments is to be determined by the following (1), (2) or (3) according to the number of damaged compartment.

(1) Where the damage involves a single zone only:

$$p_i = p(x1_j, x2_j) \cdot [r(x1_j, x2_j, b_k) - r(x1_j, x2_j, b_{k-1})]$$

Where:

$x1$ : The distance ( $m$ ) from the aft terminal of  $L_s$  to the aft end of the zone in question

$x2$ : The distance ( $m$ ) from the aft terminal of  $L_s$  to the forward end of the zone in question

$b$ : The mean transverse distance ( $m$ ) measured at right angles to the centreline at the deepest subdivision draught between the shell and an assumed vertical plane extended between the longitudinal limits used in calculating the factor  $p_i$  and which is a tangent to, or common with, all or part of the outermost portion of the longitudinal bulkhead under consideration. This vertical plane is to be so orientated that the mean transverse distance to the shell is a maximum, but not more than twice the least distance between the plane and the shell. If the upper part of a longitudinal bulkhead is below the deepest subdivision draught the vertical plane used for determination of  $b$  is assumed to extend upwards to the deepest subdivision waterline. In any case,  $b$  is not to be taken greater than  $B'/2$ .

$j$ : The aftmost damage zone number involved in the damage starting with no.1 at the stern

$k$ : The number of a particular longitudinal bulkhead as barrier for transverse penetration in a damage zone counted from shell towards the centre line. However, value of  $k$  according to side shell is to be taken as zero.

$p(x1, x2)$ : It is specified in -2.

$r(x1, x2, b)$ : It is specified in -3. However,  $r(x1, x2, b_0)$  is to be taken as zero.

(2) Where the damage involves two adjacent zones:

$$\begin{aligned} p_i = & p(x1_j, x2_{j+1}) \cdot [r(x1_j, x2_{j+1}, b_k) - r(x1_j, x2_{j+1}, b_{k-1})] \\ & - p(x1_j, x2_j) \cdot [r(x1_j, x2_j, b_k) - r(x1_j, x2_j, b_{k-1})] \\ & - p(x1_{j+1}, x2_{j+1}) \cdot [r(x1_{j+1}, x2_{j+1}, b_k) - r(x1_{j+1}, x2_{j+1}, b_{k-1})] \end{aligned}$$

(3) Where the damage involves three or more adjacent zones:

$$\begin{aligned} p_i = & p(x1_j, x2_{j+n-1}) \cdot [r(x1_j, x2_{j+n-1}, b_k) - r(x1_j, x2_{j+n-1}, b_{k-1})] \\ & - p(x1_j, x2_{j+n-2}) \cdot [r(x1_j, x2_{j+n-2}, b_k) - r(x1_j, x2_{j+n-2}, b_{k-1})] \\ & - p(x1_{j+1}, x2_{j+n-1}) \cdot [r(x1_{j+1}, x2_{j+n-1}, b_k) - r(x1_{j+1}, x2_{j+n-1}, b_{k-1})] \\ & + p(x1_{j+1}, x2_{j+n-2}) \cdot [r(x1_{j+1}, x2_{j+n-2}, b_k) - r(x1_{j+1}, x2_{j+n-2}, b_{k-1})] \end{aligned}$$

$n$ : The number of adjacent damage zones involved in the damage

2 The Compartment Flooding Probability ( $p_i$ ) is to be determined by the following (1), (2) or (3) according to longitudinal position of compartment under consideration.

(1) Where neither limits of the compartment or group of compartments under consideration coincides with the aft or forward terminals:

In case  $J \leq J_k$ :

$$p(x1, x2) = p_1 = \frac{1}{6} J^2 (b_{11} J + 3b_{12})$$

In case  $J > J_k$ :

$$\begin{aligned} p(x1, x2) = p_2 = & -\frac{1}{3} b_{11} J_k^3 + \frac{1}{2} (b_{11} J - b_{12}) J_k^2 + b_{12} J J_k - \frac{1}{3} b_{21} (J_n^3 - J_k^3) \\ & + \frac{1}{2} (b_{21} J - b_{22}) (J_n^2 - J_k^2) + b_{22} J (J_n - J_k) \end{aligned}$$

$J$ : Non-dimensional damage length given below

$$J = \frac{(x_2 - x_1)}{L_s}$$

$x_1$  and  $x_2$  are specified in -1 above.

$J_k$ : As given by the following formula:

In case  $L_s \leq 260m$ :

$$J_k = \frac{J_m}{2} + \frac{1 - \sqrt{1 - \frac{55}{6}J_m + \frac{121}{4}J_m^2}}{11}$$

$$J_m = \min\left\{\frac{10}{33}, \frac{60}{L_s}\right\}$$

In case  $L_s > 260m$ :

$$J_k = J_k^* \cdot \frac{260}{L_s}$$

$$J_k^* = \frac{J_m^*}{2} + \frac{1 - \sqrt{1 - \frac{55}{6}J_m^* + \frac{121}{4}J_m^{*2}}}{11}$$

Where:  $J_m^* = 3/13$

$$J_m = \frac{60}{L_s}$$

$b_{11}$ ,  $b_{12}$ ,  $b_{21}$  and  $b_{22}$ : Coefficient given by the following:

$$b_{11} = \frac{1}{6} \left( \frac{2}{(J_m - J_k)J_k} - \frac{11}{J_k^2} \right)$$

$$b_{12} = \begin{cases} 11 & \text{If } L_s \leq 260(m) \\ \frac{1}{6} \left( \frac{11}{J_k} - \frac{1}{J_m - J_k} \right) & \text{If } L_s > 260(m) \end{cases}$$

$$b_{21} = -\frac{1}{6} \frac{1}{(J_m - J_k)^2}$$

$$b_{22} = \frac{1}{6} \frac{J_m}{(J_m - J_k)^2}$$

$J_n$ : Normalized length of a compartment or group of compartments is to be taken as the lesser of  $J$  and  $J_m$ :

- (2) Where the aft limit of the compartment or group of compartments under consideration coincides with the aft terminal or the forward limit of the compartment or group of compartments under consideration coincides with the forward terminal:

In case  $J \leq J_k$ :

$$p(x_1, x_2) = \frac{1}{2}(p_1 + J)$$

In case  $J > J_k$ :

$$p(x_1, x_2) = \frac{1}{2}(p_2 + J)$$

$x_1$ ,  $x_2$ ,  $p_1$ ,  $p_2$ ,  $J$  and  $J_k$  are specified in (1) above.

- (3) Where the compartment or groups of compartments considered extends over the entire subdivision length ( $L_s$ ):

$$p(x_1, x_2) = 1$$

$x_1$  and  $x_2$  are specified in (1) above.

- 3 The factor  $r(x_1, x_2, b)$  is to be determined by the following formulae:

$$r(x_1, x_2, b) = 1 - (1 - C) \cdot \left[ 1 - \frac{G}{p(x_1, x_2)} \right]$$

$x_1$ ,  $x_2$  and  $b$  are specified in -1 above.

$C$ : Coefficient given by the following:

$$C = 12 \cdot J_b \cdot (-45 \cdot J_b + 4)$$

$J_b$ : Coefficient given by the following:

$$J_b = \frac{b}{15 \cdot B'}$$

$G$ : As given by the following formula:

Where the compartment or groups of compartments considered extends over the entire subdivision length ( $L_s$ ):

$$G = G_1 = \frac{1}{2} b_{11} J_b^2 + b_{12} J_b$$

Where neither limits of the compartment or group of compartments under consideration coincides with the aft or forward terminals:

$$G = G_2 = -\frac{1}{3} b_{11} J_0^3 + \frac{1}{2} (b_{11} J - b_{12}) J_0^2 + b_{12} J J_0$$

Where the aft limit of the compartment or group of compartments under consideration coincides with the aft terminal or the forward limit of the compartment or group of compartments under consideration coincides with the forward terminal:

$$G = \frac{1}{2} \cdot (G_2 + G_1 \cdot J)$$

$b_{11}$ ,  $b_{12}$  and  $J$  are specified in -2 above.

$J_0$ : Coefficient given by the following:

$$J_0 = \min(J, J_b)$$

### 2.3.6 Probability of Survival ( $s_i$ ) (SOLAS Chap.II-1 Reg.7-2)\*

1 The Probability of Survival ( $s_i$ ) for any damage case at any initial loading condition is to be obtained from the formula:

$$s_i = \min\{s_{\text{intermediate},i} \text{ or } s_{\text{final},i} \cdot s_{\text{mom},i}\}$$

$s_{\text{intermediate},i}$ : It is the probability to survive all intermediate flooding stages until the final equilibrium stage and, is calculated in accordance with -2.

$s_{\text{final},i}$ : It is the probability to survive in the final equilibrium stage of flooding. It is calculated in accordance with -3.

$s_{\text{mom},i}$ : It is the probability to survive heeling moments and, is calculated in accordance with -4.

2 The factor  $s_{\text{intermediate},i}$  is to be taken as the least of the value obtained from all flooding stages including the stage before equalization, if any, and is to be calculated as follows. Where the intermediate heel angle exceeds  $15^\circ$ ,  $s_{\text{intermediate},i}$  is to be taken as 0. Where cross-flooding fittings are required, the time for equalization is not to exceed 10 min.

$$s_{\text{intermediate},i} = \left[ \frac{GZ_{\max}}{0.05} \cdot \frac{\text{Range}}{7} \right]^{\frac{1}{4}}$$

$GZ_{\max}$ : It is the maximum positive righting lever ( $m$ ) up to the angle  $\theta_v$ . However, in the calculations of  $s_{\text{intermediate},i}$ , It is not to be taken as more than 0.05  $m$ .

$\theta_v$ : It is the angle ( $^\circ$ ), in any stage of flooding, where the righting lever becomes negative, or the angle ( $^\circ$ ) at which an opening incapable of being closed weathertight becomes submerged.

$\text{Range}$ : It is the range of positive righting levers ( $^\circ$ ) measured from the angle  $\theta_e$ . However, the positive range is to be taken up to the angle  $\theta_v$  and, in the calculations of  $s_{\text{intermediate},i}$ , it is not to be taken as more than  $7^\circ$ .

$\theta_e$ : It is the equilibrium heel angle ( $^\circ$ ) in any stage of flooding.

3 The factor  $s_{\text{final},i}$  is to be obtained from the following formula.

$$s_{\text{final},i} = K \cdot \left[ \frac{GZ_{\max}^{\frac{1}{4}}}{TGZ_{\max} \times \frac{\text{Range}}{TRange}} \right]$$

$K$ : Coefficient given by the following:

$$K = 1.0 \quad \text{if } \theta_e \leq \theta_{\min}$$

$$K = 0 \quad \text{if } \theta_e \geq \theta_{\max}$$

$$K = \sqrt{\frac{\theta_{\max} - \theta_e}{\theta_{\max} - \theta_{\min}}} \quad \text{Otherwise}$$

where,  $\theta_{\min}$  is  $7^\circ$  and  $\theta_{\max}$  is  $15^\circ$  for passenger ships.

$\theta_v$  and  $\theta_e$  are specified in -2 above.

$GZ_{\max}$ : As specified in -2 above. However, in the calculations of  $s_{\text{final},i}$ , it is not to be taken as more than  $TGZ_{\max}$ .

$\text{Range}$ : As specified in -2 above. However, in calculations of  $s_{\text{final},i}$ , it is not to be taken as more than  $TRange$ .

$TGZ_{\max}$ : 0.20 ( $m$ ), for ro-ro passenger ships each damage case that involves a ro-ro space 0.12 ( $m$ ), otherwise

$TRange$ :  $20^\circ$ , for ro-ro passenger ships each damage case that involves a ro-ro space  $16^\circ$ , otherwise

- 4 The factor  $s_{\text{mom},i}$  is to be obtained from the following formula.

$$s_{\text{mom},i} = \frac{(GZ_{\text{max}} - 0.04) \cdot V}{M_{\text{heel}}}$$

$GZ_{\text{max}}$ : It is specified in -2 above.

$V$ : Intact displacement at the respective draught ( $d_s$ ,  $d_p$  or  $d_i$ ).

$M_{\text{heel}}$ : Maximum assumed heeling moment as calculated in accordance with -5.

- 5 The heeling moment ( $M_{\text{heel}}$ ) is to be obtained from the following formula.  $M_{\text{passenger}}$ ,  $M_{\text{wind}}$  and  $M_{\text{Survivalcraft}}$ , are to be determined by the following (1), (2) or (3) respectively.

$$M_{\text{heel}} = \text{maximum}\{M_{\text{passenger}} \text{ or } M_{\text{wind}} \text{ or } M_{\text{Survivalcraft}}\}$$

- (1)  $M_{\text{passenger}}$  is the maximum assumed heeling moment resulting from movement of passengers, and is to be obtained from any of following items.

(a)  $M_{\text{passenger}} = (0.075 \cdot N_p) \cdot (0.45 \cdot B') \cdot (t \cdot m)$

$N_p$ : It is the maximum number of passengers permitted to be on board in the service condition corresponding to the deepest subdivision draught under consideration.

$B'$ : It is specified in 2.1.5-1, Part 1.

- (b) Heeling moments assume that passengers are distributed in accordance with the following i) to iii) on those decks where master stations are located

i) Passengers are distributed on available deck areas towards one side of the ship in such a way that they produce the most adverse heeling moment.

ii) Passengers are distributed with 4 persons per  $1\text{m}^2$ .

iii) The estimated weight per passenger is  $75\text{kg}$ .

- (2)  $M_{\text{wind}}$  is the maximum assumed wind moment acting in a damage situation.

$$M_{\text{wind}} = (P \cdot A \cdot Z) / 9.806 \quad (t \cdot m)$$

$P$ :  $120\text{ N/mm}^2$

$A$ : projected lateral area ( $\text{m}^2$ ) above waterline

$Z$ : distance ( $m$ ) from centre of lateral projected area above waterline to  $T/2$

$T$ : Respective draught ( $d_s$ ,  $d_p$  or  $d_i$ )

- (3)  $M_{\text{Survivalcraft}}$  is the maximum assumed heeling moment due to the launching of all fully loaded davit-launched survival craft on one side of the ship. It is to be calculated using the following assumptions.

- (a) All lifeboats and rescue boats fitted on the side to which the ship has heeled after having sustained damage is to be assumed to be swung out fully loaded and ready for lowering.

- (b) For lifeboats which are arranged to be launched fully loaded from the stowed position, the maximum heeling moment during launching is to be taken.

- (c) A fully loaded davit-launched liferaft attached to each davit on the side to which the ship has heeled after having sustained damage is to be assumed to be swung out ready for lowering.

- (d) Persons not in the life-saving appliances which are swung out is not to provide either additional heeling or righting moment.

- (e) Life-saving appliances on the side of the ship opposite to the side to which the ship has heeled is to be assumed to be in a stowed position.

- 6 Where horizontal watertight boundaries are fitted above the waterline under consideration, the factor ( $s$ ) calculated for the lower compartment or group of compartments is to be obtained by multiplying the value as determined in -1 above by the factor  $v_m$  given by following formula.

$$v_m = v(H_{j,n,m}, d') - v(H_{j,n,m-1}, d')$$

$H_{j,n,m}$ : It is the least height ( $m$ ) above the baseline within the longitudinal range of  $x1_{(j)} \dots x2_{(j+n-1)}$  of the  $m$ -th horizontal boundary which is assumed to limit the vertical extent of flooding for the damaged compartments under consideration;

$H_{j,n,m-1}$ : It is the least height ( $m$ ) above the baseline within the longitudinal range of  $x1_{(j)} \dots x2_{(j+n-1)}$  of the  $m-1$ -th horizontal boundary which is assumed to limit the vertical extent of flooding for the damaged compartments under consideration;

$j$ ,  $n$ ,  $x1$  and  $x2$  are specified in 2.3.5-1.

$m$ : It is each horizontal boundary counted upwards from the waterline under consideration;

$v(H_{j,n,m}, d')$  and  $v(H_{j,n,m-1}, d')$ : Coefficient given by the following:

$$v(H, d') = 0.8 \frac{(H-d')}{7.8} \quad \text{if } H_m - d' \leq 7.8(m)$$

$$v(H, d') = 0.8 + 0.2 \left[ \frac{(H-d')-7.8}{4.7} \right] \quad \text{Otherwise}$$

$v(H_{j,n,m}, d')$  is to be taken as 1, if  $H_m$  coincides with the uppermost watertight boundary of the ship within the range  $x1_{(j)} \dots x2_{(j+n-1)}$ , and  $v(H_{j,n,0}, d')$  is to be taken as 0.

$v_m$  is to be taken as 0, if  $v_m$  determined by above formula is taken as less than 0, and  $v_m$  is to be taken as 1, if  $v_m$  determined by above formula is taken as more than 1.

7 Where the requirement in -6 above is applied, in general, each contribution  $dA$  to the Attained Subdivision Index  $A$  is obtained from the formula:

$$dA = p_i \cdot [v_1 \cdot s_{\min 1} + (v_2 - v_1) \cdot s_{\min 2} + \dots + (1 - v_{m-1}) \cdot s_{\min m}]$$

$v_m$ : The value calculated in accordance with -6 above;

$s_{\min}$ : The least factor of  $s$  for all combinations of damages obtained when the assumed damage extends from the assumed damage height  $H_m$  downwards.

8 Unsymmetrical flooding is to be kept to a minimum consistent with the efficient arrangements. Where it is necessary to correct large angle of heel, the means adopted is to, where practicable, be self-acting, but in any case where controls to equalization devices are provided they is to be operable from above the bulkhead deck. These fittings together with their controls are to be acceptable to the Society.

9 Tanks and compartments taking part in such equalization is to be fitted with air pipes or equivalent means of sufficient cross-section to ensure that the flow of water into the equalization compartments is not delayed.

10 Probability of survival ( $s_i$ ) is to be taken as 0 in cases where the final waterline (in consideration of sinkage, heel and trim) immerses any of the bulkhead deck considered a horizontal evacuation route for compliance with Chapter II-2, SOLAS Convention.

11 The probability of survival ( $s_i$ ) is to be taken as 0 if, taking into account sinkage, heel and trim, any of the following (1) to (4) occur in any intermediate stage or in the final stage of flooding:

- (1) Immersion of any vertical escape hatch in the bulkhead deck.
- (2) Any controls intended for the operation of watertight doors, valves on piping or on ventilation ducts intended to maintain the integrity of watertight bulkheads from above the bulkhead deck become inaccessible or inoperable.
- (3) Immersion of piping or ventilation ducts located within the assumed extent of damage and carried through a watertight boundary if this can lead to the progressive flooding of compartments not assumed as flooded.
- (4) Immersion of the lower edge of openings through which progressive flooding may take place and such flooding is not accounted for in the calculation of probability of survival ( $s_i$ ). Such openings is include air pipes, ventilators and openings which to be closed by means of weathertight doors or hatch covers.

12 Notwithstanding the requirements given in -11 above, where compartments are assumed to be flooded due to progressive flooding in the damage stability calculations,  $s_i$  may be taken as  $s_{\text{intermediate},i}$  for the flooding of those compartments under consideration.

13 Where the ship carries timber deck cargo and its buoyancy is considered, the securing of the cargo is to be in accordance with **2.3.2.3-12, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships**.

### 2.3.7 Special Requirements Concerning Passenger Ship Stability (SOLAS Chap.II-1 Reg.8)

1 A passenger ship intended to carry 400 or more persons is to have watertight subdivision abaft the collision bulkhead so that  $s_i = 1$  for a damage involving all the compartments within  $0.08 L_f$  measured from the forward perpendicular for the three loading conditions used to calculate the attained subdivision index  $A$ . If the attained subdivision index  $A$  is calculated for different trims, this requirement is also to be satisfied for those loading conditions.

2 A passenger ship intended to carry 36 or more persons is to be capable of withstanding damage along the side shell to an extent specified in -3. Compliance with this regulation is to be achieved by demonstrating that  $s_i$ , as defined in 2.3.6, is not less than 0.9 for the three loading conditions used to calculate the attained subdivision index  $A$ . If the attained subdivision index  $A$  is calculated for different trims, this requirement is also to be satisfied for those loading conditions.

3 The damage extent to be assumed when demonstrating compliance with -2 above, is to be dependent on the total number of



persons carried, and  $L_f$  and, is to be specified in following (1) to (5).

- (1) The vertical extent of damage is to extend from the ship's moulded baseline to a position up to 12.5m above the position of the deepest subdivision draught as defined in 2.1.10, Part 1, unless a lesser vertical extent of damage were to give a lower value of  $s_i$ , in which case this reduced extent is to be used.
- (2) Where 400 or more persons are to be carried, a damage length of  $0.03L_f$  but not less than 3m is to be assumed at any position along the side shell, in conjunction with a penetration inboard of  $0.1B'$  but not less than 0.75m measured inboard from the ship side, at right angle to the centreline at the level of the deepest subdivision draught.
- (3) Where less than 400 persons are carried, damage length is to be assumed at any position along the shell side between transverse watertight bulkheads provided that the distance between two adjacent transverse watertight bulkheads is not less than the assumed damage length. If the distance between adjacent transverse watertight bulkheads is less than the assumed damage length, only one of these bulkheads is to be considered effective for the purpose of demonstrating compliance with -2 above.
- (4) Where 36 persons are carried, a damage length of  $0.015L_f$  but not less than 3m is to be assumed, in conjunction with a penetration inboard of  $0.05B'$  but not less than 0.75m;
- (5) Where more than 36, but fewer than 400 persons are carried the values of damage length and penetration inboard, used in the determination of the assumed extent of damage, are to be obtained by linear interpolation between the values of damage length and penetration which apply for ships carrying 36 persons and 400 persons as specified in (2) and (4) above.

## 2.4 Subdivision Load Line (SOLAS Chap.II-1 Reg.18.1, 18.5, 18.6 and 18.7)

### 2.4.1 General

1 Ships are to be marked with the subdivision load line stipulated in this section in order that the required degree of subdivision is to be maintained.

2 A ship is to be in no case be so loaded that the subdivision load line mark is immersed in sea water correspond to the particular voyage and service configuration.

3 Whatever may be the position of the subdivision load line marks, a ship is not to be loaded so as to submerge the load line mark appropriate to the season and locality as determined in accordance with the “*International Convention on Load Lines*” in force.

4 In no case is to any subdivision load line mark be placed above the deepest load line in salt water as determined by the strength of the ship or the “*International Convention on Load Lines*” in force.

### 2.4.2 Assignment of Subdivision Load Lines

A subdivision load line is to be assigned after confirming that the requirements for the hull structure and equipment in Chapter 4, Chapter 6 and Chapter 7 of Part 3 for the draught corresponding to the load line which is satisfied to the requirements for the arrangement of compartments from 2.2, 2.3 and the requirements for bilge pipe system in 2.3 of Part 5.

### 2.4.3 Marking of Subdivision Load Lines

The method of marking a subdivision load line is to be in accordance with International Convention for the Safety of Life at Sea.

### 2.4.4 Assignment of Subdivision Load Lines (SOLAS Chap.II-1 Reg.18.2)

The subdivision load lines assigned and marked is to be recorded in the Passenger Ship Safety Certificate, and is to be distinguished by the notation “P1” for the principal passenger service configuration, and “P2”, “P3”, etc., for the alternative configurations. The principal passenger configuration is to be taken as the mode of operation in which the required subdivision index ( $R$ ) will have the highest value.

### 2.4.5 Determination of Subdivision Load Lines (SOLAS Chap.II-1 Reg.18.3)

The freeboard corresponding to each of these load lines is to be measured at the same position and from the same deck line as the freeboards determined in accordance with the “*International Convention on Load Lines*” in force.

## 2.5 Capability after Flooding

### 2.5.1 General (SOLAS Chap.II-1 Reg.8-1)\*

Ships whose length ( $L_f$ ) is 120 m or more or having three or more main vertical zones are to comply with the following

requirements.

- (1) Ships are to be designed so that the systems specified in *SOLAS* Chap.II-2 Reg.21.4 remain operational when the ship is subject to flooding of any single watertight compartment.
- (2) Ships are to be provided with either onboard stability computers or shore-based support approved by the Society for the purpose of providing operational information to the Master for safe return to port after a flooding casualty.

## Chapter 3      DAMAGE CONTROL PLANS

### 3.1      General

#### 3.1.1      Application\*

In addition to the requirements in this chapter, the requirements of damage control stipulated in **2.3.4, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships** are to be correspondingly applied.

#### 3.1.2      Exhibit of Damage Control Plan

For the guidance of the officer in charge of the ship, the damage control plan approved by the Society is to be permanently exhibited, or readily available on the navigation bridge.

### 3.2      Booklet and Plan for Damage Control

#### 3.2.1      Damage Control Plan\*

A damage control plan is to be shown clearly for each deck and hold as follows:

- (1) Position of the boundaries and its openings of the watertight compartments
- (2) Position of the means of closure and any controls for openings
- (3) The arrangements for correction of any list due to flooding

#### 3.2.2      Booklets

- 1 The booklet containing the information defined in **3.2.1** is to be provided which is made available to the officers of the ship.
- 2 With respect to the provision of **2.5.1(2), Part 4**, the booklet is to include a reference to activation of damage stability support from the onboard stability computer, if installed, and to shore-based support when provided.

## Chapter 4 INTACT STABILITY

### 4.1 General

#### 4.1.1 Application\*

The requirements for intact stability defined in **Part U of the Rules for the Survey and Construction of Steel Ships** are to be correspondingly applied unless otherwise specified in this chapter.

### 4.2 Stability Requirements

#### 4.2.1 General

1 Stability curves and heeling moment curves are to be prepared by the method deemed appropriate by the Society for all designed service conditions and they are to be verified to comply with the requirements in **4.2.2**.

2 Excessive stability is to be avoided, since it may produce a greater acceleration which may have adverse in hull constructions, passengers, cargoes, etc.

3 For the ships navigating in the areas where icing is expected to occur, it is to be considered that the projected area against wind is increased and the position of centre of gravity is heightened due to icing on the structures.

4 Where values depend on the service condition, the values corresponding to the service condition are to be adopted unless otherwise specified in this chapter.

#### 4.2.2 Technical Requirements

For the stability of passenger ships, *IMO Res. MSC.267(85) "International Code on Intact Stability 2008 (2008 IS Code)"* is to apply.

### 4.3 Stability Information

#### 4.3.1 General\*

1 Passenger ships are to be inclined upon its completion. The lightweight displacement and the longitudinal, transverse and vertical position of its centre of gravity are to be determined. The master is to be supplied with such information satisfactory to the Society as is necessary to enable him by rapid and simple processes to obtain accurate guidance as to the stability of the ship under varying conditions of service.

2 Where any alternations are made to a ship so as to materially affect its stability, **2.3.1-5(1), Part B of the Rules for Survey and Construction of Steel Ships** is to be followed to determine the need for re-inclining tests, and the need for amending stability information.

#### 4.3.2 Stability Information\*

1 The Information to enable the master to maintain sufficient intact stability is to include information which indicates the maximum permissible height of the ship's centre of gravity above keel (*KG*), or alternatively the minimum permissible metacentric height (*GM*), for a range draughts or displacements sufficient to include all service conditions. The information is to show the influence of various trims taking into account the operational limits.

2 In the case of ships requiring cross-flooding, the conditions of stability on which the calculations of heel are based are to be mentioned in order to avoid excessive heeling when the ship sustain damage in a less favorable condition.

### 4.4 Marking of Draughts

#### 4.4.1 Marking of Bow and Stern Draughts (*SOLAS Chap.II-1 Reg.5.6*)

Every ship is to have scales of draughts marked clearly at the bow and stern. In the case where the draught marks are not located where they are easily readable, or operational constraints for a particular trade make it difficult to read the draught marks, then

the ship is to also be fitted with a reliable draught indicating system by which the bow and stern draughts can be determined.

## Part 5 MACHINERY INSTALLATIONS

### Chapter 1 GENERAL

#### 1.1 General

##### 1.1.1 Scope\*

1 The requirements of this Part apply to the main propulsion machinery, power transmission systems, shafting systems, propellers, prime movers other than the main propulsion machinery, boilers etc., incinerators, pressure vessels, auxiliaries, piping systems, and their control systems (hereinafter referred to as “machinery installations” in this Part).

2 The requirements in [Chapter 4](#) may apply to machinery installations installed in ships to be intended for the registry with restricted areas of services.

3 For machinery installations, the requirements in [Part D of the Rules for the Survey and Construction of Steel Ships](#) listed in the following (1) to (23) as well as the requirements of this Part are to be applied.

- (1) [Chapter 1](#) GENERAL (excluding those in [1.1.1](#))
- (2) [Chapter 2](#) RECIPROCATING INTERNAL COMBUSTION ENGINES
- (3) [Chapter 3](#) STEAM TURBINES
- (4) [Chapter 4](#) GAS TURBINES
- (5) [Chapter 5](#) POWER TRANSMISSION SYSTEMS
- (6) [Chapter 6](#) SHAFTINGS
- (7) [Chapter 7](#) PROPELLERS
- (8) [Chapter 8](#) TORSIONAL VIBRATION OF SHAFTINGS
- (9) [Chapter 9](#) BOILERS ETC. AND INCINERATORS
- (10) [Chapter 10](#) PRESSURE VESSELS
- (11) [Chapter 11](#) WELDING FOR MACHINERY INSTALLATIONS
- (12) [Chapter 12](#) PIPES, VALVES, PIPE FITTINGS AND AUXILIARIES (The “freeboard deck” referred to in [Table D12.8 Notes \(7\)](#), [Part D of the Rules for the Survey and Construction of Steel Ships](#) is to be read as “bulkhead deck”).
- (13) [Chapter 13](#) PIPING SYSTEMS (excluding those in [13.2.5](#), [13.4](#) and [13.5](#). Furthermore, the “freeboard deck” referred to in [13.2.4-3](#), [Part D of the Rules for the Survey and Construction of Steel Ships](#) is to be read as “bulkhead deck”).
- (14) [Chapter 15](#) STEERING GEARS (excluding those in [15.1.1](#), [15.2.1](#), [15.2.2](#), [15.2.3](#) and [15.6](#))
- (15) [Chapter 16](#) WINDLASSES AND MOORING WINCHES
- (16) [Chapter 17](#) REFRIGERATING EQUIPMENT
- (17) [Chapter 18](#) AUTOMATIC AND REMOTE CONTROL
- (18) [Chapter 19](#) WATERJET PROPULSION SYSTEMS (The “while operating with all steering gear steering actuating systems” referred to in [19.2.1-3.\(1\)](#), [Part D of the Rules for the Survey and Construction of Steel Ships](#) is to be read as “while any one of the steering gear steering actuating systems is out of operation” for waterjet propulsion systems.)
- (19) [Chapter 20](#) AZIMUTH THRUSTERS (The “while operating with all steering gear steering actuating systems” referred to in [20.2.1-3.\(1\)](#), [Part D of the Rules for the Survey and Construction of Steel Ships](#) is to be read as “while any one of the steering gear steering actuating systems is out of operation” for azimuth thrusters.)
- (20) [Chapter 21](#) SELECTIVE CATALYTIC REDUCTION SYSTEMS AND ASSOCIATED EQUIPMENT
- (21) [Chapter 22](#) EXHAUST GAS CLEANING SYSTEMS AND ASSOCIATED EQUIPMENT
- (22) [Chapter 23](#) EXHAUST GAS RECIRCULATION SYSTEMS AND ASSOCIATED EQUIPMENT
- (23) [Chapter 24](#) SPARE PARTS, TOOLS AND INSTRUMENTS

4 In cases where plastic pipes (including vinyl pipes) are used when applying [Chapter 12](#), [Part D of Rules for the Survey and](#)

**Construction of Steel Ships** in accordance with -1(3), the following (1) to (3) are to be complied with:

- (1) In applying **12.1.6, Part D of Rules for the Survey and Construction of Steel Ships** and **Annex 12.1.6, Part D of Rules for the Survey and Construction of Steel Ships**, the requirements regarding external pressures specified in **1.4.1-2(2), Annex 12.1.6, Part D of Rules for the Survey and Construction of Steel Ships** are to be applied to any pipe installation required to remain operational in the case of flooding damage in accordance with **2.5.1, Part 4 of the Rules**.
- (2) In applying **12.1.6, Part D of Rules for the Survey and Construction of Steel Ships** and **Annex 12.1.6, Part D of Rules for the Survey and Construction of Steel Ships**, the requirements regarding fire endurance specified in **1.5.1-1, Annex 12.1.6, Part D of Rules for the Survey and Construction of Steel Ships** are to be applied to any pipe installation used for Safe Return to Port purposes (*SOLAS* II-2, Reg.21.4). Such installations can be considered to remain operational after a fire casualty if the plastic pipes and fittings have been tested to L1 standard.
- (3) In applying **12.1.6, Part D of Rules for the Survey and Construction of Steel Ships** and **Annex 12.1.6, Part D of Rules for the Survey and Construction of Steel Ships**, the following note is added to **Table 1 of the Annex 12.1.6, Part D of Rules for the Survey and Construction of Steel Ships** and is to be considered in the application of the table:

For passenger ships subject to Reg. 21.4 (Safe Return to Port) of *SOLAS* II-2, plastic pipes for services required to remain operative in the part of the ship not affected by the casualty thresholds (such as systems intended to support safe areas) are to be considered essential services. In accordance with MSC Circular *MSC.1/Circ.1369* (interpretation 12), plastic piping can be considered to remain operational after a fire casualty if the plastic pipes and fittings have been tested to L1 standard for Safe Return to Port purposes.

## Chapter 2 SCUPPERS, SANITARY DISCHRGES, ETC., BILGE AND BALLAST PIPING SYSTEMS

### 2.1 General

#### 2.1.1 Scope

The requirements in this Chapter apply to scuppers, sanitary discharges, etc., bilge and ballast piping systems.

### 2.2 Scuppers, Sanitary Discharges, etc.

#### 2.2.1 General (SOLAS Reg. II-1/15.8 and 35-1.2, and LOAD LINE Reg. 22)\*

1 Scupper pipes sufficient in number and size to provide effective drainage are to be provided in all decks. However for the drainage of enclosed cargo spaces situated on the bulkhead deck, the Society may permit the means of drainage to be dispensed with in any particular compartment of any ship or class of ship provided that the safety of the ship is considered not to be impaired by reasons coming from size or internal subdivision of those spaces. For the special hazards associated with loss of stability when fitted with fixed pressure water-spraying fire-extinguishing systems refer to Regulation 20.6.1.4, Chapter II-2, *SOLAS* Convention.

2 Scupper pipes draining weather decks and spaces within superstructures and deckhouses of which access openings are not provided with closing means complying with the requirements in **11.3.2.6, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships** are to be led to overboard.

3 Scupper pipes from the inside of enclosed superstructures or enclosed deckhouses on the bulkhead deck are to be led directly to inboard bilge wells. Alternatively, they may be led to overboard where they are provided with valves in accordance with the following requirements.

- (1) Each separate discharge line is to have one automatic non-return valve with a positive means of closing from a position above the bulkhead deck or, alternatively, one automatic non-return valve having no positive closing means and one stop valve operable from a position above the bulkhead deck. However, where the scuppers lead overboard through the shell plating in way of a manned engine room, one locally operated positive closing valve directly installed on the shell plating and one non-return valve inboard will also be accepted. The means for the positive closing of valves operable from a position above the bulkhead deck are to be located at readily accessible places and provided with an indicator showing whether the valve is opened or closed.
- (2) Where, however, the vertical distance from the load line to the inboard end of the scupper pipe exceeds  $0.01L_f$ , the scupper pipe may have two automatic non-return valves without positive means of closing in lieu of valves prescribed in (1). In this case, the inboard valves are to be located above the level of the deepest subdivision draught and at the places always accessible for inspection under service condition. If it is not practicable to fit the inboard valves above the specified waterline then it can be accepted to locate below the specified waterline provided that a locally operable stop valve is fitted between those two automatic non-return valves.
- (3) Where the vertical distance prescribed in (2) exceeds  $0.02L_f$ , a single automatic non-return valve without positive means of closing may be accepted in lieu of the valves prescribed in (1) and (2) subject to the approval of the Society.

4 Scupper pipes from spaces below the bulkhead deck are to be led directly to inboard bilge wells. Alternatively, they may be led to overboard where they are provided with the valves in accordance with the following requirements.

- (1) Each separate discharge is to have one automatic non-return valve with a positive means of closing from a position above the bulkhead deck or alternatively, one automatic non-return valve having no positive closing means and one stop valve operable from a position above the bulkhead deck. The means for the positive closing of valves from a position above the bulkhead deck are to be located at readily accessible plates and provided with an indicator showing whether the valve is opened or closed.
- (2) Where, however, the vertical distance from the load line to the inboard end of the scupper pipe exceeds  $0.01L_f$ , the scupper pipe may have two automatic non-return valves without positive means of closing in lieu of valves prescribed in (1). In this case, the inboard valves are to be located above the level of the deepest subdivision draught and at the places always accessible



for inspection under service condition.

5 Notwithstanding the requirements in -3, scupper pipes from enclosed cargo spaces on the bulkhead deck are to be in accordance with the following requirements.

- (1) Where the freeboard to the bulkhead deck is such that the deck edge is immersed when the ship heels more than 5°, scupper pipes are to be led directly overboard and fitted in accordance with the requirement specified in -3. If the requirements specified in (2)(a) through (c) are fulfilled, scupper pipes may be led directly into inboard bilge wells.
- (2) Where the freeboard to the bulkhead deck is such that the deck edge is immersed when the ship heels 5° or less, scupper pipes are to be in accordance with the following requirements.
  - (a) Scupper pipes are to be led directly to inboard bilge wells.
  - (b) High water level alarm is to be provided in the bilge wells where scupper pipes are led.
  - (c) Where the enclosed cargo space is protected by a carbon dioxide fire-extinguishing system the deck scuppers are to be fitted with means to prevent the escape of the smothering gas.

6 Notwithstanding the requirements in -3 and -4, only one stop valve may be arranged to overboard discharge pipes which are always closed during navigation except when discharging. This stop valve is to be capable of being closed from an easily accessible position during navigation by a closing device with an indicator.

7 Scuppers originating at any level and penetrating the shell plating at either more than 450mm below the freeboard deck or below the position 600mm above the load line are to be provided with a non-return valve at the shell plating. This valve, unless specifically required by -3 and -4, may be omitted provided that the thickness of the scupper pipes complies with the requirements in Table D12.6(1) and Table D12.6(2), Part D of the Rules for the Survey and Construction of Steel Ships.

8 In cases where fixed pressure water-spraying systems are fitted in closed vehicle and Ro-Ro spaces and special category spaces, drainage systems are to comply with Regulation 20.6.1.4 and 20.6.1.5 in Chapter II-2 of the SOLAS Convention in addition to those requirements specified in -1 to -7 above.

#### 2.2.2 Common Overboard Discharge (SOLAS Reg. II-1/15.7)

The number of scuppers, sanitary discharges and other similar openings in the shell plating is to be reduced to the minimum by making one opening common for the discharges from pipes as many as possible or by any other appropriate manner. In general, however, overboard discharges from pipes of different purposes are not to be connected to each other, unless specially approved by the Society.

#### 2.2.3 Sanitary Discharges (SOLAS Reg. II-1/15)

Sanitary piping systems are to comply with the requirements in 2.2.1 and 2.2.2.

#### 2.2.4 Ash-shoot and Rubbish-shoot (LOAD LINE Reg. 22-1)

1 For ash-shoot and rubbish-shoot, two gate valves instead of the non-return valve with a positive means of closing from a position above the freeboard deck which comply with the following requirements are acceptable.

- (1) Two gate valves are to be controlled from the working deck of the chute.
- (2) The lower gate valve is to be controlled from a position above the freeboard deck. An interlock system between the two valves is to be arranged.
- (3) The inboard end is to be located above the waterline formed by an 8.5 degrees heel to port or starboard at a draft corresponding to the assigned summer freeboard, but not less than 1,000 mm above the summer waterline. Where the inboard end exceeds 0.01L<sub>F</sub> above the summer waterline, valve control from the freeboard deck is not required, provided the inboard gate valve is always accessible under service conditions.

2 A hinged weathertight cover at the inboard end of the chute together with a discharge flap may be acceptable in lieu of the upper and lower gate valves complying with the requirements in -1. In this case, the cover and flap are to be arranged with an interlock so that the discharge flap cannot be operated until the hopper cover is closed.

3 The controls for the gate valves and/or hinged covers are to be clearly marked: "Keep closed when not in use".

4 Where the inboard end of the chute is below the freeboard deck, following requirements are to be satisfied.

- (1) The inboard end hinged cover/valve is to be watertight.
- (2) The valve is to be a screw-down non-return valve fitted in an easily accessible position above the deepest load line.
- (3) The screw-down non-return valve is to be controlled from a position above the bulkhead deck and provided with open/closed indicators. The valve control is to be clearly marked: "Keep closed when not in use".

## 2.3 Bilge and Ballast Piping

### 2.3.1 General (SOLAS Reg. II-1/35-1.2 and 35-1.3)\*

1 An efficient bilge system is to be provided, capable of pumping out and draining any watertight compartment other than spaces permanently appropriate for the carriage of liquid and for which other efficient means of draining are provided, under all practical conditions.

2 The bilge pumping system required by -1 above is to be capable of pumping out and draining under all practicable conditions after a casualty whether the ship is upright or listed.

3 In the compartments where the bilge pumping system is required by -1 above, wing suctions are generally to be fitted except in narrow compartments at the end of the ship where one suction may be sufficient. In compartments of unusual form, additional suctions are to be fitted.

4 In the compartments where the bilge pumping system is required by -1 above, arrangements are to be made whereby water in the compartment may find its way to the suction pipes.

5 In case where the bilge suction pipe is at any part situated in the following (1) or (2), a non-return valve is to be fitted to the pipe in the compartment containing the open end.

(1) Areas nearer the side of the ship than one fifth of the breadth of the ship where, the breadth of the ship is the width measured at right angles to the centreline at the level of the deepest subdivision draught.

(2) Duct keel

6 Distribution boxes and valves in connection with the bilge pumping system are to be so arranged that, in the event of flooding, any one of the bilge pumps may be operative on any compartment.

7 Damage to a pump or its pipe connecting to the bilge main located in the areas specified in -5(1) above is not to put the bilge system out action.

8 If there is only one system of pipes common to all the bilge pumps, the necessary valves controlling the bilge suctions are to be capable of being operated from above the bulkhead deck. Such valves are to have their controls at their place of operation clearly marked and are to be provided with means to indicate whether they are open or closed.

9 An efficient ballast piping system is to be provided, capable of pumping ballast water into and from any tanks for carriage of ballast water under all practical conditions.

10 Where the fixed pressure water-spraying fire-extinguishing system or other fixed fire-extinguishing systems which will supply copious quantities of water are fitted for the cargo spaces as required by Part 7, the bilge pumping systems for such cargo spaces are to comply with the requirements.

11 Suitable measures are to be taken to the bilge pumping system to prevent the possibility of water passing from the sea to the watertight compartment and inadvertently passing from one compartment to another. To achieve this requirement, all bilge distribution boxes and manually operated valves in connection with the bilge pumping systems are to be in positions accessible under ordinary circumstances and all valves on the bilge distribution boxes are to be of non-return type.

12 All bilge suction pipes from cargo holds, machinery room and shaft tunnels are to be separate from any pipes other than the bilge suction pipes.

13 Bilge pipes passing through deep tanks used exclusively for ballasting, and bilge pipes and ballast pipes passing through deep tanks other than ballast tanks are to be led through an oiltight or watertight pipe tunnel, or alternatively to be of sufficient thicknesses complying with the requirements in Table D12.6(1) and Table D12.6(2), Part D of the Rules for the Survey and Construction of Steel Ships and of all joints being welded.

14 Bilge pipes penetrating through double bottom tanks are to be led through an oiltight or watertight pipe tunnel, or alternatively to be of sufficient thickness complying with the requirements in Table D12.6(1) and Table D12.6(2), Part D of the Rules for the Survey and Construction of Steel Ships.

15 Bilge pipes penetrating through double bottoms, side tanks, bilge hopper tanks or void spaces, where there is a possibility of damage of these pipes due to grounding or collision, are to be provided with non-return valves near the bilge suctions or stop valves capable of being closed from readily accessible positions.

16 Ballast piping system is to be provided with a suitable provision such as a non-return valve or a stop valve which can be kept closed except when ballasting and de-ballasting and which is provided with an indicator to show whether it is open or closed, in order

to prevent the possibility of water inadvertently passing from the sea to the ballast tanks or of ballast passing from one ballast tank to another.

**17** Where cargo holds are intended for carrying ballast water and cargo alternately, adequate provisions such as blank flange or spool piece are to be made in the ballast piping system to prevent inadvertent ingress of sea water through ballast pipes when carrying cargo and in the bilge piping system to prevent inadvertent discharge of ballast water through bilge pipes when carrying ballast water.

**18** Ballast piping system is not to be connected with a fuel oil tank. However, the requirements may be dispensed with where as deemed appropriate by the Society in consideration of the arrangements of the ballast piping system.

### 2.3.2 Terminology

**1** Main bilge line means a part of the bilge suction line which forms the main of bilge suction line connected to independent power driven bilge pumps specified in 2.3.4-1 and to which all the branch bilge suction pipes from bilge suction specified in 2.3.5 and 2.3.7-1 to -4 are connected.

**2** Branch bilge suction pipe means a pipe connected to the main bilge line from the bilge suction of each compartment.

**3** Direct bilge suction pipe means a bilge suction pipe which is connected directly to an independent power driven pump specified in 2.3.4-1 and arranged to entirely separate from other pipes.

**4** Emergency bilge suction pipe means a bilge suction pipe which is to be used in an emergency case and connected directly to an independent power driven pump specified in 2.3.7-6(1) or -7(1).

### 2.3.3 Sizes of Bilge Suction Pipes (SOLAS Reg. II-1/35-1.2 and 35-1.3)

**1** The main bilge line, direct bilge suction pipes and branch bilge suction pipes from watertight compartments are to be of the internal diameter obtained from the following formulae (1) and (2) or the standard pipes of internal diameters nearest to the calculated diameter. In case where the internal diameter of such standard pipes is smaller than the calculated value by 13mm or more, standard pipes of one grade larger diameter are to be used.

(1) For main bilge line and direct bilge suction pipes:

$$d = 1.68\sqrt{L(B + D)} + 25 \text{ (mm)}$$

where:

$d$ : Internal diameter of the main bilge line or direct bilge suction pipes (mm)

$L$ ,  $B$  and  $D$ : Length, breadth and depth of the ship, respectively (m)

However for ships to which the requirement 2.2.1-5(2) is applied, “ $D$ ” is to be considered as follows:

(a) For ships of which enclosed cargo spaces are extended for the full length of the ship, “ $D$ ” is to be considered as the depth of the ship measured to the next deck above the bulkhead deck (m)

(b) For ships of which enclosed cargo spaces are not extended for the full length of the ship, “ $D$ ” is to be considered as the depth of the ship plus  $l' \times h/L$  (m), where  $l'$  and  $h$  are the aggregate length and height of the enclosed cargo spaces respectively

(2) For branch bilge suction pipes :

$$d' = 2.15\sqrt{l(B + D)} + 25 \text{ (mm)}$$

where:

$d'$ : Internal diameter of branch bilge suction pipes (mm)

$l$ : Length of the compartment to be served by the branch bilge suction pipes (m)

$B$  and  $D$ : As defined in (1).

**2** The internal diameter of main bilge line is not to be less than any one of those of the branch bilge suction pipes obtained from the formula in -1(2).

**3** The internal diameter of direct bilge suction pipes is also to comply with the requirements in 2.3.7-5(1) and (2).

**4** Where bilge suction are provided at the fore and after parts of a cargo hold in accordance with the requirements in 2.3.5-1, the internal diameter of the branch bilge suction pipe at the fore part may be reduced to 0.7 times the value obtained from the formula in -1(2).

**5** Where the bilge pumps in the engine room are exclusively used for bilge drainage in the engine room, the internal diameter of main bilge line and direct bilge suction pipes may be reduced to the value obtained from the following formula:

$$d = \sqrt{2} \left( 2.15\sqrt{l(B + D)} + 25 \right) \text{ (mm)}$$

where:

$l$ : Length of the engine room ( $m$ ).

$d$ ,  $B$  and  $D$ : As defined in -1.

6 The internal diameter of branch bilge suction pipes is not to be less than 50mm. However, it may be reduced to 40mm, where the branch bilge suction pipe is for a small compartment and considered acceptable by the Society.

7 The internal sectional area of bilge suction pipes connecting two or more branch bilge suction pipes to the main bilge line is to be larger than the sum of the internal sectional areas of the largest two branch bilge suction pipes, but need not to exceed the internal sectional area of the main bilge line obtained from the formula in -1(1).

8 The internal diameter of branch bilge suction pipes for fore and after peaks and shaft tunnels are not to be less than 65mm. However, in ships less than 60m in length, it may be reduced to 50mm.

### 2.3.4 Bilge Pumps (SOLAS Reg. II-1/35-1.3)

#### 1 Number and arrangement of bilge pumps

- (1) All ships are to be provided with at least three independent power bilge pumps connected to the main bilge line, one of which may be driven by the propulsion machinery. Where the criterion of service numeral prescribed in 2.1.37, Part 1 is 30 or more, one additional independent power pump is to be provided.
- (2) Ballast, sanitary and general service pumps driven by independent power may be accepted as independent power bilge pumps in (1) above, provided that they are connected properly to the main bilge line.
- (3) Where practicable, the power bilge pumps are to be placed in separate watertight compartments and so arranged or situated that these compartments will not be flooded by the same damage. If the main propulsion machinery, auxiliary machinery and boilers are in two or more watertight compartments, the pumps available for bilge service are to be distributed as far as possible throughout these compartments.
- (4) On a ship of 91.5m in length and upwards or having a criterion of service numeral prescribed in 2.1.37, Part 1 of 30 or more, the arrangements are to be such that at least one power bilge pump is to be available for use in all flooding conditions which the ship is required to withstand, and in all flooding conditions derived from consideration of minor damages as specified in 2.3.7, Part 4 as follows.
  - (a) One of the required bilge pumps is to be an emergency pump of a reliable submersible type having a source of power situated above the bulkhead deck.
  - (b) The bilge pumps and their sources of power are to be so distributed throughout the length of the ship that at least one pump as an emergency pump in an undamaged compartment will be available.
- (5) With the exception of additional pumps which may be provided for peak compartments only, each required bilge pump is to be so arranged as to draw water from any space required to be drained by 2.3.1-1.

#### 2 Capacity of bilge pumps

Each pump specified in -1 is to be capable of discharging bilge of not less than that obtained from the following formula through the main bilge line specified in 2.3.3:

$$Q = 5.66d^2 \times 10^{-3} \text{ (m}^3/\text{h)}$$

where:

$Q$ : Required quantity ( $\text{m}^3/\text{h}$ )

$d$ : Internal diameter of the main bilge line specified in 2.3.3 (mm)

#### 3 Types of bilge pumps

All independent power bilge pumps prescribed in -1 are to be of self-priming type or equivalent thereto so as to be immediately operable when in use.

### 2.3.5 Bilge Suction Arrangement in Holds

1 In ships having only one hold exceeding 33m in length, bilge suction is to be provided in suitable positions in the after half-length and in the forward half-length of the hold.

2 Where the inner bottom plating extends to the ship's sides, the bilge suction is to be placed in wells at both wings and also at the centre line if the top plating has an inverse camber.

3 Where close ceiling is fitted over the bilges of the holds, proper arrangement is to be made whereby water in the hold compartment may find its way to the suction.

4 In the refrigerated chambers, the insulation to bilge wells and bilge suction strums in bilge ways is to be of a plugged type and removable.

5 In the refrigerated chambers, the insulation in way of bilge suction pipes is to be removable within the extent necessary for inspection.

### **2.3.6 Bilge Drainage from Top of Deep Tanks, Fore and After Peak Tanks and Chain Lockers\***

1 Bilge of fore and after peak tanks, compartments on the deck forming the top of these tanks and chain lockers may be drained by eductors or hand pumps. These eductors or hand pumps are to be capable of being operated at any time from accessible positions above the load water line.

2 Efficient means are to be provided for draining bilge from top of the deep tanks and other watertight flat such as steps of bulkheads.

3 Drain from spaces above deep tanks may be led to bilge wells in the shaft tunnel or an accessible compartment. In this case, these pipes are not to be more than 65A in nominal diameter and are to be provided with quick-acting self-closing valves located in an accessible position.

4 In case where a suction line is led through the collision bulkhead, it is to comply with the requirements in [6.3.2, Part 3](#).

### **2.3.7 Bilge Suction Arrangement in Engine Room (SOLAS Reg. II-1/35-1.3)**

1 Where there is no double bottom in the engine room, at least two bilge suction are to be provided near the centre line of the ship. One of these suction is to be a suction for branch bilge suction pipe and the other is to be a suction for a direct bilge suction pipe. If the slope of floor is less than 5 degrees, additional bilge suction are to be provided at both wings.

2 Where there is a double bottom in the engine room and bilge ways are formed at wings, a branch bilge suction and a direct bilge suction are to be provided at each wing.

3 Where the double bottom plating extends to the ship's sides, bilge wells are to be formed at both wings, and a branch bilge suction and a direct bilge suction are to be provided in each bilge well.

4 Where the engine room is separated by watertight bulkheads from a boiler room or an auxiliary machinery room, the bilge suction in the boiler room or the auxiliary machinery room are to comply with the requirements in [-1](#) in case of no double bottom construction, and are to comply with the requirements in [-2](#) or [-3](#) in case of double bottom construction. Only one direct bilge suction, however, will be accepted even in case of double bottom construction.

5 Direct bilge suction pipes are to comply with the following requirements.

- (1) The internal diameter of direct bilge suction pipes is not to be less than that obtained from the formula in [2.3.3-1\(1\)](#). Where a direct bilge suction pipe is provided on each side of the engine room in accordance with the requirements in [-2](#) or [-3](#), the internal diameter of one of the direct bilge suction pipes may be reduced to that obtained from the formula in [2.3.3-1\(2\)](#). In this case, the pipe reduced in its diameter is to be located on the same side as the emergency bilge suction pipe specified in [-6](#) or [-7](#).

- (2) Notwithstanding the requirements in (1), where the compartments are of small dimensions, the internal diameter of the direct bilge suction pipes may be adequately reduced.

6 Emergency bilge suction pipes for ships with steam turbines as the main propulsion machinery are to comply with the following requirements.

- (1) An emergency bilge suction pipe with a screw-down non-return valve having a hand wheel which is easily operable from above the platform in the engine room, is to be fitted to the suction end of the main circulating pump, and the suction end of this pump is to be located at a suitable level in the engine room to discharge bilge in case of emergency. The internal diameter of such suction pipe is not to be less than two-thirds of the diameter of that of pump suction.
- (2) Where the main circulating pump is not considered suitable for bilge discharge, the emergency bilge suction pipe may be fitted to the largest available power pump in the engine room other than the bilge pumps specified in [2.3.4-1](#). The capacity of this pump is not to be less than that required by [2.3.4-2](#). The internal diameter of such suction pipe is to be equal to that of pump suction.
- (3) Where the pump prescribed in (1) or (2) is of self-priming type, the direct bilge suction arranged on the same side of the emergency bilge suction may be omitted.

7 Emergency bilge suction pipes for ships in which reciprocating internal combustion engines or gas turbines are used as main propulsion machinery are to comply with the following requirements.

- (1) An emergency bilge suction pipe with a screw-down non-return valve having a hand wheel which is easily operable from above the platform in the engine room is to be fitted to the main cooling water pump, and the suction end is to be located at a suitable level in the engine room to discharge bilge in case of emergency. The internal diameter of such suction pipe is to be equal to that of pump suction.
- (2) Where the main cooling water pump is not considered suitable for bilge discharge, the emergency bilge suction pipe may be fitted to the largest available power pump in the engine room other than the bilge pumps specified in 2.3.4-1. The capacity of this pump is not to be less than that required by 2.3.4-2. The internal diameter of such a suction pipe is to be equal to that of pump suction.
- (3) Where the pump prescribed in (1) or (2) is of self-priming type, the direct bilge suction arranged on the same side of the emergency bilge suction may be omitted.

#### **2.3.8 Bilge Wells\***

- 1 The depth of bilge wells constructed in double bottom and the height from the bottom plating to the bottom of bilge wells are to comply with the requirements in 4.1.1-4, Part 3.
- 2 The capacity of each bilge well is not to be less than  $0.17m^3$ .
- 3 The bilge well may be substituted with a steel bilge hats with a reasonable capacity where the space to be drained is small or not capable of being provided with a bilge well with the volume prescribed in -2.
- 4 Where manholes to access the bilge well of cargo holds are necessary, they are to be located as near the bilge suction as practicable. It is to be avoided, as far as practicable, to provide such manholes on the fore and after bulkheads and inner bottom plating of the engine room.

#### **2.3.9 Mud Boxes and Strum Boxes**

- 1 Bilge suction pipes except for the emergency bilge suction pipes in engine rooms and shaft tunnels are to be provided with mud boxes having covers easy to be opened or closed in an easily accessible position from the topside of the platform in the engine room and straight tail pipes to bilge wells are to be fitted to the suction side of the mud boxes.
- 2 The bilge suction ends in hold spaces are to be provided with strum boxes having perforation approximately 10mm in diameter and an open area more than twice that of the suction pipes. The strum boxes are to be so constructed that they can be cleaned without disconnecting any joint of the suction pipes.

### **2.4 Flooding Detection Systems**

#### **2.4.1 General (SOLAS Reg. II-1/22-1)\***

For ships carrying 36 or more persons, a flooding detection system is to be fitted in all watertight spaces below the bulkhead deck that have a volume more than the following (1) or (2), whichever is greater.

- (1) Ship's moulded displacement per centimeter immersion, ( $m^3$ ), at deepest subdivision draught
- (2)  $30m^3$

## Chapter 3      STEERING GEARS

### 3.1      General

#### 3.1.1      Scope\*

- 1 The requirements in this Chapter apply to power-driven steering gears.
- 2 For items especially specified in this Chapter, the requirements in this Chapter are to be applied in lieu of the requirements in **Part D of the Rules for the Survey and Construction of Steel Ships**.
- 3 Electrical equipment and cables used for steering gears are to conform to the requirements of **Part 6** in addition to the requirements of **Chapter 15, Part D of the Rules for the Survey and Construction of Steel Ships**.
- 4 Manual steering gears will be considered by the Society in each case.

### 3.2      Performance and Arrangement of Steering Gears

#### 3.2.1      Number of Steering Gears (*SOLAS* Reg. II-1/29.1 and 29.6)\*

1 Unless expressly specified elsewhere, every ship is to be provided with a main steering gear and an auxiliary steering gear. The main steering gear and the auxiliary steering gear are to be so arranged that the failure of one of them will not render the other one inoperative.

2 Where the main steering gear comprises two or more identical power units, the auxiliary steering gear need not be fitted, provided that:

- (1) the main steering gear is capable of operating the rudder as required by **3.2.2(1)** while any one of the power units is out of operation;
- (2) the main steering gear is so arranged that after a single failure in its piping system or in one of the power units the defect can be isolated so that steering capability can be maintained or speedily regained. Steering gears, other than of the hydraulic type, will be considered by the Society in each case.

#### 3.2.2      Performance of Main Steering Gear (*SOLAS* Reg. II-1/29.3)

The main steering gear is to be:

- (1) capable of putting the rudder over from 35 degrees on one side to 35 degrees on the other side with the ship at its load draught and running ahead at the speed specified in **2.1.8, Part A of the Rules for the Survey and Construction of Steel Ships** and, under the same conditions, from 35 degrees on either side to 30 degrees on the other side in not more than 28 *seconds*;
- (2) operated by power when the main steering gear has to meet the requirements in (1) or when the diameter of upper stock is required in **Chapter 13, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships** to be over 120mm (calculated with a material factor  $K_S = 1$  where  $K_S$  is less than 1, and excluding the increase required for ships which have strengthening for navigation in ice, the same being referred hereinafter); and
- (3) so designed that they will not be damaged at maximum astern speed ; however, this design requirements need not be proved by trials at maximum astern speed and maximum rudder angle.

#### 3.2.3      Performance of Auxiliary Steering Gear (*SOLAS* Reg. II-1/29.4)\*

The auxiliary steering gear is to be:

- (1) capable of putting the rudder over from 15 degrees on one side to 15 degrees on the other side in not more than 60 *seconds* with the ship at its load draught and running ahead at one half of the speed specified in **2.1.8, Part A of the Rules for the Survey and Construction of Steel Ships** or 7 *knots*, whichever is the greater, and capable of being brought speedily into action in an emergency; and
- (2) operated by power when the auxiliary steering gear has to meet the requirements in (1) or when the diameter of upper stock is required in **Chapter 13, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships** to be over 230mm.



## Chapter 4 SPECIAL REQUIREMENTS FOR MACHINERY INSTALLED IN SHIPS WITH RESTRICTED AREA OF SERVICE

### 4.1 General

#### 4.1.1 Scope

The requirements in this Chapter apply to machinery to be installed in ships intended for registry with restricted areas of service in place of the relevant requirements in Chapters up to the preceding **Chapter 3**.

### 4.2 Modified Requirements

#### 4.2.1 Ships with Class Notation “Coasting Service” or Equivalent

**1** For the following machinery, provisions of spare one may be omitted provided that the total capacity of machinery is sufficient enough to obtain the maximum continuous output of the main propulsion machinery or the maximum evaporative capacity of the main and essential auxiliary boiler, and two sets of machinery in nearly the same capacity and whose capacity of either one set is sufficient enough to obtain navigable speed of the ships.

- (1) The source of pressure to drive the clutch of power transmission systems for main propulsion specified in **5.2.4-3, Part D of the Rules for the Survey and Construction of Steel Ships**.
- (2) Hydraulic pumps for pitch control gears of controllable pitch propellers specified in **7.2.2-8, Part D of the Rules for the Survey and Construction of Steel Ships**.
- (3) Fuel oil supply pumps specified in **13.9.6-1 and -2, Part D of the Rules for the Survey and Construction of Steel Ships**.
- (4) Burning systems for boilers specified in **13.9.7-1 and -2, Part D of the Rules for the Survey and Construction of Steel Ships**.
- (5) Lubricating oil pumps specified in **13.10.2-1 and -2, Part D of the Rules for the Survey and Construction of Steel Ships**.
- (6) Cooling water (oil) pumps for main propulsion machinery specified in **13.12.1-1 and -2 Part D of the Rules for the Survey and Construction of Steel Ships**.
- (7) Feed water systems specified in **13.15.1-1 and -2, Part D of the Rules for the Survey and Construction of Steel Ships**.

**2** In the following requirements, the provisions to provide a complete set of the spare pump may not apply.

- (1) **13.9.6-1(2), Part D of the Rules for the Survey and Construction of Steel Ships**.
- (2) **13.10.2-1(2), Part D of the Rules for the Survey and Construction of Steel Ships**.
- (3) **13.12.1-1(3), Part D of the Rules for the Survey and Construction of Steel Ships**.

**3** The requirement specified in **15.3.1-4, Part D of the Rules for the Survey and Construction of Steel Ships** may not apply.

**4** For ships with the Class Notation “Coasting Service” or equivalent, which are not engaged in international voyages, the following requirements may apply in addition to the requirements in **-1 to -3** above.

- (1) The requirements in **13.4 and 13.5, Part D of the Rules for the Survey and Construction of Steel Ships** may apply in place of the relevant requirements in **Chapter 2** of this Part. However, the requirements specified in **13.4.1-4, Part D of the Rules for the Survey and Construction of Steel Ships** may not apply.
- (2) The requirements in **15.2.1 to 15.2.3, Part D of the Rules for the Survey and Construction of Steel Ships** may apply in place of the relevant requirements in **Chapter 3** of this Part.
- (3) The requirements specified in **2.5.4-2, Part D** and **4.2.2(5)(b), Part R of the Rules for the Survey and Construction of Steel Ships** may not apply to reciprocating internal combustion engines having an maximum continuous output of less than 375 kW installed in the space other than machinery spaces of category *A*, provided that a suitable enclosure for the fuel injection piping system is fitted.
- (4) The requirements specified in **1.3.8, Part D of the Rules for the Survey and Construction of Steel Ships** may not apply.
- (5) The requirements specified in **1.3.9, Part D of the Rules for the Survey and Construction of Steel Ships** may not apply.
- (6) Any other appropriate unit specified in **5.2.4-3, Part D of the Rules for the Survey and Construction of Steel Ships** may be replaced with emergency fixing bolts for clutch to enable the ship to have a navigable speed.



- (7) Other suitable device specified in **7.2.2-8, Part D of the Rules for the Survey and Construction of Steel Ships** may be replaced with a propeller pitch-fixing device to enable the ship to have a navigable speed.
- (8) The requirements specified in **13.6.1-5, 13.9.1-5 and 13.9.1-6, Part D of the Rules for the Survey and Construction of Steel Ships** may not apply.
- (9) The requirements of an additional oil level gauge specified in **4.2.2(3)(e)(i), Part R of the Rules for the Survey and Construction of Steel Ships** may not apply.
- (10) The requirements specified in **15.1.5, Part D of the Rules for the Survey and Construction of Steel Ships** may not apply.
- (11) The requirements specified in **15.2.4-5 and -6, Part D of the Rules for the Survey and Construction of Steel Ships** may not apply (excluding those cases where the provision of auxiliary steering gear is omitted according to the requirements in **3.2.1-2**).
- (12) The requirements for an alternative source of power specified in **15.2.6, Part D of the Rules for the Survey and Construction of Steel Ships** may not apply.
- (13) The requirements in **15.2.7-1 and -7, Part D of the Rules for the Survey and Construction of Steel Ships** may not apply.
- (14) The requirements for overload alarm for motors specified in **15.2.7-5, Part D of the Rules for the Survey and Construction of Steel Ships** may not apply.
- (15) A means of communication between the navigating bridge and the steering gear compartment specified in **15.2.9, Part D of the Rules for the Survey and Construction of Steel Ships** may be replaced with an appropriate alternative means.
- (16) The requirements in **15.3.1-3, Part D of the Rules for the Survey and Construction of Steel Ships** may not apply.
- (17) The requirements in **2.4** may not apply.

#### **4.2.2 Ships with the Class Notation “Smooth Water Service” or Equivalent**

**1** The buffer arrangements specified in **15.4.9, Part D of the Rules for the Survey and Construction of Steel Ships** may be omitted, and in addition, the requirements specified in **4.2.1-1, -2 and -3** above may apply.

**2** For ships with the Class Notation “Smooth Water Service” or equivalent which are not engaged in international voyages, the following requirements may apply in addition to the requirements specified in **4.2.1-1 to -4, and 4.2.2-1**.

- (1) Notwithstanding the requirements in **1.3.1-4, Part D of the Rules for the Survey and Construction of Steel Ships**, provisions of one unit or one set each of the machinery specified in **4.2.1-1(1) to (7)** may be accepted, provided that each has such a capacity sufficient for the main propulsion machinery to obtain the maximum continuous output and for the main and essential auxiliary boiler to obtain the maximum evaporative capacity.
- (2) The requirements for fuel oil transfer pumps specified in **13.9.3, Part D of the Rules for the Survey and Construction of Steel Ships** may be modified to require one pump driven by an independent source of power.
- (3) Notwithstanding the requirement in **1.3.1-3, Part D of the Rules for the Survey and Construction of Steel Ships**, the requirements for two or more starting air compressors specified in **13.13.3, Part D of the Rules for the Survey and Construction of Steel Ships** may be modified to one starting air compressor driven by an independent source of power.

### **4.3 Spare Parts, Tools and Instruments for Ships with Restricted Areas of Service**

#### **4.3.1 Spare Parts, Tools and Instruments and etc. for Ships with Class Notation “Coasting Service” or Equivalent**

Spare parts for the machinery installed in ships with a Class Notation of “Coasting Service” or equivalent may be in compliance with the requirements specified in **Table 5.4.1**. Further, for ships equipped with 2 or more reciprocating internal combustion engines or steam turbines used as main propulsion machinery and for ships equipped with 2 or more main generators, spare parts for such engines or turbines are not required, respectively.

#### **4.3.2 Spare Parts for Ships with Class Notation “Smooth Water Service” or Equivalent**

Spare parts for the machinery installed in ships with a Class Notation of “Smooth Water Service” may be in compliance with the requirements specified in **Table 5.4.2**. Further, for ships equipped with 2 or more reciprocating internal combustion engines or steam turbines used as main propulsion machinery and for ships equipped with 2 or more main generators, spare parts for such engines or turbines are not required, respectively.

Table 5.4.1 Spare Parts for Ships of Coasting Service

Table D21.1 Spare Parts for Ships of Coasting Service					
Area of service	Table No. in <b>Chapter 21, Part D of the Rules for the Survey and Construction of Steel Ships</b>		Items and types of spares	Quantity	
Coasting Service	Table D21.1	Table D21.2	Cylinder liner, cylinder cover, piston, camshaft driving gear, cylinder lubricator, scavenging air blower (including turbocharger), scavenging air system, reduction gear, reversing gear	Omitted	
			Main bearing, piston cooling system		
			Cylinder-mounted valve		Starting air valve, relief valve
					Exhaust gas valve, fuel injector
			Connecting rod bearing	Lower half of small end bearing metal, upper half of big end bearing metal, one piece each	
	Table D21.3 and Table D21.4		All items and all types	Omitted	
	Table D21.5	Cylindrical water gauge glass		6 pieces	
		Flat water gauge glass		One piece	
	Table D21.6	Centrifugal pump, gear pump, air compressor		Omitted	
	Table D21.7	Standard pressure gauge			
Tube plug		Water tube boiler	4 pieces each		
		Other types boiler	4 pieces in total		

Table 5.4.2 Spare Parts for Ships of Smooth Water Service

Table D21.2 Spares Parts for Ships of Smooth Water Service				
Area of service	Table No. in <b>Chapter 21, Part D of the Rules for the Survey and Construction of Steel Ships</b>	Items and types of spares		Quantity
Smooth Water Service	<b>Table D21.1</b> and <b>Table D21.2</b>	Connecting rod bearing		Lower half of small end bearing metal, upper half of big end bearing metal, one piece each
		All items excluding connecting rod bearing		Omitted
	<b>Table D21.1</b> and <b>Table D21.2</b>	All items and all types		
	<b>Table D21.5</b>	Safety valve spring, complete set of oil burner nozzles		
		Cylindrical water gauge glass		
		Flat water gauge glass		One piece
	<b>Table D21.6</b>	Centrifugal pump, gear pump, air compressor		Omitted
	<b>Table D21.7</b>	Standard pressure gauge		
		Tube plug	Water tube boiler	
Other types of boiler			2 pieces in total	

## Part 6 ELECTRICAL INSTALLATIONS

### Chapter 1 GENERAL

#### 1.1 General

##### 1.1.1 Scope\*

1 The requirements in this part apply to the electrical equipment and wiring for ships (hereinafter referred to as the “electrical installations”)

2 For electrical installations of ships with restricted service area and electrical installations of ships other than those to which the Society's permission are given, the application of the requirements of this part may partly be modified in accordance with the requirements of **Chapter 4** except those specified for the protection of shocks, fire and other hazards caused by electricity.

3 For electrical installations, requirements in **Part H of the Rules for the Survey and Construction of Steel Ships** listed in the following (1) to (11) as well as the requirements in this Part are to be applied. In this case, the Society may arrange the requirements partly in order to make them suitable to apply to the passenger ships.

- (1) **1.1.2**           Equivalency
- (2) **1.1.3**           Electrical Installations with Novel Design Features
- (3) **1.1.5**           Definitions
- (4) **1.1.6**           Drawings and Data
- (5) **1.1.7**           Ambient Conditions
- (6) **1.2**            Testing
- (7) **Chapter 2**       ELECTRICAL INSTALLATIONS AND SYSTEM DESIGN
- (8) **3.4**            Starting Arrangement for Emergency Generating Sets
- (9) **3.7**            Lightning Conductors
- (10) **3.8**           Spare Parts, Tools and Instruments
- (11) **Chapter 5**     ADDITIONAL REQUIREMENTS FOR ELECTRIC PROPULSION PLANTS

#### 1.2 General Requirements for Electrical Installations

##### 1.2.1 Cable Installation (*SOLAS* Reg. II-1/45.11)

Main and emergency feeders passing through a main vertical zone are to be separated both vertically and horizontally as widely as is practicable.

## Chapter 2 DESIGN OF INSTALLATIONS

### 2.1 General

#### 2.1.1 General

This chapter specifies the requirements for the design of installations of main source of electrical power, emergency source of electrical power and other electrical installations on board ships.

#### 2.1.2 Design and Construction (*SOLAS* Reg. II-1/40)\*

Electrical installations are to comply with the following:

- (1) All electrical auxiliary services necessary for maintaining the ship in normal operational and habitable conditions and other electrical services as deemed necessary by the Society will be ensured without recourse to the emergency source of electrical power;
- (2) Electrical services essential for safety will be ensured under various emergency conditions; and
- (3) The safety of passengers, crew and ship from electrical hazards will be ensured.

### 2.2 Main Source of Electrical Power and Lighting Systems

#### 2.2.1 Main Source of Electrical Power\*

1 A main source of electrical power of sufficient capacity to supply all those services specified in **2.1.2(1)** is to be provided. This main source of electrical power is to consist of at least two generating sets. (*SOLAS* Reg. II-1/41.1.1)

2 The capacity of these generating sets is to be such that in the event of any one generating set being stopped it will still be possible to supply those services necessary to provide normal operational conditions of propulsion and safety and other electrical services as deemed necessary by the Society. Minimum comfortable conditions of habitability is also to be ensured which include at least adequate services for cooking, heating, domestic refrigeration, mechanical ventilation, sanitary and fresh water. (*SOLAS* Reg. II-1/41.1.2)

3 Where the main source of electrical power is necessary for propulsion and steering of the ship, the system is to be so arranged that the electrical supply to equipment necessary for propulsion and steering and to ensure safety of the ship will be maintained or immediately restored in the case of loss of any one of the generators in service. (*SOLAS* Reg. II-1/41.5.1.1)

4 The arrangements of the ship's main source of electrical power are to be such that the services referred to the requirement in **2.1.2(1)** can be maintained regardless of the speed and direction of the propulsion machinery or shafting. (*SOLAS* Reg. II-1/41.1.3)

5 The generating sets are to be such as to ensure that with any one generator or its primary source of power out of operation, the remaining generating sets are to be capable of providing the electrical services necessary to start the main propulsion plant from a dead ship condition. The emergency source of electrical power may be used for the purpose of starting from a dead ship condition if its capability either alone or combined with that of any other source of electrical power is sufficient to provide at the same time those services required to be supplied by the requirements in **2.3.2-2(1)** to **(4)**. (*SOLAS* Reg. II-1/41.1.4)

#### 2.2.2 Number and Ratings of Transformers\*

Where transformers constitute an essential part of the electrical supply system required by **2.2.1**, the system is to be so arranged as to ensure the same continuity of the supply as stated in **2.2.1**. (*SOLAS* Reg. II-1/41.1.5)

#### 2.2.3 Lighting Systems\*

1 A main electric lighting system supplied from the main source of electrical power is to be provided in spaces or compartments where passengers and crew use and normally work on duty. (*SOLAS* Reg. II-1/41.2.1)

2 The main electric lighting system is to be so arranged as not to be impaired in the event of a fire or other causality in spaces containing the emergency source of electrical power, associated transforming equipment, the emergency switchboard and the emergency lighting switchboard. (*SOLAS* Reg. II-1/41.2.3)

3 Emergency lighting is to provide sufficient illumination necessary for the safety;  
(*SOLAS* Reg. II-1/42.2.1)

- (1) at every muster and embarkation station as required by Regulation 11.4 and 15.7, Chapter III, *SOLAS*;
- (2) in alleyways, stairways and exits giving access to the muster and embarkation station as required by Regulation 11.5, Chapter III, *SOLAS*
- (3) in all service and accommodation alleyways, stairways and exits, personnel lift cars and personnel lift trunks;
- (4) in the machinery spaces and main generating stations including their control positions;
- (5) in all control stations, machinery control rooms, and at each main and emergency switchboard;
- (6) at all stowage positions for firemen's outfit;
- (7) at the steering gear; and,
- (8) at the fire pump referred to in **2.3.2-2(5)**, at the sprinkler pump and at the emergency bilge pump referred to in **2.3.4-1(4)**, **Part 5** and at the starting positions of their motors.

#### **4 Supplementary Emergency Lighting for ro-ro Passenger Ships (*SOLAS* Reg. II-1/42-1.1)**

##### **(1) Supplementary Lighting consisting of accumulator batteries**

All passenger public spaces and alleyways are to be provided with supplementary electric lighting complied with the following **(a) to (d)**;

- (a) To be capable of operating for at least 3 *hours* when all other sources of electric power have failed and under any condition of heel;
- (b) The illumination of those is to be such that the approach to the means of escape can be readily seen;
- (c) For easily apparent of any failure of lamp, the lighting is to be provided with a test switch, or to be arranged so that it always illuminates, or other equivalent means are to be provided; and,
- (d) Accumulator batteries located within the lighting units are to be continuously charged from the emergency switchboard.

##### **(2) Portable rechargeable battery operated lamp**

A portable rechargeable battery operated lamp is to be provided in every crew space alleyway, recreational space and every working space which is normally occupied unless supplementary emergency lighting, as required by **(1)** above, is provided.

**5** The emergency electric lighting systems specified in **-3** and navigation lights and other lights specified in **2.3.2-2(2)** are to be so arranged as not to be impaired in the event of a fire or other causality in spaces containing the main source of electrical power, associated transforming equipment, the main switchboard and the main lighting switchboard. (*SOLAS* Reg. II-1/41.2.3)

**6** Supplementary lighting shall be provided in all cabins to clearly indicate the exit so that occupants will be able to find their way to the door. Such lighting, which may be connected to an emergency source of power or have a self-contained source of electrical power in each cabin, shall automatically illuminate when power to the normal cabin lighting is lost and remain on for a minimum of 30 minutes.

#### **2.2.4 Location of Main Switchboard (*SOLAS* Reg. II-1/41.3)\***

The main switchboard and one main generating station are to be located in a same space. However, the main switchboard may be separated from the generators by an environmental enclosure, such as may be provided by a machinery control room situated within the main boundaries of the space.

### **2.3 Emergency Source of Electrical Power**

#### **2.3.1 General\***

**1** A self-contained emergency source of electrical power is to be provided. (*SOLAS* Reg. II-1/42.1.1)

**2** The emergency source of electrical power, associated transforming equipment, the transitional source of emergency electrical power, the emergency switchboard and the emergency lighting switchboard are to be located above the uppermost continuous deck and are to be readily accessible from the open deck. They are not to be located forward of the collision bulkhead. (*SOLAS* Reg. II-1/42.1.2)

**3** The location of the emergency source of electrical power, associated transforming equipment, the transitional source of emergency electrical power, the emergency switchboard and the emergency lighting switchboard are to be such as to ensure to the satisfaction of the Society that a fire or other casualty in the space containing the main source of electrical power, associated transforming equipment, and the main switchboard, or in any machinery space of category *A* will not interfere with the supply, control and distribution of emergency electrical power. As far as practicable, the space containing the emergency source of electrical power, associated transforming equipment, the transitional source of emergency electrical power and the emergency switchboard is not to be

contiguous to the boundaries of machinery spaces of category *A* or those spaces containing the main source of electrical power, associated transforming equipment and the main switchboard. (*SOLAS* Reg. II-1/42.1.3)

4 Provided that suitable measures are taken for safeguarding independent emergency operation under all circumstances, the emergency generator may be used, exceptionally, and for short periods, to supply non-emergency circuits. (*SOLAS* Reg. II-1/42.1.4)

### 2.3.2 Capacity of Emergency Source of Power (*SOLAS* Reg. II-1/42.2)\*

1 The electrical power available is to be sufficient to supply all those services that are essential for safety in an emergency, due regard being paid to such services as may have to be operated simultaneously.

2 The emergency source of electrical power is to be capable, having regard to starting currents and the transitory nature of certain loads, of supplying simultaneously at least the following services for the periods specified hereinafter, if they depend upon an electrical source for their operation:

- (1) For a period of 36 *hours*, the emergency lighting specified in 2.2.3-3 and -4.
  - (2) For a period of 36 *hours*, the navigation lights and other lights required by the International Regulations for Preventing Collisions at Sea in force and lights required by the National Regulations of the country to which the ship is registered.
  - (3) For a period of 36 *hours*, installations listed in the following (a) to (d) as required by Chapter IV of *SOLAS* and installed in the ship. Where, however, these radio installations are installed in duplicate, it is not necessary to consider duplicated installations are operated simultaneously in determining capacity of the emergency source of electrical power.
    - (a) *VHF* radio installations
    - (b) *MF* radio installations
    - (c) Recognized mobile satellite service ship earth stations
    - (d) *MF/HF* radio installations
  - (4) For a period of 36 *hours* (unless such services have an independent supply for the period of 36 *hours* from an accumulator battery suitably located for use in an emergency):
    - (a) All internal communication equipment as required in an emergency;
    - (b) The navigational aids as required by Regulation 12, Chapter V of *SOLAS* unless the flag Government exempts the ship from application of said Regulation; where such provision is unreasonable or impracticable this requirement may be waived for ships of less than 5,000 *gross tonnage*;
    - (c) The fire detection and fire alarm system, and the fire door holding and release system; and
    - (d) Intermittent operation of the daylight signaling lamp, the ship's whistle, the manual fire alarms, and all internal signals that are required in an emergency;
  - (5) For a period of 36 *hours*, the fire pump so designed as being supplied from the emergency generator by the requirements in Chapter 4, Part 7.
  - (6) For the period of time required by Chapter 3, Part 5, the steering gear where it is required to be so supplied by that requirement.
  - (7) For a period of 36 *hours*, the automatic sprinkler pump specified in Chapter 4, Part 7.
  - (8) For a period of 36 *hours*, the emergency bilge pump and all the equipment essential for the operation of electrically powered remote controlled bilge valves.
  - (9) For a period of 30 *minutes*:
    - (a) Any watertight doors required by 6.4 Part 3 to be power operated together with their indicators and warning signals;
    - (b) The emergency arrangements to bring the lift cars to deck level for the escape of persons. The passenger lift cars may be brought to deck level sequentially in an emergency.
  - (10) For 36 *hours*, low location lighting (electrically operated ones only) required by Chapter 3, Part 7. (*SOLAS* Reg. II-2/13.3.2.5)
  - (11) For the period of 36 *hours*, intermittent operation of means to bring the stabilizer wings inboard and indicators to show the position of them, as required by Paragraph 9, Regulation 16, Chapter III, the Annex to *SOLAS* Convention.
  - (12) For the period of 36 *hours*, intermittent operation of the secondary launching appliances of the free-fall lifeboat as required by Paragraph 6.1.4.7, Chapter VI of the International Life-Saving Appliances (*LSA*) Code.
  - (13) In a ship engaged regularly in voyages of short duration, the Society if satisfied that an adequate standard of safety would be attained may accept a lesser period than the 36 *hours* period specified in (1) to (8) and (10) but not less than 12 *hours*.
- 3 Where electrical source is necessary to restore propulsion, the capacity of the emergency source of power shall be sufficient

to restore propulsion to the ship from a dead ship condition within 30 *minutes* after blackout. (SOLAS II-1/42.3.4)

### **2.3.3 Kind and Performance of Emergency Source of Electrical Power (SOLAS Reg. II-1/42.3)\***

The emergency source of electrical power is to be a generator or an accumulator battery or an uninterruptible power system, which is to comply with the following:

- (1) Where the emergency source of electrical power is a generator, it is to comply with the following:
  - (a) The emergency generator is to be driven by a suitable prime mover with an independent supply of fuel, having a flashpoint (closed cup test) of not less than 43°C;
  - (b) The emergency generator is to be started automatically upon failure of the main source of electrical power and to be automatically connected to the emergency switchboard; those services referred to the requirements in 2.3.4 are then to be transferred automatically to the emergency generator; The emergency generator is to supply the required load as quickly as is safe and practicable subject to a maximum of 45 *seconds*;
  - (c) A transitional source of emergency electrical power specified in 2.3.4 is to be provided.
- (2) Where the emergency source of electrical power is an accumulator battery it is to be capable of:
  - (a) carrying the emergency electrical load without recharging while maintaining the voltage of the battery throughout the discharge period within 12 % above or below its nominal voltage;
  - (b) automatically connecting to the emergency switchboard in the event of failure of the main source of electrical power; and
  - (c) immediately supplying at least those services specified in paragraph 2.3.4.
- (3) Where the emergency generator is an uninterruptible power system, the requirements are as deemed appropriate by the Society.

### **2.3.4 Transitional Source of Emergency Electrical Power (SOLAS Reg. II-1/42.4)\***

The transitional source of emergency electrical power where required by 2.3.3(1)(c) is to consist of an accumulator battery suitably located for use in an emergency which is to:

- (1) operate without recharging while maintaining the voltage of the battery through the discharge period within 12% above or below its nominal voltage ; and
- (2) be of sufficient capacity and be so arranged as to supply automatically in the event of failure of either the main or the emergency source of electrical power at least the following services if they depend upon an electrical source for their operation:
  - (a) For a period of 30 *minutes*, the lighting required by 2.3.2-2(1) and (2);
  - (b) For a period of 30 *minutes*, all services required by 2.3.2-2(4)(a), (c), (d) and 2.3.2-2(10) unless such services have an independent supply for the period specified from an accumulator battery suitably located for use in an emergency;
  - (c) For a period of time necessary for operation, power to operate the watertight doors as required by 6.4 Part 3, but not necessarily all of them simultaneously, unless an independent temporary source of stored energy is provided.
  - (d) For a period of 30 *minutes*, power to control, indication and alarm circuits for the watertight doors as required by 6.4 Part 3.

### **2.3.5 Location, etc. of Emergency Source of Electrical Power (SOLAS Reg. II-1/42.5)**

- 1 The emergency switchboard is to be installed as near as practicable to the emergency source of electrical power.
- 2 Where the emergency source of electrical power is a generator, the emergency switchboard is to be located in the same space unless the operation of the emergency switchboard would thereby be impaired.
- 3 No accumulator battery fitted in accordance with this 2.3 is to be installed in the same space as the emergency switchboard.
- 4 An indicator is to be mounted in a suitable place on the main switchboard or in the machinery control room to indicate when the batteries constituting either the emergency source of electrical power or the transitional source of electrical power referred to the requirements in 2.3.3(2) or 2.3.4 are being discharged.
- 5 An interconnector feeder connecting the emergency switchboard and the main switchboard is to satisfy the following (1) to (3). In addition, the emergency switchboard is to be supplied during normal operation from the main switchboard.
  - (1) To be adequately protected at the main switchboard against overload and short circuit;
  - (2) To be disconnected automatically at the emergency switchboard upon failure of the main source of electrical power; and
  - (3) To be protected at the emergency switchboard at least against short circuit where the system is arranged for feedback operation.
 In addition, the emergency switchboard is to be supplied during normal operation from the main switchboard.
- 6 Arrangements are to be made where necessary to disconnect automatically non-emergency circuits from the emergency



switchboard to ensure that electrical power is available automatically to the emergency circuits.

### **2.3.6 Provision for the Testing (SOLAS Reg. II-1/42.7)**

Emergency electrical system is to be provided with measures for periodic testing. The periodic testing is to include the testing of automatic starting arrangements.

## **2.4 Steering Gear**

### **2.4.1 General**

See [Chapter 3, Part 5](#).

## **2.5 Navigation Lights, Other Lights, Internal Signals, etc.**

### **2.5.1 Navigation Lights**

- 1 Navigation lights are to be connected separately to the navigation light indicator panel.
- 2 Each navigation light is to be controlled and protected in each insulated pole by a switch with fuses or a circuit breaker fitted on the navigation light indicator panel.
- 3 The navigation light indicator panel is to be power supplied by a separate circuit from the main switchboard or the secondary busbar of transformers connected to it and from the emergency switchboard or the secondary busbar of transformers connected to it respectively. The circuits are to be separated throughout their length as widely as practicable.
- 4 Switches and fuses are not to be provided on the feeder circuits of navigation lights, except the switchboards and indicator panel.
- 5 The navigation light indicator panel is to be placed in an accessible position on the navigation bridge.
- 6 In the event of the failure of navigation lights due to blown bulbs, short-circuits, etc., visual and audible alarms are to activate on navigation light indicator panels. Such alarm devices are to be fed from the main sources and emergency sources of power and their feeder circuits are to be independent of the feeder circuits from navigation light indicator panels to navigation lights.

### **2.5.2 Not under Command Lights and Anchor Lights**

Not under command lights and anchor lights are to be power supplied from both main source of electrical power and emergency source of electrical power.

### **2.5.3 Signal Lights**

Signal lights are to be power supplied from both main source of electrical power and emergency source of electrical power.

### **2.5.4 General Emergency Alarm Systems**

General emergency alarm system specified in the Regulation 6.4.2, Chapter III, *SOLAS* and public address system or other suitable means of communication specified in the Regulation 6.5, Chapter III, *SOLAS* are to satisfy the following:

- (1) To be provided with two sources of electrical power and at least one source is to be of the transitional source of emergency electrical power.
- (2) Feeder circuits of the system are to be of exclusive circuits only for this purpose.
- (3) Feeder circuits of the system are to be connected to the automatic change over switch fitted in the emergency alarm panel, public address system panel or adjacent to those panels.

### **2.5.5 On-board Communications**

On-board communication specified in the Regulation 6.4.1, Chapter III, *SOLAS* is to be power supplied from the electrical source(s) suitably located for use in an emergency.

### **2.5.6 Automatic Sprinkler Pump (SOLAS Reg. II-2/12.7.1)**

The automatic sprinkler pump specified in [Chapter 4, Part 7](#) is to be supplied from the main switchboard and the emergency switchboard through the exclusive circuits for this purpose. In addition, these circuits are to be connected to automatic change over switch fitted adjacent to the sprinkler pump.



## Chapter 3      **ADDITIONAL REQUIREMENTS FOR SHIPS CARRYING SPECIAL CARGOES**

### 3.1      **General**

#### 3.1.1      **Scope\***

Electrical installations for ships or cargo spaces carrying special cargoes as specified in the following (1) to (3) are to comply with the requirements in this chapter, in addition to the requirements in other relevant chapters in this part.

- (1) Special category spaces
- (2) Cargo spaces intended for the carriage of motor vehicles with fuel in their tanks for their own propulsion other than special category spaces
- (3) Ships carrying dangerous goods

### 3.2      **Special Category Spaces**

#### 3.2.1      **Electrical Installations in Special Category Spaces (SOLAS Reg. II-2/20.3.2, 20.3.3)\***

- 1    Electrical installations in special category spaces are to comply with the requirements in this [3.2.1](#).
- 2    Electrical installations are to be of a type suitable for use in explosive gas atmosphere concerned.
- 3    Special category space above the bulkhead deck

Electrical equipment installed within special category space above the bulkhead deck and fitted above a height of 450mm from any deck or platform for vehicles may be of a type so enclosed and protected as to prevent the escape of sparks as an alternative of the electrical equipment specified in [-2](#), on condition that the ventilation systems are capable of ventilating the cargo holds at the rate of at least 10 *air changes per hour*. The platforms with openings of sufficient size permitting penetration of petrol gases downwards may not be regarded as the platforms in this requirement.

4    Electrical installations in exhaust ventilation ducts for a cargo hold are to be of a type approved by the Society for use in explosive gas atmosphere concerned.

5    As a rule, no portable electrical appliances are to be located in the cargo holds. Where it is unavoidable to locate the appliances in the holds, they are subject to the approval of the Society.

#### 3.2.2      **Electrical Equipment in Enclosed Compartments Adjoining Enclosed Cargo Holds**

For the electrical equipment in enclosed compartments adjoining enclosed cargo holds and having openings such as non-gastight door, hatch, scuttle and the like in their bulkheads and decks, the requirements in [3.2.1](#) are generally to be applied.

### 3.3      **Vehicle Spaces other than Special Category Spaces**

#### 3.3.1      **Electrical Installations in Cargo Spaces (SOLAS Reg. II-2/20.3.2, 20.3.3)\***

- 1    Electrical installations in cargo spaces are to comply with the requirements in this [3.3.1](#).
- 2    Electrical installations are to be of a type suitable for use in explosive gas atmosphere concerned.
- 3    Electrical equipment installed within such a space and fitted above a height of 450mm from any deck or platform for vehicles may be of a type so enclosed and protected as to prevent the escape of sparks as an alternative of the electrical equipment specified in [-2](#), on condition that the ventilation systems are capable of ventilating the cargo holds at the rate of at least 10 *air changes per hour*. The platforms with openings of sufficient size permitting penetration of petrol gases downwards may not be regarded as the platforms in this requirement.

4    Electrical installations in exhaust ventilation ducts for a cargo hold are to be of a type approved by the Society for use in explosive gas atmosphere concerned.

5    As a rule, no portable electrical appliances are to be located in the cargo holds. Where it is unavoidable to locate the appliances in the holds, they are subject to the approval of the Society.

### **3.3.2 Electrical Equipment in Enclosed Compartments Adjoining Enclosed Cargo Holds**

For the electrical equipment in enclosed compartments adjoining enclosed cargo holds and having openings such as non-gastight door, hatch, scuttle and the like in their bulkheads and decks, the requirements in [3.3.1](#) are generally to be applied.

## **3.4 Special Requirements for Ships Carrying Dangerous Goods**

### **3.4.1 General**

Electrical installations for ships carrying dangerous goods are to comply with the requirements in [Chapter 19, Part R of the Rules for the Survey and Construction of Steel Ships](#) as well as the relevant requirements in this part.

## Chapter 4 SPECIAL REQUIREMENTS FOR SHIPS WITH RESTRICTED SERVICE

### 4.1 Scope

The requirements in this chapter apply to electrical installations of ships in place of the relevant requirements of this part.

#### 4.1.1 Ships with Class Notations “Coasting Service”, “Smooth Water Service”, “Harbour Service” or Equivalent Thereto other than Ro-ro Passenger Ships with a Gross Tonnage not less than 1,000 tons

The following (1) to (8) may be applied to ships with class notations “Coasting Service”, “Smooth Water Service”, “Harbour Service” or equivalent thereto other than Ro-Ro passenger ships with a gross tonnage not less than 1,000 tons.

##### (1) Ambient Conditions

In **Table H1.1, Part H of the Rules for the Survey and Construction of Steel Ships**, air temperature of 40°C and sea water temperature of 27°C may be applied in place of air temperature of 45°C and sea water temperature of 32°C except for ships which are navigating tropical areas.

##### (2) Insulation Monitoring System

In applying the requirements of **2.2.2, Part H of the Rules for the Survey and Construction of Steel Ships**, insulation monitoring system may be replaced with other earth indicating systems.

##### (3) Lighting Circuits

One of two lighting circuits specified in **2.2.7-4, Part H of the Rules for the Survey and Construction of Steel Ships**, may be of reserve lighting circuit.

##### (4) Installation of Cables

The requirements of **1.2.1** may not be applied.

##### (5) Precaution against Fire

The requirements of **2.9.11, Part H of the Rules for the Survey and Construction of Steel Ships** may not be applied.

##### (6) Lighting Systems

The requirements of **2.2.3-3** and **-4** may not be applied. Further, the ships are to be provided with reserve lighting systems at the following places.

- (a) Launching station of life rafts and outboard side in the vicinity
- (b) All corridors, stairs and exits
- (c) Machinery space and the place where the reserve source of electrical power is installed
- (d) Control station of main engine

##### (7) Location of Main Switchboard

The requirements of **2.2.4** may not be applied.

##### (8) Emergency Source of Electrical Power

The requirements of **2.3** may not be applied. However, a reserve source of electrical power capable of supplying simultaneously to the following loads at least for 3 hours (continuously 30 minutes for signaling equipment and alarming devices of intermittent services) is to be provided.

- (a) All internal communications required in an emergency
- (b) Navigation lights, not under command lights, anchor lights and signaling lights
- (c) The lighting systems at locations indicated in (6) above.

#### 4.1.2 Ro-ro Passenger Ships with Class Notations “Coasting Service”, “Smooth Water Service”, “Harbour Service” or Equivalent Thereto with a Gross Tonnage 1,000 Tons and above but less than 3,000 Tons

Ro-ro passenger ships with class notations “Coasting Service”, “Smooth Water Service”, “Harbour Service” or equivalent thereto with a gross tonnage 1,000 tons and above but less than 3,000 tons may apply **4.1.1(1)** to (5) and (7). In addition, where applying **2.3, Part 6**, emergency loads supplied from the emergency source of electrical power and the transitional source of electrical power may reduce to the following.

- (1) For a period of 3 hours, emergency loads listed in **4.1.1(8)(a)** and (b). (Continuously 30 minutes for signaling equipment and

alarming devices of intermittent services)

- (2) For a period of 12 *hours*, emergency lighting systems specified in **2.2.3-3, Part 6**.
- (3) For a period of 12 *hours*, low location lighting systems specified in **2.3.2-2, Part 6**.

#### **4.1.3 Ro-ro Passenger Ships with Class Notations “Coasting Service”, “Smooth Water Service”, “Harbour Service” or Equivalent Thereto with a Gross Tonnage 3,000 Tons and above**

Ro-ro passenger ships with class notations “Coasting Service”, “Smooth Water Service”, “Harbour Service” or equivalent thereto with a gross tonnage 3,000 *tons* and above may apply **4.1.1(1) to (5) and (7)**. In addition, where applying **2.3, Part 6**, emergency loads supplied from the emergency source of electrical power and the transitional source of electrical power may reduce to the following.

- (1) Emergency loads listed in **4.1.2** above. (A period of supply time may also apply **4.1.2**.)
- (2) Emergency loads listed in **3.3.2, Part H of the Rules for the Survey and Construction of Steel Ships**. (In this case, the wording “a period of 18 *hours*” specified in **3.3.2, Part H of the Rules for the Survey and Construction of Steel Ships** may replace to the wording “a period of 12 *hours*”)

## Part 7 FIRE SAFETY MEASURES

### Chapter 1 GENERAL

#### 1.1 General

##### 1.1.1 Application\*

1 The requirements in this Part apply to the construction for fire protection, means of escape, fire protection apparatus for passenger ships which are engaged in international voyage (hereinafter referred to as the “fire safety measures”).

2 With respect to passenger ships which are not engaged on international voyages and are intended for the service in restricted areas, the requirements in this Part for fire protection, detection, extinction and means of escape may be modified by the Society. In this case, they will be registered in the Register of Ships with the descriptive note “*n.f.*”.

##### 1.1.2 Basic Principles

The following basic principles underlie the provisions in this Part and are embodied in the provision as appropriate, having regard to the construction of ships and the potential fire hazard involved: therein are subjected to the following general requirements that:

- (1) divisions of ship into main vertical zones by thermal and structural boundaries;
- (2) separation of accommodation spaces from the remainder of the ship by thermal and structural boundaries;
- (3) restricted use of combustible materials;
- (4) detection of any fire in the zone of origin;
- (5) containment and extinction of any fire in the space of origin;
- (6) protection of means of escape or access for fire fighting;
- (7) ready availability of fire-extinguishing appliances;
- (8) minimization of possibility of ignition of flammable cargo vapour.

##### 1.1.3 Equivalency

Alternative construction, equipment, arrangement and materials may be accepted by the Society, provided that the Society is satisfied that such construction, equipment, arrangement and materials are equivalent to those required in this Part. In this case, reference is to be made to the provisions of [Chapter 17, Part R of the Rules for the Survey and Construction of Steel Ships](#).

## Chapter 2 CONSTRUCTION FOR FIRE PROTECTION

### 2.1 General

#### 2.1.1 Application\*

Construction for fire protection are to comply with the provisions of Regulations 4 to 6, 8, 9 and 11 and the relevant requirements in Regulations 3, 14 to 16 and 18 to 20, Chapter II-2, International Convention for the Safety of Life at Sea, as may be amended (hereinafter referred to as “*SOLAS* Convention” in this Rules), unless otherwise specified in this Chapter. Reference is to be made to relevant provisions in [Part R of the Rules for the Survey and Construction of Steel Ships](#).

#### 2.1.2 General

**1** Accommodation spaces for crew and passengers are not to be directly adjacent to the tanks for carriage of fuel oil. Such compartments are to be separated from the fuel oil tanks by the cofferdams which are well ventilated and accessible. Where the top of fuel oil tanks has no openings and is coated with incombustible coverings of *38mm* and over in thickness, the cofferdam between such compartments and the top of fuel oil tanks may be omitted.

**2** Emergency sources of electrical power, fire pumps, bilge pumps except those specifically serving the spaces forward of the collision bulkhead, fixed fire extinguishing systems and emergency installations which are essential for the safety of the ship, except anchor windlass, are not to be installed forward of the collision bulkhead.

## Chapter 3 MEANS OF ESCAPE

### 3.1 General

#### 3.1.1 Application\*

Means of escape are to comply with the provisions of Regulations 12 and 13 and the relevant requirements in Regulations 3, 14 to 16 and 18 to 20, Chapter II-2, *SOLAS* Convention, unless otherwise specified in this Chapter. Reference is to be made to relevant provisions in **Part R of the Rules for the Survey and Construction of Steel Ships**.

#### 3.1.2 Instruction for the Passenger to Escape Safely

**1** Instruction which specify meaning of the alarm in an emergency for passenger and clear instruction on action in emergency is to be conspicuously displayed in passenger spaces, public rooms and other spaces for passenger.

**2** Instruction displayed in passenger spaces and public rooms, specified in **-1** above is to specify the following **(1)** to **(4)**.

- (1) plans showing arrangement of lifeboats, liferafts, lifebuoys, rescue boats and life jackets
- (2) plans showing escape routes from the passenger room and public room by red
- (3) plans showing stowage position of fire extinguishing apparatus (stowage position of portable fire extinguishers and arrangement and operational range of fixed fire extinguishing system)
- (4) notice for using fixed fire extinguishing system

**3** For Ro-Ro passenger ships, instruction to specify number showing deck level (the lowest deck and tank top is number 1 and the upper deck is in order.) is to be displayed in landing of stairway and lobby fitted with elevator. Where the specific deck name is used, the specific deck name is to be displayed together with the specific number of deck.

## **Chapter 4      FIRE PROTECTION APPARATUS**

### **4.1      General**

#### **4.1.1      Application\***

Fire protection apparatus are to be in accordance with the relevant requirements in Chapter II-2, *SOLAS* Convention, and *FSS* Code unless otherwise specified in this Chapter. Reference is to be made to relevant provisions in **Part R of the Rules for the Survey and Construction of Steel Ships**.



## **Chapter 5      FIRE CONTROL ETC.**

### **5.1      General**

#### **5.1.1      General\***

Fire control plans, maintenance plans, training manuals, fire safety operational booklets, operation manuals for helicopter operation, residual performance after a fire casualty and providing the safety centre are to comply with the relevant requirements in Regulations 14 to 16, 18, 21, 22 and 23 Chapter II-2, *SOLAS* Convention, unless otherwise specified in this Chapter. Reference is to be made to relevant provisions in [Part R of the Rules for the Survey and Construction of Steel Ships](#).

## **Part 8 LOAD LINES**

### **Chapter 1 GENERAL**

#### **1.1 General**

##### **1.1.1 Application**

Assignment of freeboard and making of load lines are to comply with the requirements in [Part V of the Rules for the Survey and Construction of Steel Ships](#).

## **Part 9 NAVIGATION BRIDGE VISIBILITY**

### **Chapter 1 GENERAL**

#### **1.1 General**

##### **1.1.1 Application**

Navigation bridge visibility is to be in accordance with the requirements in **Part W of the Rules for the Survey and Construction of Steel Ships**.

## Part 10 PASSENGER SUBMERSIBLE CRAFT

### Chapter 1 GENERAL

#### 1.1 General

##### 1.1.1 Scope

1 The requirements specified in this Part apply to the passenger submersible craft and to their support systems.

2 Passenger submersible craft and their support systems are to comply with the requirements specified in this Part, notwithstanding those specified in [Part 2](#) through [Part 9](#).

##### 1.1.2 Special Passenger Submersible Craft

Special passenger submersible craft and their support systems to which the requirements of this Part are not directly applicable are to be at the discretion of the Society taking their maximum diving depth, operation procedure, etc. into consideration.

##### 1.1.3 Equivalency

Passenger submersible craft and their support systems which do not comply with the requirements in this Part may be accepted when they are examined and considered to be equivalent to those specified in this Part by the Society.

##### 1.1.4 Additional Requirements\*

The Society may apply additional requirements where deemed necessary.

#### 1.2 Definitions

##### 1.2.1 Passenger Submersible Craft

Passenger submersible craft (hereinafter referred to as “submersible” in this Part) is a craft complying with the following (1) through (6).

- (1) to carry passengers for underwater excursions
- (2) to have self-propulsion systems and own buoyancy control systems for ascending and descending
- (3) to rely on support systems for monitoring and recharging at least one of the followings:
  - (a) power supply
  - (b) high pressure air
  - (c) life support (moisture absorbent,  $CO_2$  absorbent,  $O_2$ , etc.)
- (4) to have no physical connection to support systems during operation
- (5) to have pressure hulls in which passengers accommodate at a pressure of around 0.1 MPa (1 atmosphere) during operation
- (6) to be only operable in designated service areas

##### 1.2.2 Support Systems

Support systems are the total back-up systems, including support ships and land support station, having functions of housing, operation, rescue and maintenance of the submersible and accommodation of persons on board.

##### 1.2.3 Designated Service Areas

Designated service areas are the sea areas designated by the Administration where the following items at least are specified.

- (1) Depth around the course in service
- (2) Current around the course in service
- (3) Obstacles around the course in service
- (4) Discrimination of course in service
- (5) Traffic amount on the surface
- (6) Disposal of waste from the surface

(7) Distance from the land

#### **1.2.4 Support Ships**

Support ships are the ships having partial functions required for the support systems of the submersible operated in designated service areas and being engaged in support works such as communication with the submersible and the land support station and/or other ships consisting the support systems by always staying for monitoring on the surface under which the submersible is diving.

#### **1.2.5 Maximum Diving Depth**

Maximum diving depth is the maximum depth specified by the distance from the bottom of keel to the water surface, to which the submersible is certified to dive and operate safely.

#### **1.2.6 Design Diving Depth**

Design diving depth is either of the depth specified below.

- (1) For submersibles with a spherical pressure hull, the depth specified in [1.2.5](#)
- (2) For submersibles with a pressure hull other than specified in (1), the depth specified in [1.2.5](#) plus 1/8 length of the pressure hull.

#### **1.2.7 Pressure Hulls**

Pressure hulls are shell structure taking persons and equipment inside and being capable of withstanding an external pressure corresponding to the diving depth.

#### **1.2.8 Pressure Enclosures**

Pressure enclosures are shell structure taking equipment inside and being capable of withstanding an external pressure corresponding to the diving depth.

#### **1.2.9 Maximum Design Mission Time**

Maximum design mission time is the maximum designed duration during which normal dives are available without any change or charge of expendable supplies.

#### **1.2.10 Buoyancy Control Systems**

Buoyancy control systems are the systems to obtain buoyancy of the submersible necessary to operate at any diving depth including buoyancy tank systems, ballast tank systems and drop weights jettisoning systems.

#### **1.2.11 Trim Control Systems**

Trim control systems are the systems to control trim of the submersible within an allowance limit at any diving depth.

#### **1.2.12 Manoeuvring Systems**

Manoeuvring systems are the systems including propelling systems and controlling systems to move or turn the submersible in every direction under normal trim and neutral buoyancy condition.

#### **1.2.13 Life Support Systems**

Life support systems are the equipment and systems required to maintain the submersible in a habitable condition in all anticipated operating conditions.

#### **1.2.14 Pilots**

Pilots are persons appointed to command the submersible.

### **1.3 General Requirements**

#### **1.3.1 Design for Safety**

1 Submersibles are to be designed to be capable of returning to the surface in the event of any single failure, by means of appropriate back up systems and equipment, without external assistance.

2 Submersibles are to be designed to be capable of being operated safely in the environmental conditions and temperature ranges anticipated both whilst on the surface and under water.

3 Submersibles are to be designed to minimize hazards of smoke and fire.

#### **1.3.2 Arrangements for Embarking and Disembarking**

1 Adequate means, such as guardrails taller than 1m and anti-slip surfaces on the embarkation decks, are to be provided to protect embarking and disembarking persons. The clearance between the horizontal bars of the guardrails is not to exceed 230mm except when means, such as sailcloth or net, etc., are provided.

**2** Additional means to protect embarking and disembarking passengers are to be provided, taking into account the relative heights between the submersible and the boarding area, wave effects, the appurtenances on the submersible and the configuration of the transfer vessel, where necessary.

**1.3.3 Conditions for Operation**

**1** Submersibles are to be operated only in waters with a sea-bed depth not greater than the maximum diving depth.

**2** Pilots are to be skilled and qualified for operation of the submersible taking into account the sea-bed depth, currents, maximum diving depth and ability of the submersible

## Chapter 2 SURVEYS OF SUBMERSIBLES

### 2.1 General

#### 2.1.1 General Requirements on Surveys

**1** The surveys of submersibles are to be in accordance with the general requirements specified in **Chapter 1** (excluding **1.1.1**, **1.1.2**, **1.1.3-1** and **-2**), **Part 2** (in this case, the term “Intermediate Survey” is to be read as “Annual Survey”), in addition to this **2.1.1**.

#### **2** Classification Surveys

- (1) The submersibles intended to be classed with the Society are to be subjected to Classification Surveys by the Surveyor in accordance with the requirements in this Chapter.
- (2) Classification Surveys are composed of the following surveys.
  - (a) Classification Survey during Construction
  - (b) Classification Survey of Submersibles not Built under Survey

#### **3** Class Maintenance Surveys

Submersibles which have been registered with Classification are to undergo Class Maintenance Surveys by the Surveyor in accordance with the requirements in this Chapter. Class Maintenance Surveys consist of the Periodical Surveys and Occasional Surveys, which are as specified in the following **(1)** and **(2)**. At each survey it is to be verified that items concerned are being complied with the relevant requirements upon necessary examinations and tests.

##### **(1)** Periodical Surveys

- (a) Annual Surveys
- (b) Docking Surveys
- (c) Special Surveys

##### **(2)** Occasional Surveys

The surveys consist of examinations of hull, machinery, equipment and systems including damaged part and of works for repairs, modifications or conversions, which are carried out separately from **(1)**.

#### **4** Due date of the Periodical Surveys

##### **(1)** Annual Surveys

Annual Surveys are to be carried out within 3 *months* before or after each anniversary date (the day corresponding to the expiry date of the Classification Certificate, excluding the expiry date of the Classification Certificate).

##### **(2)** Docking Surveys

Docking Surveys are to be carried out at the timing as prescribed in **(a)** and **(b)** below. Annual Surveys are not required when a Docking Survey is carried out.

- (a) When Special Surveys are carried out.
- (b) Within 36 *month* from the date of completion of the Classification Survey or the previous Docking Survey.

##### **(3)** Special Surveys

Special Surveys are to be carried out within 3 *month* before the expiry date of the Classification Certificate.

### 2.2 Classification Survey during Construction

#### 2.2.1 General

In Classification Survey during construction, it is to be examined in detail and verified that construction, materials, scantling and workmanship of hulls and various apparatus of submersibles and support systems comply with the relevant requirements in this Part.

#### 2.2.2 Plans and Documents to be Submitted

##### **1** Plans and documents to be submitted for approval

With respect to submersibles intended to undergo Classification Survey during construction, prior to the commencement of the works,

the plans and documents specified in the followings are to be submitted to the Society for approval:

- (1) General
  - (a) General arrangement
  - (b) Midship section
  - (c) Arrangements of machinery and equipment (including those installed outside pressure hull)
  - (d) Arrangements of manoeuvring station and accommodation space
  - (e) Particulars of manoeuvring systems and other machinery and equipment
  - (f) Specifications of materials of important parts
  - (g) Welding procedures of important parts
  - (h) Plans and procedures of tests
- (2) Hull
  - (a) Construction of pressure hulls and pressure enclosures (including details of structural components)
  - (b) Construction and arrangement of protections and guards for pressure hulls and pressure enclosures
  - (c) Construction of hatch covers for access openings
  - (d) Construction of windows
  - (e) Construction and arrangements of penetrations
  - (f) Construction and arrangements of lifting lugs
  - (g) Construction and arrangements of mooring equipment
  - (h) Construction of buoyancy tanks, ballast tanks and trim tanks
  - (i) Arrangements of embarkation deck
  - (j) Construction of partition bulkheads and decks inside pressure hulls
- (3) Manoeuvring Systems, etc.
  - (a) Construction of buoyancy control systems (including pumps when provided)
  - (b) Construction of trim control systems (including pumps when provided)
  - (c) Construction and arrangements of drop weights system and solid ballast system
  - (d) Construction of propelling systems
  - (e) Construction of manoeuvring systems (including hydraulic pumps, motors and cylinders when provided)
  - (f) Construction of emergency releasing means specified in [4.1.6](#)
  - (g) Pressure equalising means specified in [4.2.5](#)
  - (h) Construction of pressure vessels
  - (i) Piping diagrams of ballast, trim, bilge, hydraulic, compressed air and life support systems, etc.
  - (j) Control systems
- (4) Electrical installations
  - (a) Arrangements of main and reserve sources of electric power
  - (b) Switch boards
  - (c) Wiring diagrams
  - (d) Charging and discharging boards

(5) Others considered necessary by the Society

## 2 Plans and documents to be submitted for reference

With respect to submersibles intended to undergo Classification Survey during construction, the plans and documents related to the items specified in the followings are to be submitted for reference in addition to those specified in [-1](#):

- (1) General
  - (a) Specifications for design and manufacture
  - (b) List of manufacturers of materials of important parts, machinery and equipment
  - (c) Calculation of mass and centre of gravity
  - (d) Calculation of buoyancy and centre of buoyancy
  - (e) Lines and dimensions of the hull
  - (f) Hydrostatic curves



- (g) Calculation of stability
- (h) Calculation of trim
- (i) Calculation of propelling and manoeuvring characteristics
- (j) Calculation of submerging and surfacing rates
- (k) Operation manuals including the items specified in [8.1.2](#)
- (l) Maintenance manuals
- (m) Data of the numbers or quantities of fittings such as blankets, clocks and water
- (2) Hull
  - (a) Calculation of strength of pressure hulls and pressure enclosures, hatch covers, windows, penetrations and lifting lugs
  - (b) Protections for surfaces of windows
- (3) Manoeuvring Systems
  - (a) Specifications of indication devices specified in [4.1.2-2\(3\)](#) and [4.1.3\(3\)](#)
  - (b) Specifications of navigational equipment, excluding clocks, specified in [4.1.5](#)
  - (c) Specifications of pingers and/or transponders specified in [4.2.7](#)
  - (d) Specifications of communication systems specified in [4.5](#)
  - (e) Specifications of high pressure vessels
  - (f) Specifications of pipes, valves and pipe fittings
  - (g) Calculation of strength of tanks, pumps and pressure vessels or bottles used under a high pressure
- (4) Electrical installations
  - (a) Specifications of main and reserve sources of electric power
  - (b) Specifications of cables
  - (c) Specifications of motors
  - (d) Specifications of lightings
  - (e) Specifications of cable penetration connectors
  - (f) Specifications of  $H_2$  detectors
  - (g) Power consumption
  - (h) Calculation of short circuit
  - (i) Specifications of water ingress detectors
- (5) Facilities for accommodation
  - (a) Specifications of interior fittings
  - (b) Specifications of life support systems including instruments and monitoring devices
  - (c) Calculation of capacity of life support systems
- (6) Support systems
  - (a) Specifications of devices to detect position of the submersible
  - (b) Specifications of communication systems
  - (c) Construction and strength calculation of towing systems, launch and recovery systems and cranes when provided
- (7) Fire extinguishing apparatus
  - Specifications of fire extinguishers
- (8) Life saving appliances
  - (a) Specifications of life jackets
  - (b) Specifications of breathing masks
  - (c) Specifications of emergency locating buoys
  - (d) Construction of devices to release emergency locating buoys
  - (e) Specifications of buoyant apparatus or equivalent provided on the support ship
- (9) Others considered necessary by the Society

### 2.2.3 Presence of the Surveyor

The presence of the Surveyor is to be required at the following stages. To implement surveys of items specified otherwise by the Society, in lieu of traditional ordinary surveys where the Surveyor is in attendance, the Society may approve other survey methods

which it considers to be appropriate in the following cases.

- (1) When the tests on materials specified in **Part K of the Rules for the Survey and Construction of Steel Ships** are carried out.
- (2) When the materials or parts are being applied to the submersible which are ordered to outside the yard which constructs the submersible.
- (3) During shop works, sub-assembly or when designated by the Society.
- (4) When each parts of the hull is completed.
- (5) When the principal dimensions of the hull are measured.
- (6) When the tests specified in **7.2.1, 7.2.2, 7.2.4 and 7.2.5** are carried out.
- (7) With respect to the pressure vessels, when the tests specified in **Chapter 10, Part D of the Rules for the Survey and Construction of Steel Ships** are carried out.
- (8) When facilities for the support system are being supplied to the support ship or the land support station.
- (9) When considered necessary by the Society.

## **2.3 Classification Survey of Submersibles Not Built under Survey**

### **2.3.1 General**

**1** The surveys equivalent to the Special Survey are to be carried out for the Classification Survey of submersibles not built under survey. Where, however, deemed appropriate by the Society as a result of the examination of the operation records, the diving depth at the test dive may be modified.

**2** With respect to submersibles intended to undergo the Classification Survey specified in **-1**, the plans and documents considered necessary are to be submitted following the case of the Classification Survey during construction.

## **2.4 Periodical Surveys**

### **2.4.1 Annual Surveys**

**1** At each Annual Survey, the following tests and inspections are to be carried out in order to verify that the submersible is in good order.

- (1) Inspections of the actual condition on pressure hulls and pressure enclosures, windows, hatch covers and penetrations
- (2) Inspections of the actual condition on the machinery, equipment and piping (including life support systems) and inspections of the internal corrosion on sea water piping where deemed necessary
- (3) Operation or performance tests on the followings
  - (a) Buoyancy control systems
  - (b) Trim control systems
  - (c) Manoeuvring systems
  - (d) Devices indicating open or close of hatch covers and valves
  - (e) Main and reserve sources of electric power
  - (f) Lighting
  - (g) Navigational equipment specified in **4.1.5**
  - (h) Emergency releasing means specified in **4.1.6**
  - (i) Pressure equalising means specified in **4.2.5**
  - (j) Pingers and/or transponders specified in **4.2.7**
  - (k) Communication systems specified in **4.5**
  - (l) Protective devices and emergency cut-off devices specified in **4.3.4**
  - (m) Life support systems
  - (n)  $H_2$  detectors specified in **4.3.10(2)**
  - (o) Water ingress detectors specified in **4.2.1-7**
- (4) Adjustment tests of the pressure indicating devices for high pressure bottles, the liquid level indicating devices for ballast tanks,  $O_2$  content meters,  $CO_2$  content meters,  $H_2$  content meters, depth gauges and pressure gauges for interior atmosphere

- (5) Inspections of the actual condition on fire extinguishing apparatus, accommodation, means of escape and life saving appliances
- (6) Underwater operation tests at the depth considered appropriate by the Society
- (7) A test dive at the maximum diving depth
- (8) Insulation resistance tests of electrical installations
- (9) General examination of support systems

**2** At the Annual Survey, tests and inspections specified in **-1(3)(c), (f), (h) and (j)** may be dispensed with at the discretion of the Surveyor by examining the maintenance records and operation records.

**3** At the Annual Survey, the Society may, where considered necessary, require thorough examinations of underwater components in a dry dock or on a slipway.

#### **2.4.2 Docking Surveys**

**1** At each Docking Survey, the following tests and inspections are to be carried out in a dry dock or on a slipway in order to verify that the submersible is in good order.

- (1) Inspections of the actual condition on pressure hulls and pressure enclosures, windows and hatch covers
- (2) Internal inspections of tanks including buoyancy tanks
- (3) Measurements of the thickness of pressure hulls and on lateral buckling of ring stiffeners, where deemed necessary
- (4) Inspections of the actual condition on the machinery, equipment and piping (including life support systems) and inspections of the internal corrosion on sea water piping where deemed necessary
- (5) Overhaul inspections of essential machinery where considered necessary by the Society such as manoeuvring systems, ballast pumps, trim pumps, etc.
- (6) With respect to the windows, hatch covers and penetrations of the pressure hull or the pressure enclosure and to the pipes and valves subjected to an external pressure, overhaul inspections on their watertight packing and hydrostatic test (where, however, it is difficult to carry out this test, the test may be substituted by any other tests and inspections subject to the approval by the Society) specified in **7.2.1(3), 7.2.2-4 or 7.2.2-6(7)**
- (7) Operation or performance tests on the followings
  - (a) Buoyancy control systems
  - (b) Trim control systems
  - (c) Manoeuvring systems
  - (d) Devices indicating open or close of hatch covers and valves
  - (e) Main and reserve sources of electric power
  - (f) Lighting
  - (g) Navigational equipment specified in **4.1.5**
  - (h) Emergency releasing means specified in **4.1.6**
  - (i) Pressure equalising means specified in **4.2.5**
  - (j) Pingers and/or transponders (including devices to release emergency locating buoys) specified in **4.2.7**
  - (k) Communication systems specified in **4.5**
  - (l) Protective devices and emergency cut-off devices specified in **4.3.4**
  - (m) Life support systems
  - (n)  $H_2$  detectors specified in **4.3.10(2)**
  - (o) Water ingress detectors specified in **4.2.1-7**
- (8) Adjustment tests of the pressure indicating devices for high pressure bottles, the liquid level indicating devices for ballast tanks,  $O_2$  content meters,  $CO_2$  content meters,  $H_2$  content meters, depth gauges and pressure gauges for interior atmosphere
- (9) Inspections of the actual condition on fire extinguishing apparatus, accommodation, means of escape and life saving appliances
- (10) Underwater operation tests at the depth considered appropriate by the Society
- (11) A test dive at the maximum diving depth or an external hydrostatic test equivalent thereto
- (12) Insulation resistance tests of electrical installations
- (13) Inspections of the actual condition and performance tests of support systems, and open-up inspections on launch and recovery systems or cranes for lifting the submersible if necessary
- (14) Other inspections or tests considered necessary by the Society

**2** At the Docking Survey, inspections in detail may be dispensed with at the discretion of the Surveyor with respect to the items inspected in accordance with **-1** at or after the previous Annual Survey.

**2.4.3 Special Surveys**

At each Special Survey, surveys specified in **2.4.2** are to be carried out.

## Chapter 3 HULL CONSTRUCTION

### 3.1 General

#### 3.1.1 Freeboard while being Surface\*

- 1 Submersibles are to have proper freeboard while being surface.
- 2 Upper edges of access hatches of the pressure hull planned to be used for embarking and disembarking on the surface are to have sufficient height above the water surface to prevent down flooding through opened hatches during all normal conditions on the surface.

#### 3.1.2 Stability\*

- 1 Submersibles are to have a sufficient stability and to remain a safe and controlled condition while being on the surface, submerging or surfacing and being underwater.
- 2 Under all service conditions including drop weights being jettisoned, submersibles are to have the centre of gravity lower than that of buoyancy and to maintain heel and trim within the range for the safety reason and the operational reason of the equipment.
- 3 Submersibles are not to produce excessive heel and trim under the condition that persons on board inadvertently move or shift to one side or one end.
- 4 Submersibles are to comply with the requirements specified in -2 above and [Chapter 4, Part 4](#) while they are on the surface with the estimated numbers of embarking and/or disembarking passengers on the embarkation deck.

#### 3.1.3 Consideration against Corrosion

Important parts of the submersible considered liable to corrode are to be properly protected by means of increasing in thickness or the like against corrosion by taking the materials used, environmental conditions, etc. into consideration.

#### 3.1.4 Special Consideration against Damages from Outside\*

- 1 Pressure hulls and pressure enclosures are to be properly protected to prevent them from damages due to contact with foreign obstacles such as the support ship.
- 2 Pressure hulls and pressure enclosures are to be properly protected against collision, etc. with foreign objects and the like.
- 3 Hull structural members other than pressure hulls and pressure enclosures considered liable to suffer mechanical damages which affect the safety of the submersible are to be properly protected or strengthened.

#### 3.1.5 Consideration while being Lifted, etc.

Submersibles are to have sufficient strength and stability while being lifted (including in an emergency condition), housed and towed.

#### 3.1.6 Consideration during Sailing on the Surface and Ascending

- 1 Submersibles intended to sail on the surface are to be so constructed as to be able to watch the water surface with the hatches closed or to be provided with suitable devices in lieu of such a construction. Where, however, submersibles can sail safely with the hatches opened, this requirement may not apply.
- 2 Provisions are to be made for the pilot to assess the situation in the area in which the submersible is intended to surface.
- 3 Means are to be provided to render the submersible, while on the surface, readily visible to other vessels.

#### 3.1.7 Mooring Fittings

Submersibles are, in order to enable passengers to embark and disembark safely, to have means capable of mooring to the support ship or piers by use of chain or rope.

#### 3.1.8 Externally Mounted Equipment

Externally mounted equipment such as thrusters, manipulators, etc. are to be designed to minimize the risk of entanglement or fouling.

### 3.2 Materials and Welding

#### 3.2.1 Materials\*

1 Materials used for important structural members such as pressure hulls and pressure enclosures are to be of those comply with the requirements specified in **Part K of the Rules for the Survey and Construction of Steel Ships**.

2 Materials used for windows are to be of those comply with the requirements specified in a standard considered appropriate by the Society or the equivalent thereto.

3 Non-metal materials used for packings, buoyancy tanks, etc. are to be of those comply with a national standard considered appropriate by the Society or the equivalent thereto.

#### 3.2.2 Welding Materials and Procedure

1 Welding materials and procedure used for important structural members are to be of those comply with the requirements specified in **Part M of the Rules for the Survey and Construction of Steel Ships**.

2 Post welded heat treatments for relieving residual stresses are to be conducted on pressure hulls or pressure enclosures where considered necessary by the Society taking the construction, materials, shapes of welding joints, welding procedure and the like into consideration.

### 3.3 Pressure Hulls and Pressure Enclosures

#### 3.3.1 Fire-proof Materials\*

1 Materials composing pressure hulls or pressure enclosures are to be non-combustible. However, this requirement may not apply to materials used for windows, packings, etc. and considered appropriate by the Society.

2 Materials used inside pressure hulls or pressure enclosures are to be non-combustible. However, in such unavoidable uses as paints and seats, etc., materials passed through tests considered appropriate by the Society may be used.

3 Apparatuses which may cause fire, such as room heaters and cooking stoves, is not to be provided inside pressure hulls.

#### 3.3.2 Construction and Strength of Pressure Hulls and Pressure Enclosures

1 Pressure hulls and pressure enclosures are to have strength not to collapse at an external pressure corresponding to at least twice the design diving depth. Where, however, for submersibles whose design diving depth is 600metres or more, the external pressure mentioned above may decrease to that corresponding to 1.5 times the design diving depth plus 300meters subject to the collapsing strength taking the initial imperfection of fabrication into consideration has been sufficiently confirmed by means of experiments and analysis and considered appropriate by the Society.

2 Pressure hulls and pressure enclosures are to be designed to have such strength that the stresses caused by an external pressure corresponding to the design diving depth are sufficiently smaller than the yielding point of the materials used.

3 Submersibles are to have lifting lugs with such strength as to be capable of being lifted to the water surface.

4 Windows and hatch covers of the pressure hull or the pressure enclosure are to have such strength as to be equivalent or more to that of the main bodies.

5 Opening parts of the pressure hull or the pressure enclosure are to have such strength as to be equivalent or more to that of the main bodies having no openings.

6 Parts where windows, hatch covers, and valves, etc. are fitted to and where pipes and cables penetrate through the pressure hull or the pressure enclosure are to have sufficient watertightness. Movable parts and their bearings penetrating through the pressure hull or the pressure enclosure are to have enough watertightness to ensure the safe service of the submersible.

7 Openings on the pressure hull or the pressure enclosure are to be necessary minimum in number and to be located at easily accessible positions.

#### 3.3.3 Access Hatches

Access hatches of the pressure hulls are to comply with the followings:

- (1) Hatches are to be arranged with consideration given to all relevant risks such as fire, smoke, hydrostatic stability of the submersible after passenger movement, possible down flooding due to adverse sea state, etc.
- (2) Hatches are to be capable of handling from each side and to have two means including one visible in the manoeuvring station to ensure that hatches are closed and secured prior to diving.

- (3) Means are to be provided to ensure that hatches are clear of water before opening.
- (4) Hatches are to be outward opening.
- (5) The means for opening and closing of hatches are to permit operation by a single person in all anticipated conditions.
- (6) Hatches are to have means for securing them in the open and closed positions.

#### **3.3.4 Windows\***

- 1** Windows are to be protected in such a way specified in below.
  - (1) Protective means are to be provided to prevent contacts with foreign objects.
  - (2) Protection covers such as vinyl sheets are to be provided, if necessary, to protect surfaces of the windows.
- 2** Acrylic plastic windows are to have construction and strength considered appropriate by the Society.

### **3.4 Structural Members other than Pressure Hulls and Pressure Enclosures**

#### **3.4.1 General**

Structural members composing the hull structure other than the pressure hull and the pressure enclosure are to have sufficient strength withstanding all operating conditions of the submersible in a normal service.

## Chapter 4 MANOEUVRING SYSTEMS, ETC.

### 4.1 Manoeuvring Systems, etc.

#### 4.1.1 General

1 Buoyancy control systems, trim control systems and manoeuvring systems (hereinafter referred to as “manoeuvring systems, etc.” in this Chapter) are to be designed on the fail-to-safe principle in such a way that one fault does not result in other fault taking overall safety of the submersible and personnel into consideration.

2 Manoeuvring systems, etc. are to effectively operate under environmental conditions of the location and the planned operating conditions. Moreover, these systems are to be capable of operating when the submersible is inclined at any angle of trim up to 30 degrees or heel up to 15 degrees or when the submersible is rolled up to 60 degrees on the surface. As for the systems not used while the submersible being surface, consideration for the operation during rolling is not necessary, but they are to be capable of operating efficiently after the submersible has restored from the rolling of 60 degrees.

3 Instruments or indication devices to monitor the operation of the manoeuvring systems, etc. are to be provided at easily visible positions in the manoeuvring station. Where, however, these systems are installed in such a position that their operations can be directly watched from the manoeuvring station, this requirement may not apply.

#### 4.1.2 Buoyancy Control Systems\*

##### 1 Buoyancy tank systems

Submersibles are to have buoyancy tank systems which are capable of holding proper freeboard while being surface and complying with the followings.

- (1) Buoyancy tanks which have following construction and function are to be provided.
  - (a) The tanks are to have such construction that an internal pressure can be equalized to an external pressure in the underwater.
  - (b) The tanks are to have such construction as being divided into properly and their arrangements are to ensure the function specified in 3.1.2.
  - (c) The tanks are to have vent valves on each compartment to accumulate or discharge internal air.
  - (d) The tanks are to have such construction as to keep the necessary amount of air for buoyancy inside the tanks while surfacing or being surface even when the submersible is excessively inclined.
  - (e) The tanks are to have such construction that internal air can easily be discharged when submerging.
  - (f) Pipes which have openings at the tanks and are connected to the pipes to supply air into pressure hulls are to be provided with check valves as close to the openings as possible.
- (2) High pressure bottles containing compressed air and piping systems for blow water off the tanks are to be provided. The arrangements of the bottles and piping systems are to be properly protected against damages from outside.
- (3) A pressure indicating device for the compressed air mentioned in (2) is to be provided at the manoeuvring station.
- (4) Valves concerned to the operation of buoyancy tank systems are to be capable of handling at the manoeuvring station independent of any sources of submersible's power.

##### 2 Ballast tank systems

Submersibles are to have ballast tank systems which are capable of controlling the weight in the underwater and complying with the followings.

- (1) Ballast tanks with pressure resisting construction are to be provided.
- (2) Ballast pumps to charge and discharge water in the tanks are to be provided.
- (3) The volume of water in the tanks are to be monitored at the manoeuvring station.
- (4) The requirement specified in -1(1)(f) is to apply.

##### 3 Drop weights

- (1) Submersibles are to have drop weights which are capable of surfacing the submersible by being jettisoned. The total mass of drop weights is to be larger than that specified in (a). In addition, those for submersibles which obtain buoyancy by blowing water off the ballast tanks are to be larger than both of those specified in (a) or (b) below.



- (a) The mass corresponding to sea water volume of all ballast tanks and all trim tanks minus the planned sea water volume at normal condition. However, when the ballast tanks are capable of being deballasted by compressed air, the mass may be decreased to the half of that specified above.
  - (b) The mass corresponding to seawater volume of the largest single possible floodable pressure enclosures or pressure bottles. (the volume of contents may be subtracted.)
- (2) Drop weights are to be capable of being jettisoned from inside the pressure hull at the maximum diving depth by reliable two independent systems. However, when the submersible is so designed as to have another surfacing means considered appropriate by the Society, a single system may be acceptable. Each system is to require at least two positive manual actions and, in any case, at least one system is to be independent of any sources of submersible's power.

#### **4.1.3 Trim Control Systems**

Submersibles are to have trim control systems complying with the followings. Where, however, considered appropriate by the Society, means in common with the ballast tank systems specified in 4.1.2-2 or other equivalent means may be acceptable.

- (1) Trim tanks are to be provided in fore and aft positions.
- (2) Trim pumps for inter-tank shifting of liquid are to be provided.
- (3) The level of the trim tanks are to be monitored at the manoeuvring station.

#### **4.1.4 Manoeuvring Systems**

1 Submersibles are to have manoeuvring systems which are capable of effectively controlling, including ascending, under all planned service conditions.

- 2 Manoeuvring systems are to have reliable function and to be operable easily at the manoeuvring station.
- 3 Instruments for the manoeuvring systems are to have such an accuracy to ensure a safe operation of the submersible.
- 4 Propellers, shaftings, reduction gears, prime movers and the like are to comply with the followings.
  - (1) They are to have construction and strength considered appropriate by the Society.
  - (2) The output of the systems are to be sufficient to keep a speed for control of the submersible and to provide an astern power capable of braking effectively when operating condition is changed from ahead to astern.

#### **4.1.5 Navigational Equipment**

In order to enable submersibles to operate safely under all planned operating conditions, the following navigational equipment is to be provided at the manoeuvring station.

- (1) Depth gauges
  - (a) Depth gauges are to be capable of monitoring the depth of 1.25 times the maximum diving depth or more. The submersible is to have at least two depth gauges working independently.
  - (b) At least one of the depth gauges specified in (a) is to be a pressure gauge capable of functioning even in emergency situation. If both are pressure gauges, they are not to have a common inlet.
- (2) A compass
- (3) A sounding device
- (4) A clock
- (5) A heel and trim indicator
- (6) A speed and distance measuring device
- (7) A sonar
- (8) A loudspeaker
- (9) Navigation lights
- (10) Signaling apparatus as deemed appropriate by the Society (except for the submersible which does not sail on the surface)

#### **4.1.6 Means for Emergency Releasing**

Where submersibles have balanced chains, anchors, manipulators or the like which are liable to be trapped by rocks or obstacles on the sea bed, proper means such as apparatuses requiring two positive manual actions from inside the pressure hull to jettison them are to be provided. In case when they are jettisoned, the stability of the submersible is to remain adequate.

## 4.2 Construction and Arrangements of Machinery, Equipment and Piping Systems

### 4.2.1 General

1 Machinery, equipment and pipings installed inside the pressure hull are to be of free from outbreak and leakage of inflammable or toxic gases.

2 Machinery, equipment and pipings installed inside the pressure hull or the pressure enclosure are to be made of materials complying with the requirements specified in **3.3.1-2**. However, materials used for those installed inside the pressure enclosure may be of fire-retardant.

3 In case where the use of materials not complying with **-2** above is unavoidable, such materials are to be of minimum outbreking of smoke and toxic gases when burnt. In addition, consideration is to be given to minimize the initiation and propagation of fire.

4 Machinery, equipment and pipings installed outside the pressure hull or the pressure enclosure used under an external pressure are to have sufficient strength to withstand an external pressure corresponding to the design diving depth.

5 Machinery, equipment and pipings installed outside the pressure hull or the pressure enclosure liable to corrode are to be properly protected against corrosion taking the materials used into consideration.

6 Moving parts of machinery liable to injure personnel are to be protected to minimize any danger to personnel.

7 Water ingress detectors with their indicators at the manoeuvring stations are to be provided at positions where having penetrators through the pressure hull or in the pressure enclosure containing accumulator batteries and where expecting no watches by crews.

8 Handles of hatch covers, valves, other equipment and the like are to have means to indicate the opening/closing condition. Valves are to be marked or to have appropriate means for identification to avoid misoperations.

9 Pipings which may be susceptible to mechanical damage are to be adequately protected.

10 Taper cocks are not to be used in the piping systems.

### 4.2.2 Construction and Materials of Machinery and Equipment

1 Pumps used for buoyancy control systems, trim control systems or manoeuvring systems are to comply with the followings.

- (1) The requirements specified in **Part D of the Rules for the Survey and Construction of Steel Ships**.
- (2) The pumps are to have a sufficient flow rate under a delivery pressure corresponding to 1.1 times the maximum diving depth or more and to be capable of discharging under an external pressure corresponding to 1.2 times the maximum diving depth.
- (3) Check valves are to be provided at the delivery side of the pump. Where, however, the stop valve with a visual alarm to indicate its open is provided at the delivery side of the pump, this requirement may not apply.

2 Pressure vessels, tanks and the like are to comply with the followings.

- (1) Pressure vessels, tanks and the like subjected to an internal pressure are to comply with the requirements specified in **Part D of the Rules for the Survey and Construction of Steel Ships** with regard to their construction, materials used and welding.
- (2) High pressure bottles are to be of those complying with a standard or regulations considered appropriate by the Society.
- (3) Pipes penetrating through the pressure hull are not to lead to tanks installed inside the pressure hull.
- (4) High pressure bottles excluding those deemed necessary by the Society are not to be provided in the accommodation spaces.
- (5) Gas bottles are to have reliable protection against mechanical damage and to be securely stowed. The volume of a single internal source is to be limited in such a way that complete release of its contents will not increase the pressure beyond the safe limit for the submersible and persons in it.
- (6) Gas bottles and pressure vessels mounted externally of which contents may be depleted while being underwater are to be designed to withstand external pressure corresponding to the design diving depth of the submersible

### 4.2.3 Arrangements of Piping Systems

1 Any piping system penetrating the pressure hull is to be equipped with a manual stop valve mounted directly on the inner side of the hull at an easily accessible position. Where this is not practicable, the valve may be fitted as close as possible to the pressure hull penetrator provided the construction between the valve and the penetrator is rigid.

2 Where piping systems penetrating through the pressure hull have openings at outside the pressure hull, the valves specified below is to be provided at a position as close as possible to the stop valve specified in **-1**.

- (1) For piping systems to discharge outside the pressure hull, a check valve or a valve capable of being remotely controlled.
- (2) For piping systems to charge inside the pressure hull, a valve capable of being remotely controlled.

3 Piping systems penetrating through the pressure hull are to be located as far as possible at a position easily capable of

conducting maintenance and repair works and finding out a leakage.

4 Joints in piping systems are not to be provided in spaces other than those easily capable of conducting maintenance and repair works and finding out a leakage

#### **4.2.4 Materials, Welding and Construction of Piping Systems**

1 Pipes, valves and fittings of the piping systems subjected to an internal pressure are to comply with the requirements specified in **Part D of the Rules for the Survey and Construction of Steel Ships** with regard to their construction, materials used and welding. The essential piping systems such as those penetrating through the pressure hull are to be considered as Group I piping systems.

2 Piping systems penetrating through the pressure hull are to be designed complying with the requirements specified in **Part D of the Rules for the Survey and Construction of Steel Ships** by taking a pressure corresponding to the maximum diving depth or the maximum operating pressure of the piping system, whichever is the larger, as the design pressure.

3 Relief valves are to be provided on the delivery side of the pumps in case the piping systems are possibly over pressurized without them and arrangements are to be made so that the discharged liquid are led to the suction side of the pumps.

#### **4.2.5 Means for Pressure Equalizing**

Means are to be provided to equalize the internal pressure to atmospheric pressure gradually prior to the opening of the hatches.

#### **4.2.6 Control Systems**

Control systems for the machinery and equipment concerning to the safety of the submersible and personnel are to comply with the followings.

- (1) The control systems are to have reliable function and easy operation to ensure the necessary control such as starting and stopping of the machinery.
- (2) The function of automatic and/or remote control systems is to be capable of being manually cancelled. In addition, the important machinery and equipment for the safety of the submersible and personnel are also to be controlled manually.
- (3) The control systems are to be provided independently each other with regard to their purposes, functions, etc.

#### **4.2.7 Pingers and/or Transponders**

1 Submersibles are to have means such as pingers, transponders or the like to be detected the position by the support system.

2 Every submersible is to have means listed below to be detected the position by the support system in emergency. These means are to remain operational in the event of loss of main source of electric power.

- (1) An acoustic pinger compatible with the device on the support ship to detect position of the submersible
- (2) An emergency locating buoy (Release arrangement for the buoy is not to be electrically but manually or hand-hydraulically powered and to be able to operate at all anticipated angles of heel and trim. The size of the buoy and length of string are to be such that expected currents acting on the string do not prevent the buoy from coming to the surface. )

### **4.3 Electrical Installations**

#### **4.3.1 General**

1 Electrical installations are to be fit for marine use and to be effectively and safely operable under environmental conditions of their installed locations.

2 Electrical installations are to be so suitably installed that electrical contacts could not initiate a fire even in oxygen enriched atmosphere.

#### **4.3.2 Power Distribution Systems**

Power distribution systems are to be of insulated ones which have monitoring devices for the insulation level.

#### **4.3.3 System Voltage**

The system voltage of electrical installations is to be 250 V or less.

#### **4.3.4 Protective Devices and Emergency Cut-off Devices**

1 Electrical installations are to be protected against every overcurrent including short-circuit. The protective devices are to be capable of breaking the fault circuit so as to minimize damage and risk of fire as well as to keep other sound circuits operable continuously as far as possible.

2 Submersibles are to have devices to cut-off the main source of electric power in case of an emergency condition from an easily accessible position. Where, however, the switchboard is arranged to be easily operable, the circuit breakers on the switchboard may be

regarded as the above mentioned devices.

#### **4.3.5 Earthing**

Non-current-carrying exposed metal parts of electrical equipment and metal coverings of cables are to be effectively earthed.

#### **4.3.6 Lightings in the Pressure Hull**

1 Lightings in the pressure hull necessary for safe operation of the submersible are to be so arranged that failure of any one circuit will not leave the space in darkness.

2 Emergency lighting equipment having the source of electrical power and being switched on automatically in the event of failure of the main source of electric power is to be installed at proper positions in the pressure hull.

#### **4.3.7 Main Source of Electric Power**

Submersibles are to have main source of electric power having sufficient capacity capable of supplying electrical power for the services for the period of time as specified below.

- (1) For a period of the maximum design mission time for all electrical installations. In any case, for at least 1 *hour* for breathing gas systems.
- (2) For a period of 72 *hours* for those specified below
  - (a) Life support systems (excluding those specified in 5.1.2)
  - (b) Life-saving appliances
  - (c) Fire extinguishing apparatus
  - (d) Communication systems
  - (e) Pingers and/or transponders
  - (f) Other equipment required in emergency

#### **4.3.8 Reserve Source of Electric Power**

1 Submersibles are to have reserve source of electric power, being independent of the main source of electric power, of which capacity is capable of supplying electric power for the services specified in 4.3.7(2) and emergency lighting equipment at least for 72 *hours*. The period to supply electric power to emergency lighting equipment may be shortened considering the emergency rescue plan, but not to be less than 24 *hours* in any case.

2 Reserve source of electric power specified in -1 is to be located so as to ensure its function in the event of fire or other casualty causing failure to the main source of electric power.

#### **4.3.9 Electrical Equipment**

1 Electrical equipment of the submersible is to be designed and manufactured on the basis of consideration for the environmental temperature range between being housed in the support station, etc. and being submerged.

2 Electrical equipment inside the pressure hull is to be capable of effectively operating under the possible most humid condition by taking the capacity of humidity control devices into consideration.

3 Electrical equipment outside the pressure hull or the pressure enclosure is to be of a submerged type and to have sufficient function under all planned operating conditions.

4 Electrical equipment liable to condensate water drops inside is to be of at least drip-proof construction and electrical equipment located in the pressure hull is to be so constructed and arranged as to prevent persons from accidentally contacting with the live parts.

5 Switchboards and transformers inside the pressure hull are to comply with the followings.

- (1) Switchboards are to be of a dead-front type.
- (2) Transformers are to be of a double wound, dry and naturally cooled type and to be so constructed and arranged as to prevent persons from accidentally contacting with the live parts.

6 Electrical installations of submersibles using accumulator batteries for their sources of electrical power are to be effectively operated during the range from fully charged voltage to finally discharged voltage.

#### **4.3.10 Accumulator Batteries**

Accumulator batteries are to comply with the requirements specified in (1) to (6) below as well as the requirements specified in 4.3.9-1 to -4.

- (1) Accumulator batteries are to be located at positions free from bilge.
- (2) Accumulator batteries located inside the pressure hull are to comply with the followings.
  - (a) The batteries are to be of a sealed type.

- (b) The batteries are to be installed in a compartment assigned to them only.
- (c) An  $H_2$  detector is to be provided in the compartment specified in (b) to detect the  $H_2$  content at or above 1 % by volume.
- (d) The  $H_2$  detector specified in (c) is to be of a certified safe type deemed appropriate by the Society.
- (e) Effective means are to be provided to prevent  $H_2$  content in the compartment specified in (b) above from exceeding 1% by volume.
- (3) Accumulator batteries located outside the pressure hull are to be installed in the enclosures specified below.
  - (a) Enclosures in which pressure can be equalized to an external pressure and having devices to release  $H_2$  gases
  - (b) Pressure enclosures provided with means against  $H_2$  gases considered appropriate by the Society
- (4) Accumulator batteries for main source or reserve source of electric power are to be provided with a device to indicate the charged/discharged conditions of the accumulator batteries at the manoeuvring station.
- (5) When the protection devices referred to in 4.3.4-1 are considered to be a possible ignition source for the hydrogen gas, they are not to be located in the compartment where accumulator batteries are located.
- (6) Rigid interconnecting links between batteries are not to be used.

#### **4.3.11 Cables\***

- 1 Cables fitted inside the pressure hull are to be of non-combustible type or those passed the test deemed appropriate by the Society which produce little injurious gases when burning.
- 2 Cables fitted outside the pressure hull or the pressure enclosure are to be of a water-proof type.
- 3 Connectors fitted outside the pressure hull or the pressure enclosure or on the openings of them are to have watertight construction.
- 4 Cables and connectors specified in -2 and -3 are to have sufficient function under all planned operating conditions.
- 5 Cables are to be fixed to frames, pressure hulls, pressure enclosure, guide plates and the like in ways suitable for the kind of the cables.
- 6 Cables are to be located at positions free from damages from outside as far as possible. When located at undesirable positions, proper means for protection are to be provided.

#### **4.3.12 Penetrating Parts of Cables through the Pressure Hull or the Pressure Enclosure**

- 1 Penetrating parts of cables through the pressure hull or the pressure enclosure are to be sustained watertightness to ensure the safety of the submersible even in the cases specified below.
  - (1) In case of the cables being cut off at outside the pressure hull or the pressure enclosure when the cables penetrate through the pressure hull or the pressure enclosure directly
  - (2) In case of the plugs being disconnected or broken when the cables penetrate through the pressure hull or the pressure enclosure by use of connectors
- 2 Electrical conductors within the penetrating parts are to be of solid material.
- 3 When the positive and negative conductors pass through the same penetrating part, the following requirements are to be complied with.
  - (1) All anticipated risks of short-circuit between conductors are to be precluded
  - (2) Any failures of the insulation are not to spoil the expected watertightness of the penetrating part
- 4 Penetrating parts of the cables are not to contain any pipes or other system passing through together with them.

### **4.4 Fire Detection and Extinction**

#### **4.4.1 Fire Extinguishing Apparatus**

Submersibles are to have portable fire extinguishers complying with the followings.

- (1) Sea water and gases hazardous to human health such as  $CO_2$  are not to be used.
- (2) Rise in pressure affecting human health is not to be caused.

#### **4.4.2 Fire Detection and Fire Alarm Systems**

Fire detectors in unoccupied spaces in submersibles to alert the crew may be required where deemed necessary by the Society.

## **4.5 Communication Systems**

### **4.5.1 General\***

- 1** Submersibles are to have external communication systems which are effective both when the submersibles are on the surface and submerged with a sufficient communicable range to ensure good communication with the support ship.
- 2** Submersibles are to have internal communication systems for communications between the crew members and for public announcements to passengers.
- 3** Where the submersibles have more than one compartment, an intercommunication system is to be provided.

## Chapter 5 LIFE SUPPORT SYSTEMS, ACCOMMODATION, MEANS OF ESCAPE AND LIFE-SAVING APPLIANCES

### 5.1 Life Support Systems

#### 5.1.1 Humidity Removal Devices

Where the increase of humidity is considered liable to affect the functions of the electrical equipment specified in 4.3.7(2), submersible are to have humidity removal devices having a removal capacity of humidity for the maximum design mission time plus 72 hours.

#### 5.1.2 Breathing Gas Systems\*

Submersibles are to have breathing gas systems capable of breathing for the maximum design mission time (in any case for at least 1 hour) for the number of persons certified to carry. In this case, the breathing gas systems are to be composed of  $CO_2$  removal systems, atmospheric circulation systems and air or  $O_2$  supply systems. The atmospheric circulation systems are to have a sufficient flow rate to homogenize the contents of atmosphere inside the pressure hull.

#### 5.1.3 Reserve Breathing Gas Systems\*

Submersibles are to have reserve breathing gas systems with a removal capacity of  $CO_2$  and a supply capacity of air or  $O_2$  for 72 hours for the number of persons certified to carry in addition to the systems specified in 5.1.2. In this case, high pressure bottles and piping systems installed outside the pressure hull are to be independent of those used for the systems specified in 5.1.2 and to be arranged effectively protected against damages from outside.

#### 5.1.4 Oxygen Systems

1 Where oxygen containers are located inside the pressure hull, the volume of a single container is to be limited such that the complete release of its contents will not increase the pressure by more than 0.1 MPa (1 atmosphere) nor raise the oxygen level above 25% by volume. The allowable pressure increase may be further limited by design and safety considerations.

2 When the pressure containers for oxygen are stored outside the pressure hull, they are to be arranged in at least two banks with separate penetrations entering the submersible.

3 In view of the hazards associated with oxygen systems, special consideration is to be given to the selection of materials, equipment, installation, cleaning and testing procedures. Ball valves are not be used in oxygen systems.

#### 5.1.5 Monitoring Systems

1 Monitoring systems of the following items are to be provided in duplicate inside the pressure hull.

- (1)  $O_2$  content of interior atmosphere (One of the monitoring systems is to be provided with high and low content alarms.)
- (2)  $CO_2$  content of interior atmosphere (One of the monitoring systems is to be provided with a high content alarm.)

2 A barometer, a thermometer, a humidity meter and pressure gauges (at least one mechanical gauge) for the high pressure container composing the breathing gas system are to be provided inside the pressure hull.

### 5.2 Accommodation

#### 5.2.1 Accommodation Spaces

1 Divisions are to be provided adequately between accommodation spaces for passengers and machinery spaces.

2 Adequate measures are to be taken to prevent passengers from interfering with the operation of the submersibles.

3 The notice of no smoking, passenger capacity and locations of exits and escape routes are to be shown inside the accommodation spaces.

4 Ceiling height in accommodation spaces for passengers is generally to be 1.7 m or more.

5 Accommodation spaces for passengers are to be equipped with the same number of seats as persons certified to carry.

6 The number of persons certified to carry is to be determined in accordance with the followings.

- (1) It is to be the smallest number calculated in accordance with (a) to (c).

(a) the number dividing total volume of air in pressure hulls in  $m^3$  by 1.5

- (b) the number enable to sustain freeboard and stability deemed adequate by the Society
- (c) the number in compliance with the National Regulations of the country in which the submersible is to be registered
- (2) Where it is calculated by a way other than that specified in (1), relevant data are to be submitted to the Society for consideration.

### 5.3 Means of Escape

#### 5.3.1 General\*

- 1 The arrangement of occupied spaces in submersibles is to provide for easy evacuation.
- 2 Submersibles are to have an emergency access hatches in addition to the hatches for normal use, except when considered unavoidable by the Society.
- 3 The width of access hatches, irrespective of whether they are for normal use or emergency use, is to be 10 times the number of persons certified to carry or more in *mm* and, in any case, not less than 600 *mm*.
- 4 Stairways are normally to be used for means of vertical escape. However, vertical ladders may be used for the means of escape intended only for emergency use.
- 5 Stairways referred to in 4 are to be equipped with handrails and the ceiling height above the stairways is to be 1.7 *m* or more at a position close to the access hatch.
- 6 Handrails provided as means of escape are to have sufficient strength to be used safely during escaping from the submersible even when it is inclined.

### 5.4 Life Saving Appliances

#### 5.4.1 General

- 1 Submersibles are to be provided with the life saving appliances listed below.
  - (1) Inflatable lifejackets for the number of persons certified to carry.
  - (2) Fresh water for the number of persons certified to carry, estimated as at least 6 *liters* per person for 3 *days*.
  - (3) Blankets for the number of persons certified to carry. This requirement applies only when deemed necessary by the Society taking into account the service areas of the submersible.
  - (4) Medical first-aid equipment.
  - (5) Thermal protection, sanitary facilities and food ration, corresponding to the maximum design mission time and the emergency rescue plan.
  - (6) Lifebuoys or equivalent available during embarkation and disembarkation of passengers or whenever personnel are on freeboard deck.
  - (7) Breathing masks for the number of persons certified to carry. These masks are to be capable of being used for breathing and removing *CO<sub>2</sub>* for at least 20 *minutes*.
- 2 Support ships are to be provided with the life saving appliances listed below.
  - (1) Buoyant apparatus or equivalent corresponding to the number of the persons certified to carry.
  - (2) Medical first-aid equipment.



## Chapter 6 SUPPORT SYSTEMS

### 6.1 Support Systems

#### 6.1.1 General\*

**1** Support systems, in general, are to be composed of the support facilities specified below.

- (1) Towing systems which have sufficient capacity and strength to tow the submersible safely and passed through tests considered appropriate by the Society
- (2) Launch and recovery systems or cranes which are designed and manufactured by applying the requirements of [Part 1 of the Rules for Lifting Appliances and Anchor Handling Winches](#) by regarding the design lifting load or a load considered appropriate by the Society as the safe working load
- (3) Systems related to recharging of power supply, high pressure air and life support.
- (4) Communication systems with the land support station or other ships
- (5) Devices to detect positions of the submersible corresponding to those specified in [4.2.7](#)
- (6) Communication systems corresponding to those specified in [4.5](#)
- (7) Ladders
- (8) Loudspeakers
- (9) Search lights
- (10) Others deemed necessary by the Society in consideration of the operation scheme of the submersible

**2** In case persons transfer while a submersible is on the surface, its support system is to be capable of accommodating all persons on board the submersible in addition to the crews and passengers already accommodated in the system.

**3** The function of support systems is to be maintained by the support ship and the land support station, etc.

#### 6.1.2 Support Ships

Support ships are to be of those considered appropriate by the Society by taking the construction and operation scheme of the submersible into consideration and to have at least the support systems specified in [6.1.1-1\(4\)](#) to **(10)**.

## Chapter 7 TESTS

### 7.1 General

#### 7.1.1 Scope

- 1 Tests for hulls and installations of submersibles are to be in accordance with the requirements in this Chapter.
- 2 Tests specified in this Chapter which are deemed difficult by the Society to be carried out on real subjects may be substituted by tests on suitable models or samples.

#### 7.1.2 Additional Tests

Tests not specified in this Chapter may apply where deemed necessary by the Society.

#### 7.1.3 Exemption of Tests

As for the machinery or equipment holding adequate certificates, the Society may exempt the tests specified in this Chapter partly or wholly.

### 7.2 Tests

#### 7.2.1 Tests for Pressure Hulls and Pressure Enclosures\*

Pressure hulls and pressure enclosures and windows, hatch covers, penetrators, etc. fitted on the openings of them are to undergo the tests specified below.

- (1) Radiographic examinations are to be conducted on the whole length of butt welded parts of the pressure hull and the pressure enclosure to confirm no harmful defect exists. Where, however, approved by the Society, suitable non-destructive examinations may partly substitute for the radiographic examinations.
- (2) Upon completion of works of the pressure hull, the alignment of the pressure hull is to be measured and confirmed that it is within an allowable tolerance deemed appropriate by the Society.
- (3) Windows and hatch covers (excluding conical sheet hatches) fitted on the openings of the pressure hull and the pressure enclosure are to be hydrostatically tested at an external pressure corresponding to 1.25 times the design diving depth and confirmed no leakage nor injurious deformation exists. As for the acrylic windows, the temperature of pressurizing medium at the hydrostatic test is to be at least 14°C lower than the design temperature, but not to be less than 0°C.
- (4) Pressure hulls and pressure enclosures are to be hydrostatically tested after all fittings have been fitted at an external pressure corresponding to 1.25 times the design diving depth and confirmed that they have sound watertightness. (Movable parts and their bearings penetrating through the pressure hull or the pressure enclosure are to have enough watertightness to ensure the safe service of the submersible.) And pressure hulls are to be confirmed that strains measured at proper points are within the proper value and no injurious deformation exists by measuring, for example, the spherical accuracy of the pressure hull.

#### 7.2.2 Tests for Machinery, Equipment and Piping Systems

1 Piping systems are to be tested in accordance with the requirements specified in **Part D of the Rules for the Survey and Construction of Steel Ships**. In this case, the essential piping systems such as those penetrating through the pressure hull are to be tested as the Group I piping systems. And for piping systems which may be subjected to an internal pressure when a part outside the pressure hull or the pressure enclosure is damaged, the test pressure of hydrostatic test is to be that corresponding to 1.5 times the design diving depth or 1.5 times the design pressure whichever is the larger.

2 Casings of machinery subjected to an internal pressure such as those of pumps are to be hydrostatically tested at a test pressure of 1.5 times the design pressure.

3 Pumps used for buoyancy control systems or trim control systems are to be tested to comply with requirements specified in **4.2.2**.

4 Piping systems, equipment and the like fitted outside the pressure hull or the pressure enclosure or on the openings of those subjected to an external pressure corresponding to the diving depth are to be hydrostatically tested at a test pressure corresponding to 1.5 times the design diving depth. However, the Society may exempt the test or modify the test pressure taking construction and usage

of the piping systems, equipment and the like into consideration.

5 Pressure indicating devices for high pressure bottles, liquid level indicating devices for ballast tanks and for trim tanks and instruments specified in **5.1.5-1** are to undergo an adjustment test.

6 Electrical Installations are to be subjected to the following tests.

- (1) Insulation resistance test
- (2) Charging and discharging test on the accumulator batteries specified in **4.3.10**
- (3) Performance test on the protective devices and cut-off devices specified in **4.3.4**
- (4) Watertightness test by a method approved by the Society on the penetrating parts of cables specified in **4.3.12**
- (5) Tests specified in **Part H of the Rules for the Survey and Construction of Steel Ships** for equipment and cables installed inside the pressure hull or the pressure enclosure
- (6) Tests specified in **Part H of the Rules for the Survey and Construction of Steel Ships** and a hydrostatic test at an external pressure corresponding to 1.5 times the design diving depth for cables installed outside the pressure hull or the pressure enclosure
- (7) Hydrostatic tests at an external pressure corresponding to 1.5 times the design diving depth on connectors installed outside the pressure hull or the pressure enclosure
- (8) Tests correspondingly regarded to those specified in **Part H of the Rules for the Survey and Construction of Steel Ships** for equipment installed outside the pressure hull or the pressure enclosure, by taking their environmental conditions into consideration

7 The following systems or devices and their electric sources of power including equipment composing them are to be tested by methods approved by the Society to confirm their performances.

- (1) Buoyancy control systems
- (2) Trim control systems
- (3) Manoeuvring systems
- (4) Depth gages
- (5) Life support systems (including adjustment tests for pressure gauges for the high pressure container composing the breathing gas system and  $O_2$  content monitoring systems,  $CO_2$  content monitoring systems and barometers of interior atmosphere)
- (6)  $H_2$  detectors in case accumulator batteries are located inside the pressure hull.
- (7) Release arrangements, operated inside the pressure hulls, for emergency locating buoys
- (8) Communication systems
- (9) Breathing masks

### **7.2.3 Inclining Tests**

Upon completion of all works, submersibles are to undergo inclining tests to determine particulars concerned to stability. The determined particulars are to be stated in the operation manuals specified in **8.1.2**.

### **7.2.4 Sea Trials**

Upon completion of all works, submersibles are to undergo sea trials including the items specified below.

- (1) Operation tests on manoeuvring systems and buoyancy control systems at the maximum diving depth
- (2) Operation tests on functions of surfacing, submersing, propelling, turning and stopping and performance tests on life support systems, etc. at proper diving depth
- (3) In case that the submersible is intended to navigate on the surface, operation tests on functions of propelling, turning and stopping and function tests on open/close indicating devices of access openings on the surface.

### **7.2.5 Tests for Support Systems**

Facilities for support systems are to undergo the tests specified below.

- (1) Performance tests on underwater communication systems and devices to detect positions of the submersible on sea trials at the maximum diving depth
- (2) The following tests on towing systems, housing systems, launch and recovery systems or cranes for lifting the submersible
  - (a) As for the towing systems, tests to confirm the effectiveness of the systems
  - (b) As for the housing systems, tests to confirm the effectiveness of the systems
  - (c) As for the launch and recovery systems or cranes for lifting the submersible, tests correspondingly regarded to those

specified in 2.4 and 2.5, Part 1 of the Rules for Lifting Appliances and Anchor Handling Winches

## Chapter 8 OPERATIONAL REQUIREMENTS

### 8.1 General

#### 8.1.1 Management of Operation

1 The management of submersibles operations is to comply with the International Safety Management (*ISM*) Code (the International Management Code for the Safe Operation of Ships and for Pollution Prevention adopted by the International Maritime Organization (*IMO*) by resolution A.741(18), as may be amended by *IMO*, provided that such amendments are adopted, brought into force and take effect in accordance with the provisions concerning the amendment procedures specified by *IMO*) or the equivalent thereto.

2 A chain of command is to be well documented for each operation such that each person involved knows who is in charge.

3 A written emergency response plan for each operating submersible is to be prepared and be available on board and to others as deemed necessary.

4 Emergency drills are to be performed on a regular basis. These drills are to clearly demonstrate the effectiveness of the procedures.

5 A maintenance manual containing procedures for periodic inspections and preventative maintenance techniques is to be provided. The manual is to include the expected service life of the pressure hull and of other components and equipment vital to life supporting (e.g. windows, accumulator batteries, etc.) along with particular instructions for the maintenance of items requiring special attention. The manual, together with operational and maintenance records is to be readily available at the manoeuvring station.

#### 8.1.2 Operation Manuals

Operation manuals which include the following items, together with essential drawings, are to be presented to the pilot and readily available on board to ensure the safety of the submersible.

- (1) Mission of operation, maximum design mission time, Maximum diving depth and other operational diving depth
- (2) Handling of hatches for access openings on the pressure hull
- (3) Operation of machinery, equipment and instruments
- (4) Sequence of submerging and surfacing
- (5) Changes in gravity of sea water, compressive deformation due to diving depth and changes in buoyancy due to temperature of sea water
- (6) Interior atmosphere to maintain an anticipated condition for persons in the pressure hull with regard to  $O_2$  or air supply,  $CO_2$  removal, air conditioning and allowable limits for toxic gases
- (7) Increase and decrease of interior pressure, where the pressure hull is arranged to increase its interior pressure
- (8) Periodical and routine maintenance
- (9) Routine check-up
- (10) Use of life-saving appliances
- (11) Use of fire extinguishing apparatus and plan for fire protection
- (12) Handling of accumulator batteries (including procedure for charging and expected life of accumulator batteries)
- (13) Maximum speed and limits of trim in both surface and underwater conditions and crash astern performance
- (14) Weather conditions and sea states for permitting in service
- (15) Geographical dive site limitations
- (16) Control of fire in cabins
- (17) Emergency surfacing
- (18) Provision for support and rescue in emergency condition (including support divers and cranes or winches to lift up)
- (19) Communication with other ships or land facilities
- (20) Control of persons on board to take seats in balanced condition
- (21) Action in emergency condition with regard to communication, manoeuvring and control of persons' disembarkation
- (22) Special restrictions based on uniqueness of design and operating conditions

- (23) Operation check lists, including pre and post diving
- (24) Manning levels
- (25) Others considered necessary

**8.1.3 Training\***

Pilots, crews and maintenance staffs of submersibles are to be trained as deemed appropriate by the Society.

## **Part 11            COMPUTER-BASED SYSTEMS**

### **Chapter 1        GENERAL**

#### **1.1        General**

##### **1.1.1        Scope**

Computer-based systems are to be according to relevant requirements in [Chapter 3](#) and subsequent chapters, [Part X of the Rules for the Survey and Construction of Steel Ships](#).

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# GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF PASSENGER SHIPS

## Part 1 GENERAL

### Chapter 1 GENERAL

#### 1.1 General

##### 1.1.1 Application

With respect to the provisions of the Rules, unless explicitly specified otherwise in the relevant requirements, distances regarding ship length, breadth, depth, and tank length, breadth, height, etc. are to be measured by using moulded dimensions. However, where the effects of plate thickness are not negligible, this requirement is not applicable.

##### 1.1.6 Ships Using Low-flashpoint Fuels

In applying **Part GF of the Rules for the Survey and Construction of Steel Ships** with respect to requirement **1.1.6, Part 1 of the Rules**, the following (1) and (2) are to be applied.

- (1) The wording “docking surveys carried out at the times specified in **1.1.3-1(4)(a), Part B of the Rules**” in **GF15.4.2, Part GF of the Guidance for the Survey and Construction of Steel Ships** is to be interpreted to mean “docking surveys carried out at the times specified in **1.1.3-1(3), Part 2 of the Rules for the Survey and Construction of Passenger Ships**”. In such cases, the docking surveys are to be carried out every 5 years in accordance with *IMO Resolution A.1104(29)*.
- (2) The requirement specified in **GF11.3.1-4, Part GF of the Guidance for the Survey and Construction of Steel Ships** is to be replaced with as follows:

The following “other rooms with high fire risk” (as referred to in **11.3.1-3, Part GF of the Rules**) are as a minimum to be considered, but not be restricted to:

- (a) cargo spaces except cargo tanks for liquids with flashpoint above 60°C and except cargo spaces exempted in accordance with Regulation 10.7.1.2, Chapter II-2 of *SOLAS*;
- (b) vehicle, ro-ro and special category spaces;
- (c) service spaces (high risk): galleys, pantries containing cooking appliances, saunas, paint lockers and store-rooms having areas of 4 m<sup>2</sup> or more, spaces for the storage of flammable liquids and workshops other than those forming part of the machinery space, as provided in Regulation 9.2.2.4, Chapter II-2 of *SOLAS*; and
- (d) accommodation spaces of greater fire risk: saunas, sale shops, barber shops and beauty parlours and public spaces containing furniture and furnishing of other than restricted fire risk and having deck area of 50 m<sup>2</sup> or more, as provided in Regulation 9.2.2.3, Chapter II-2 of *SOLAS*.

#### 1.2 Class Notations

##### 1.2.1 General

For the application of **1.2.1, Part 1 of the Rules**, reference is to be made to **A1.2 Part A of the Guidance for the Survey and Construction of Steel Ships**.

##### 1.2.4 Hull Construction and Equipment

With respect to the provisions of **1.2.4, Part 1 of the Rules**, for ships of catamaran or trimaran and complying with relevant requirements, the notation of “*Catamaran*” (abbreviated to *CAT*) or “*Trimaran*” (abbreviated to *TRI*) is affixed proceeding with notation relating to structural materials for main hull specified in **1.2.3, Part 1 of the Rules**.

## Chapter 2      DEFINITIONS

### 2.1      General

#### 2.1.6      Subdivision Length of the Ship

“Deck or decks limiting the vertical extent of flooding” stated in **2.1.6, Part 1** of the Rules refers to the weather deck. However, when the ship has multiple decks above  $d_s + 12.5$  (m) at the deepest subdivision draught, the deck just above  $d_s + 12.5$  (m) is implied.

#### 2.1.11      Subdivision Length of the Ship

“Light service draught” stated in **2.1.11, Part 1** of the Rules corresponds, in general, to the arrival condition with 10 % consumables, a full complement of passengers and crew and their effects, and ballast as necessary for stability and trim.

#### 2.1.17      Permeability

With respect to the provisions of **2.1.17, Part 1** of the Rules, the volume of a space under consideration is to be taken as the moulded volume.

## Part 2 CLASS SURVEY

### Chapter 1 GENERAL

#### 1.1 Surveys

##### 1.1.1 Classification Surveys

1 With respect to **1.1.1, Part 2 of the Rules**, in cases where the regulations of **Part B of the Rules for the Survey and Construction of Steel Ships** are applied, the ship is to be considered to be not less than 500 *gross tonnage* even if ship is less than 500 *gross tonnage*.

2 With respect to **1.1.1-3, Part 2 of the Rules**, surveyors are to confirm the asbestos-free declarations and supporting documents specified in **2.1.3(7), Part 2 of the Rules**. The wording “materials containing asbestos” means that asbestos is present in the product/material above the threshold value stipulated in Appendix 1 of *IMO resolution MEPC.379(80)*.

##### 1.1.2 Class Maintenance Surveys

1 Modifications or conversions referred to in **1.1.2-2(3), Part 2 of the Rules** are to be in accordance with the provisions specified in **B1.1.2, Part B of the Guidance for the Survey and Construction of Steel Ships**.

2 With respect to **1.1.2, Part 2 of the Rules**, in cases where the regulations of **Part B of the Rules for the Survey and Construction of Steel Ships** are applied, the ship is to be considered to be not less than 500 *gross tonnage* even if ship is less than 500 *gross tonnage*.

##### 1.1.3 Intervals of Class Maintenance Surveys

1 For the application of the requirements of **1.1.3-3, Part 2 of the Rules**, in addition to the requirements specified in **B1.1.3-3 (except for (22)), Part B of the Guidance for the Survey and Construction of Steel Ships**, occasional surveys are to be in accordance with those specified in **(1) to (9)** below:

- (1) For ships carrying more than 36 passengers which had been at beginning stage of construction before 1 October 1994, a survey is to be carried out for verification of the compliance with the requirements of Regulation 41-2, Chapter II-2, *SOLAS* Convention adopted by the Maritime Safety Committee of the International Maritime Organization by the Resolution *MSC.24(60)*, by the date specified in Regulation 41-1, Chapter II-2, *SOLAS* Convention of the Resolution. However, ships which are not engaged on international voyages need not to comply with this requirement.
- (2) For ships engaged on international voyages which had been at the beginning stage of construction before 1 July 2008, a survey is to be carried out to verify compliance with the requirements of Regulations 5.3.1.3.2 and 5.3.4, Chapter II-2, *SOLAS* Convention adopted by the Maritime Safety Committee of the International Maritime Organization by the Resolution *MSC.216(82)*, by the date of the first survey after 1 July 2008.
- (3) For ships engaged on international voyages which had been at the beginning stage of construction prior to 1 January 2010, a survey is to be carried out to verify compliance with the emergency towing procedures requirements (**14.5.3, Part 1, Part C** or **23.3, Part CS of the Rules for the Survey and Construction of Steel Ships**) referred to in **1.1.1-4, Part 3 of the Rules** by 1 January 2010.

#### (4) Carriage of Dangerous Goods

For passenger ships, with cargo spaces intended for the carriage of packaged dangerous goods, which had been at the beginning stage of construction on or after 1 September 1984 but before 1 January 2011, a survey is to be carried out to verify compliance with the requirement specified in Regulation 19.3 Chapter II-2, *SOLAS* Convention, in accordance with Tables 19.1 and 19.3, by the first special survey of the ship on or after 1 January 2011. However, the following provisions may apply:

- (a) Passenger ships which had been at the beginning stage of construction on or after 1 September 1984 but before 1 July 1986 need not comply with 19.3.3, Chapter II-2, *SOLAS* Convention, provided that they comply with the Regulation 54.2.3, Chapter II-2, *SOLAS* Convention, as adopted by Resolution *MSC.1(XLV)*

- (b) Passenger ships which had been at the beginning stage of construction on or after 1 July 1986 but before 1 February 1992 need not comply with 19.3.3, Chapter II-2, *SOLAS* Convention, provided that they comply with the Regulation 54.2.3, Chapter II-2, *SOLAS* Convention, as adopted by Resolution MSC.6(48).
  - (c) Passenger ships which had been at the beginning stage of construction on or after 1 September 1984 but before 1 July 1998 need not comply with 19.3.10.1 and 19.3.10.2, Chapter II-2, *SOLAS* Convention.
  - (d) Passenger ships which had been at the beginning stage of construction on or after 1 February 1992 but before 1 July 2002 need not comply with 19.3.3, Chapter II-2, *SOLAS* Convention, provided that they comply with the Regulation 54.2.3, Chapter II-2, *SOLAS* Convention, as adopted by Resolution MSC.13(57).
  - (e) Passenger ships which had been at the beginning stage of construction on or after 1 September 1984 but before 1 July 2002 need not comply with 19.3.1, 19.3.5, 19.3.6 and 19.3.9, Chapter II-2, *SOLAS* Convention, provided that they comply with Regulations 54.2.1, 54.2.5, 54.2.6 and 54.2.9, Chapter II-2, *SOLAS* Convention, as adopted by Resolution MSC.1(XLV).
- (5) Portable Atmosphere Testing Instruments for Enclosed Spaces
- For ships of less than 500 *gross tonnage* engaged on international voyages which had been at the beginning stage of construction before 1 July 2016, it is to be verified that portable atmosphere testing instruments complying with **1.5.1, Part B of the Rules** are provided on board by the first survey on or after 1 July 2016.
- (6) Ships Using Low-flashpoint Fuels
- (a) For ships that fall under the following **i)** or **ii)**, a survey is to be carried out to verify compliance with **1.1.6, Part 1 of the Rules** before using low-flashpoint fuels or undertaking to use different low-flashpoint fuels than specified:
    - i) Ships which convert to using low-flashpoint fuels on or after 1 January 2017; or
    - ii) Ships which, on or after 1 January 2017, undertake to use low-flashpoint fuels different from those which they were originally approved to use before 1 January 2017.
  - (b) For ships that fall under the following **i)** or **ii)**, a survey is to be carried out to verify compliance with **GF11.3.1-1, GF11.3.1-2, GF12.5.2-2 and GF15.10.1, Part GF of the Guidance for the Survey and Construction of Steel Ships** before using low-flashpoint fuels or undertaking to use different low-flashpoint fuels than specified:
    - i) Ships which convert to using low-flashpoint fuels on or after 1 July 2019; or
    - ii) Ships which, on or after 1 July 2019, undertake to use low-flashpoint fuels different from those which they were originally approved to use before 1 July 2019.
  - (c) For ships that fall under the following **i)** or **ii)**, surveys are to be carried out to verify compliance with **11.8.1, Part GF of the Rules for the Survey and Construction of Steel Ships** and **GF11.3.1-2, Part GF of the Guidance for the Survey and Construction of Steel Ships** before beginning to use low-flashpoint fuels for the first time or before undertaking to use low-flashpoint fuels different from those approved to use:
    - i) Ships which convert to using low-flashpoint fuels on or after 1 January 2024; or
    - ii) Ships which, on or after 1 January 2024, undertake to use low-flashpoint fuels different from those which they were originally approved to use before 1 January 2024.
  - (d) For ships that fall under the following **i)** or **ii)**, a survey is to be carried out to verify compliance with **4.2.2, 5.12.1, 6.7.3-1(1), 6.9.1-1, 7.3.2-1, 8.4, 9.3.1, 9.4.7, 9.4.8, 9.6.1, 9.8.1, 9.8.2, 9.8.4, 11.3.1-1, 11.6.1-2, 12.5.1, 12.5.2, 15.4.1-3, Part GF of the Rules for the Survey and Construction of Steel Ships** and **GF11.7.1, Part GF of the Guidance for the Survey and Construction of Steel Ships** before using low-flashpoint fuels or undertaking to use different low-flashpoint fuels than specified:
    - i) Ships which convert to using low-flashpoint fuels on or after 1 January 2026; or
    - ii) Ships which, on or after 1 January 2026, undertake to use low-flashpoint fuels different from those which they were originally approved to use before 1 January 2026.
- (7) For ships engaged on international voyages which had been at the beginning stage of construction before 1 January 2014, a survey is to be carried out to verify compliance with **2.5.1(2), Part 4 of the Rules** by the first intermediate survey of the ships on or after 1 January 2025.
- (8) Amendments to IGF Code (MSC.551(108))
- For ships other than those ships defined in **2.2.1-45, Part GF of the Rules for the Survey and Construction of Steel Ships**, a

survey is to be carried out by the due date of the first Annual, Intermediate or Special Survey on or after 1 January 2026 to verify compliance with [4.2.2](#), [8.4](#) and [11.6.1-2, Part GF of the Rules for the Survey and Construction of Steel Ships](#).

- (9) For ships engaged on international voyages which had been at the beginning stage of construction before 1 January 2026, a survey is to be carried out for verification of the compliance with the requirements of Regulation 20.4.1.6, 20.4.4.1, 20.4.4.2 and 20.6.2.3, Chapter II-2, *SOLAS* Convention adopted by the Maritime Safety Committee of the International Maritime Organization by the Resolution *MSC.550(108)*, by the first survey of the ships on or after 1 January 2028.

2 With respect to the provisions of [-1](#) above, for ships at beginning stage of construction, such construction began before the effective date of each Occasional Survey requirements and such ships are delivered after these effective date, the Classification Survey of such ships is regarded as either their “first survey” or their “first scheduled dry docking”; therefore, these ships need to comply with each of the requirements of Occasional Surveys by the completion date of their Classification Survey.

#### **1.1.4 Periodical Surveys Carried Out in Advance**

1 In case where Intermediate Surveys were carried out in advance in accordance with [1.1.4-2, Part 2 of the Rules](#), the anniversary date is to be amended to a date on which the Intermediate Survey was completed. The subsequent Intermediate Surveys specified in [1.1.2-2\(1\)\(a\), Part 2 of the Rules](#) are to be carried out at the intervals using the new anniversary date.

2 Notwithstanding the requirements in [-1](#) above, for ships which are not engaged in international voyages, in case where Intermediate Surveys were carried out in advance in accordance with [1.1.4-2, Part 2 of the Rules](#), the anniversary date is to be amended to a date which is 3 *months* later the date on which the Intermediate Survey was completed. The subsequent Intermediate Surveys specified in [1.1.2-2\(1\)\(a\), Part 2 of the Rules](#) are to be carried out at the intervals using the new anniversary date.

#### **1.1.5 Postponement of Periodical Surveys**

The procedure and approval of the postponement of Periodical Surveys specified in [1.1.5, Part 2 of the Rules](#) are to be in accordance with the provisions specified in [B1.1.5, Part B of the Guidance for the Survey and Construction of Steel Ships](#).

#### **1.1.6 Modification of the Requirements**

The modifications of the requirements are to be in accordance with the provisions specified in [B1.1.6, Part B of the Guidance for the Survey and Construction of Steel Ships](#).

#### **1.1.7 Laid-up Ships**

Laid-up ships are to be in accordance with the provisions specified in [B1.1.8, Part B of the Guidance for the Survey and Construction of Steel Ships](#).

### **1.4 Preparation for Surveys and Others**

With respect to [1.4, Part 2 of the Rules](#), in cases where the regulations of [Part B of the Rules for the Survey and Construction of Steel Ships](#) are applied, the ship is to be considered to be not less than 500 *gross tonnage* even if ship is less than 500 *gross tonnage*.



## Chapter 2 CLASSIFICATION SURVEYS

### 2.1 Classification Survey during Construction

#### 2.1.1 General

The submission of plans and documents for Classification Survey during Construction is to be in accordance with the provisions specified in **B2.1, Part B of the Guidance for the Survey and Construction of Steel Ships**.

#### 2.1.3 Submission of Other Plans and Documents

**1** The documents of qualitative failure analysis referred to in **2.1.3(5), Part 2 of the Rules** are to comply with the requirements in the following **(1)** to **(4)**:

- (1) The qualitative failure analysis is to include the following information:
  - (a) For ships having a length of 120 *m* or more or having three or more main vertical zones, plans of action to ensure the availability of propulsion and steering upon the failure of relevant equipment and systems due to fire and flooding.
  - (b) For ships other than those specified above, possible solutions for enhancing the availability of propulsion and steering upon the failures of relevant equipment and systems due to fire and flooding.
- (2) The qualitative failure analysis is to be performed on the following equipment or systems which might affect the propulsion and steering of ships:
  - (a) Main propulsion systems
  - (b) Power transmission systems
  - (c) Steering gear and communication equipment
  - (d) Propeller, azimuthing thrusters or water jet
  - (e) Main power supply systems
  - (f) Essential auxiliary systems (compressed air, fuel oil, lubricating oil, and cooling water)
  - (g) Control and monitoring systems
  - (h) Other systems which might impair the propulsion and steering of ships (e.g., lighting, ventilation)
- (3) The fault conditions which are to be considered are to comply with the following:
  - (a) In principle, the qualitative failure analysis is to be based on single failure criteria.
  - (b) In cases where a single failure cause results in the failure of more than one component in a system, all the resulting failures are to be considered.
  - (c) In cases where the occurrence of a failure leads directly to further failures, all those failures are to be considered together.
  - (d) In cases where considering the effects of fire and flooding in a single compartment, the analysis is to address the location and layout of all equipment and systems.
- (4) The following information is to be specified:
  - (a) Standards used for analysis of the design
  - (b) Objectives of the analysis
  - (c) Any assumptions made in the analysis
  - (d) Operation modes of the equipment, systems or sub-systems.
  - (e) Identification of the probable modes and acceptable deviations from the intended or required function
  - (f) Evaluation of the local effects and the effects on the system as whole of each failure mode as applicable
  - (g) Trials and testing which justify a conclusion

**2** The watertight cable penetration register specified in **2.1.6-1(2)(o)** and **-2(10), Part 2 of the Rules** is to be in accordance with **(1)** to **(4)** below.

- (1) All watertight cable penetrations are to be recorded and identified in the watertight cable penetration register. This is to include documentation referencing the manufacturer manual(s) for each type of watertight cable penetration installed, the type approval certificate for each type of watertight cable penetration, applicable installation drawings, a recording of each installed watertight cable penetration documenting the as-built condition after final inspection at the shipyard and sections to record any inspection,

modification, repair and maintenance.

- (2) The watertight cable penetration register is to be provided by the shipbuilder and reviewed by the attending surveyor.
- (3) The watertight cable penetration register can be either a hard copy or digitized media.
- (4) For unmanned vessels, watertight cable penetration register may be kept on shore.

#### **2.1.4 Presence of Surveyors**

**1** As the necessary stages for the presence of surveyors specified in **2.1.4-2, Part 2 of the Rules**, the following examinations and tests are to be specially considered.

- (1) Hull
  - (a) Examination of the piping and valves of cross-flooding fittings and operation test of its remote control system
  - (b) Remote control test of bulkhead valves on the collision bulkhead from the bulkhead deck
  - (c) Following operation tests of watertight doors including confirmation of the caution plates
    - i) Open-close operation of doors (at door and by remote control)
    - ii) Operation of door indicators
    - iii) Alarm system
    - iv) Change over of mode at the central control console
  - (d) Examination of side scuttles, gangways, cargo and coal ports and other openings in the shell plating, watertight test for these openings below the bulkhead deck or weathertight test for these openings above the bulkhead deck, and operation test for these openings, door indicators and water leakage detectors of shell doors
  - (e) Examination of the inboard openings of ash-shoots and rubbish-shoots, and operation test of closing appliances where the inboard openings are below the bulkhead deck
  - (f) Examination of watertightness of fitted parts of fin-stabilizers
- (2) Fire protection, means of escape and fire extinguishing system
  - (a) Examination of closing appliances of openings (skylights, funnels and ventilators) in machinery spaces and operation test of their fire-dampers
  - (b) Examination and operation test of doors in machinery spaces
  - (c) Examination and operation test of fire dampers fitted to the duct whose sectional area is  $0.075m^2$  and more
  - (d) Examination of openings (penetration such as cables, pipes, ducts, girders, etc.) in “**A**” class or “**B**” class divisions
  - (e) Examination of electric-radiators and waste-receptacles
  - (f) Examination of the fire protection of the divisions forming the boundaries of the horizontal zones and the main vertical zones and stairway enclosures.
  - (g) Examination and operation test of “**A**” class fire doors and “**B**” class fire doors including test of both remote and self closing systems, and examination of fire windows and side scuttles
  - (h) Examination of draft stops, ceilings and linings
  - (i) Operation test of sprinkler systems, pressure test of pressure tanks, and operation test of alarm systems by both main and emergency source of power
  - (j) Examination of a lockable screw-down non-return valve of sprinkler systems at the connection with the fire main line, and examination of spare sprinkler heads
  - (k) Test of continuation of the output of water by the automatic starting of fire pumps
  - (l) Examination of fire protection, fire extinguishing system, fire detecting system, fire alarm system, ventilation system, and bilge system in the special category spaces, and operation test of these systems
  - (m) Operation test of the alarm system to summon the crew
  - (n) Operation test of the public address system
  - (o) Examination of fire protection, fire extinguishing system, fire detecting system, ventilation system and bilge system in spaces carrying dangerous goods and operation test of these systems
  - (p) Examination of means of escape including those from a radio room and special category spaces and diagrams of escape route put up in passenger spaces
  - (q) Operation test of smoke extraction system of atriums
  - (r) Operation test of closing arrangements of ventilation ducts and fire dampers

(s) General inspections and operation tests of smoke dampers

(3) Machinery

- (a) Performance test of electrical installation for main propulsion use in accordance with the approved test procedures
- (b) Operation test of emergency lighting (including supplementary emergency lighting and low location lighting)
- (c) Examination of electrical cables penetrating through divisions of main vertical zones

2 The wording “items specified otherwise by the Society” and the wording “survey methods which it considers to be appropriate” in **2.1.4-2, Part 2 of the Rules** mean to be in accordance with the following (1) and (2) respectively:

- (1) The wording “items specified otherwise by the Society” means surveys of the tests specified in item 1, **Table B2.7, Part B of the Rules for the Survey and Construction of Steel Ships**.
- (2) The wording “the Society may approve other survey methods which it considers to be appropriate” means survey methods which it considers to be able to obtain information equivalent to that obtained through traditional ordinary surveys where the Surveyor is in attendance.

3 The wording “survey methods which it considers to be appropriate” in **2.1.4-3, Part 2 of the Rules** means to be in accordance with **-2(2)**.

#### 2.1.6 Documents to be Maintained On Board

1 The certificates specified in **2.1.6-5, Part 2 of the Rules** are those such as the ones issued for each piece of equipment, device, etc., type approval certificates valid at the time of the Classification Survey, or others applicable. With regard to fire pumps, hose test records after installation on board may be accepted. In addition, unless equipment or devices on board are renewed after the ship has entered service, these certificates need not be updated.

2 The management plans for inspection and maintenance of mooring equipment (including mooring lines) specified in **2.1.6-1(2)(p), Part 2 of the Rules** are to be prepared in accordance with *MSC.1/Circ.1620* and are to include the following (1) to (6).

- (1) Procedures for mooring equipment (including mooring lines) operations, inspection and maintenance.
- (2) Procedures to allow the identification and management of mooring lines, tails and associated attachments.
- (3) Manufacturer criteria for mooring line replacement.
- (4) Records of the original mooring design concepts, equipment, arrangements and specifications. For ships the keels of which were laid before 1 January 2007 and which are without appropriate documentation, *MBL<sub>sd</sub>* should be established in accordance with the following (a) and (b).
  - (a) *MBL<sub>sd</sub>* should be established based on the Safe Working Load (*SWL*) of the mooring equipment provided on board.
  - (b) If no safe working load is specified, the strength of the mooring equipment and its supporting hull structure should be checked based on **14.4.3, Part 1, Part C of the Rules** and determine *MBL<sub>sd</sub>* based on the actual capacity of the equipment on board and its supporting hull structure.
- (5) Manufacturers' test certificates for mooring lines, joining shackles and synthetic tails
- (6) Records of mooring equipment inspections and maintenance, and mooring line inspections and replacement. The selection of replacement mooring lines is to be in accordance with the following (a) to (g).
  - (a) When replacing mooring lines, compatibility with the mooring equipment and fittings on board, as specified in the mooring arrangement plan, is to be taken into account, and a replacement mooring line which meets the designed specification is to be selected.
  - (b) In cases where (a) above cannot be satisfied, the following i) to vii) properties are to be taken into consideration and the towing and mooring arrangement plan updated accordingly.
    - i) breaking strength;
    - ii) environmental conditions to be used (e.g. temperature);
    - iii) linear density;
    - iv) tenacity;
    - v) D/d ratios;
    - vi) compression fatigue; and
    - vii) stiffness.
  - (c) Any increase in LDBF for the mooring lines above the limits specified, i.e. 100 % to 105 % of the *MBLSD*, may require a review of the operating parameters and design loads of mooring equipment and fittings, and their associated hull

supporting structures.

- (d) It is to be considered that their strength will decay due to varying environmental conditions and thus the original service life expectations may not be achieved.
- (e) For wire ropes, corrosion protection is to be considered.
- (f) The acceptable minimum bend radius (D/d ratio) recommended by the manufacturer is to be taken into consideration. The mooring line regularly exposed to below the acceptable minimum bend radius is to be subject to particular attention during inspections, taking into account the possibility that they may need to be replaced before the end of the service life recommended by the manufacturer.
- (g) When selecting replacement mooring lines with high stiffness, consideration is to be given to the use of synthetic tails. The effect of the use of synthetic tail on the stored energy and possible snap-back of the high stiffness mooring lines is to also be considered.

### **2.1.8 Verification of Coating Application**

**1** The “Technical Data Sheet” stipulated in **2.1.8(1), Part 2 of the Rules** refers to the paint manufacturers’ Product Data Sheet which contains detailed technical instruction and information relevant to the coating and its application.

**2** The “certificate deemed appropriate by the Society” stipulated in **2.1.8(1), Part 2 of the Rules** refers to one of the following **(1)** to **(3)**:

- (1) The Society’s approval certificate specified in **Chapter 4, Part 5 of Guidance for the Approval of Materials and Equipment for Marine Use**
- (2) Statement of Compliance issued by the Research Institute of Marine Engineering, Japan (*RIME*), the Japan Paint Inspection and testing Association or MARINTEK
- (3) Other documents approved by the Society

**3** The “qualification standards deemed appropriate by the Society” stipulated in **2.1.8(3), Part 2 of the Rules** refers to the qualifications that the coating inspector is to have, at least one of which is from the following **(1)** to **(3)**:

- (1) AMPP Certified Coatings Inspector
- (2) FROSIO Inspector Level III
- (3) Equivalent qualifications approved by the Society

**4** The “coating inspection requirements deemed appropriate by the Society” stipulated in **2.1.8(5), Part 2 of the Rules** refers to the requirements specified in **6, IMO Resolution MSC.215(82)**.

## Chapter 3 INTERMEDIATE SURVEYS

### 3.2 Hull, Equipment and Fire Extinguishing Systems

#### 3.2.2 Fire Protection, Means of Escape and Fire Extinguishing System

Operation test of automatic sprinkler system required in **3.2.2(9), Part 2 of the Rules**, includes water passing test for piping, operation test of sprinkler pumps and sprinkler heads. In principle, operation test is to be carried out for all sections, however the Society may accept the sampling test as shown below provided that such test is considered to represent the operation test for each sprinkler section serving the area.

- (1) Operation test is carried out for at least one sprinkler piping with a sprinkler head led to the exposed space which represents each sprinkler section serving the area.
- (2) Operation test is carried out for at least one sprinkler piping with a sprinkler head which is selected to represent each sprinkler section serving the area and provided with a saucer underneath the head to prevent water from splashing on to the interiors of the area.

### 3.3 Machinery

#### 3.3.1 Machinery

The case “if deemed necessary by the Society” specified in **3.3.1(5), Part 2 of the Rules** means such case that ship’s characteristics of manoeuvrability or propulsion is affected due to any modification and/or conversion of hull, machinery and equipment etc.

## Chapter 4 SPECIAL SURVEYS

### 4.2 Hull, Equipment and Fire Extinguishing Systems

#### 4.2.1 Hull

**1** An example of the procedure of the lightweight check specified in **4.2.1(2), Part 2 of the Rules**, is shown below:

**(1) Lightweight**

- (a) Drafts for the test condition are measured at the bow, midship and stern by draft scales and sea water temperature and density are also measured. If necessary, sea water density is corrected by sea water temperature.
- (b) Additional weight such as measuring equipment and liquid in tanks for the test condition are measured and included in the calculation of the lightweight.
- (c) The lightweight is calculated on the basis of the results of the measurement mentioned above and the hydraulic curves (indicating the change of displacement per *cm*). However, in case where ship's trim or deflection is relatively large, the light weight needs to be corrected by a suitable method.

**(2) Centre of gravity**

The centre of gravity of the ship is calculated on the basis of the results of the measurements mentioned in **(1)** above (ship's drafts, additional weights and lightweight) and hydraulic curves indicating the centre of buoyancy, the change of trim per *cm*.

**2** When the lightweight survey results do not exceed the deviation limits specified in **4.2.1(2), Part 2 of the Rules**, the lightship displacement and the longitudinal and transverse centres of gravity obtained from the lightweight survey are to be used in conjunction with the vertical centre of gravity derived from the most recent inclining in all subsequent stability information supplied to the master.

**3** In applying **4.2.1(2), Part 2 of the Rules**, for ships that have undergone major alternations so as to materially affect their main ship particulars, regardless of **-2** above, the lightship properties (as specified in **2.3.1, Part B of the Rules**) obtained from lightweight surveys are to be used for stability information thereafter, even when lightweight survey results do not exceed the deviation limits specified in **4.2.1(2), Part 2 of the Rules**.

### 4.3 Machinery

#### 4.3.1 Machinery

Among the tests for machinery required in **4.3.1, Part 2 of the Rules**, operation test of low location lighting is to be as follows.

- (1) After the extinction of all light sources other than those of low location lighting, the luminance test of low location lighting is to be carried out at the particular spaces specified by the Surveyor.
- (2) In case where the result of the luminance test mentioned in **(1)** above does not meet the requirements of **Table 2.4.3.1-1**, the luminance test is to be carried out at least ten locations equally spaced apart in the space. If more than 30% of the results of the test do not meet the requirements of **Table 2.4.3.1-1**, the low location lighting is to be replaced. If between 20% and 30% of the results of the test do not meet the requirements of **Table 2.4.3.1-1**, the low location lighting is to be tested again in one *year* or replaced.

Table 2.4.3.1-1 The Luminance of Low Location Lighting

Photoluminescent systems ( <i>PL</i> systems)	After 10 <i>minutes</i>	After 60 <i>minutes</i>
	Luminance : at least 15 <i>mcd/m</i> <sup>2</sup>	Luminance : at least 2 <i>mcd/m</i> <sup>2</sup>
Electrically powered systems ( <i>EP</i> systems)	Luminance of active part : at least 10 <i>cd/m</i> <sup>2</sup>	

## **Chapter 5      DOCKING SURVEYS**

### **5.1      Docking Surveys**

#### **5.1.2      In-water Surveys**

The approval to the application of In-water Surveys is to be in accordance with the provisions specified in [6.1.2, Part B of the Rules for the Survey and Construction of Steel Ships](#).

## Part 3 HULL CONSTRUCTION AND EQUIPMENT

### Chapter 1 GENERAL

#### 1.1 General

##### 1.1.1 Application

Hull construction and equipment of ships to be classed for restricted service is to be in accordance with the follows:

- (1) The reduction of scantlings of structural member is to be applied correspondingly the requirements in **27.2, 27.3 and 27.4, Part CS of the Rules for the Survey and Construction of Steel Ships**, according to the restricted service.
- (2) The height of sills of access openings is to be applied correspondingly the requirements in **27.2, 27.3 and 27.4, Part CS of the Rules for the Survey and Construction of Steel Ships**, according to the restricted service.
- (3) Equipment number and equipment are to be applied correspondingly the requirements in **27.2, 27.3 and 27.4, Part CS of the Rules for the Survey and Construction of Steel Ships**, according to the restricted service. However, openings installed in watertight bulkhead of Ro-Ro passenger ships is to be applied correspondingly the requirements in **6.3, Part 3 of the Rules**.
- (4) Means of embarkation and disembarkation are to be applied correspondingly the requirements in **27.2, 27.3 and 27.4, Part CS of the Rules for the Survey and Construction of Steel Ships**, according to the restricted service.
- (5) Emergency Towing Procedures are to be applied correspondingly the requirements in **27.2, 27.3 and 27.4, Part CS of the Rules for the Survey and Construction of Steel Ships**, according to the restricted service.
- (6) With regard to the arrangement of openings for ships which are not engaged on international voyages, in lieu of the bulkhead valve required by **6.3.1-3, Part 3 of the Rules**, suitable screw-down valves or butterfly valves that are operable from above the bulkhead deck may be fitted and valve chests may be secured to a bulkhead located inside the forepeak. These valves may be fitted on the aft side of the collision bulkhead in question provided that the valves are readily accessible under all service conditions, and that the space in which they are located is not a cargo space. Remote control devices for these valves may be omitted.

##### 1.1.4 Direct Calculations

**1** The procedure of determining the scantlings of hull structural members by the direct calculations of the requirements in **1.1.4, Part 3** of the Rules is also to comply with the **Chapter 8, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships**. In case where the application of this Guidance and **Part 3** of the Rules are considered to be difficult, however, the analytical procedure, load conditions, allowable stresses, etc. may be determined at the discretion of the Society.

**2** In case where the scantlings of each structural member are determined by the direct calculations, the procedure of examining the buckling strength of each structural member on the basis of the results of direct calculations is to comply with the **8.6.2, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships**.

**3** When the Society recognizes the necessity of examination of fatigue strength of the parts, such as joints of structural members and discontinuous structures where stress concentration can be predicted, materials and data on the analysis procedure, load condition, etc. are to be submitted.



## **Chapter 2        MATERIALS AND WELDING**

### **2.1        Materials**

#### **2.1.1        Application**

Where materials of high tensile steel are used, the construction and scantlings are to be determined with special reference to the relevant requirements of **Part C of the Rules for the Survey and Construction of Steel Ships**, unless otherwise specified.

## Chapter 3 LONGITUDINAL STRENGTH

### 3.1 Bending Strength

#### 3.1.1 Bending Strength at the Midship Part

1 Bending strength at the midship part of ships having long multi-deckhouses on strength deck is to be in accordance with the follows:

- (1) The requirements in **3.1.1-1, Part 3** of the Rules are to be complied with.
- (2) The calculation of section modulus and moment of inertia for hull cross section, in addition to sub-paragraph (1), is to apply the requirement in **5.2.1, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships** for each deck which the deck directly below the deckhouse that the ratio of the length of ship length direction of deckhouse of each every layer and the circumference of cross section of deckhouse (the value of two times of the sum of width and height of the deckhouse) is less than 5, hereinafter referred to as “the deck which is needed to examine the longitudinal strength”, and all longitudinal member which are located below the deck and are considered effective to the longitudinal strength are to be included in the calculation. In this case, the openings of deck except for strength deck is to be handled as well as the openings of strength deck. Where, however, longitudinal plate member that compressive buckling strength is not enough and which is considered to give no contribution to the longitudinal strength is located above the strength deck, the sagging moment which arises under navigation is to be in accordance with the following requirements in (a) and (b).
  - (a) The sub-paragraph (2) is to be applied, provided the longitudinal plate member that compressive buckling strength is not enough and which is considered to give no contribution to the longitudinal strength is removed from inclusion member of hull cross section modulus and moment of inertia.
  - (b) For frame members, the plate members having the effective width calculated by the requirement in **14.6.5.6(3), Part 1, Part C of the Rules for the Survey and Construction of Steel Ships** may be considered as flange of the frame members and may be added to the inclusion members.
- (3) Where an approval by the Society is obtained, bending strength may be examined by other method which is specially considered, notwithstanding the provisions of (1) and (2).

2 In case of the stairway rooms including atrium and elevator centralized in midship deck of hull, bending strength around openings is to be confirmed by the result of direct calculations. Allowable stress is to be suited to the provision of **Chapter 5, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships**. However, allowable stress around corner may be applied corresponding to the provision of **8.6, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships**.

### 3.2 Buckling Strength

#### 3.2.1 Compressive Buckling Strength

1 Compressive buckling strength at the midship part of ships having long multi-deckhouses on strength deck is to be in accordance with the follows:

- (1) The requirements of **3.2.1-1, Part 3** of the Rules are to be complied with.
- (2) The application of the compressive buckling strength of the deck which requires the examination specified in **3.1.1** of the Rules and all shell platings, decks, superstructure side platings and plate members of longitudinal bulkhead which is located below the deck and contribute to the longitudinal strength, compressive buckling, torsional buckling of its longitudinal stiffeners and compressive buckling strength of web are to be in accordance with the requirements in **Annex 5.3, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships**. In this case, the determination of moment of inertia for the hull cross section is to be in accordance with the requirements in **An3.1.1(2), Annex 5.3, Part 1, Part C of the Rules**, except for proviso. And, the minimum value of the compressive stress of members specified in **5.3.2, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships** needs not to be taken  $30/K$  ( $N/mm^2$ ), hereinafter  $K$  is the material factor and is in accordance with the requirements in **5.2.1-1(1), Part 3** of the Rules. Where, however, longitudinal plate member that

compressive buckling strength is not enough and which is considered to give no contribution to the longitudinal strength is located above the strength deck, the sagging moment which arises under navigation is to be in accordance with the following requirements in (a) and (b).

- (a) The sub-paragraph (2) is to be applied only considering frame members, provided the longitudinal plate member that compressive buckling strength is not enough and which is considered to give no contribution to the longitudinal strength is removed from inclusion member of hull cross section modulus and moment of inertia.
- (b) Frame members may be in accordance with the requirements in 3.1.1-1(2)(b) of the Rules.
- (3) Where an approval by the Society is obtained, buckling strength may be examined by other method which is specially considered, notwithstanding the provisions of (1) and (2).

**2** In case of the stairway rooms including atrium and elevator centralized in midship deck of hull, buckling strength around openings is to be confirmed by the result of direct calculations of 3.2.1-2.

## Chapter 4 DOUBLE BOTTOM CONSTRUCTION

### 4.1 Arrangement

#### 4.1.1 Arrangement

1 In the case of ships to which the provisions of **2.1.36, Part 1** of the Rules apply and which are engaged on regular service within the limits of a short international voyage as defined in **1.2.14, Part 1** of the Rules, the Society may permit a double bottom to be dispensed with, if satisfied that the fitting of a double bottom in that part would not be compatible with the design and proper working of the ship, and that the requirements in the following **-3** are satisfied.

2 “provided the safety of the ship is not impaired” specified in **4.1.1-2, Part 3** of the Rules means to satisfy the requirement of damaged stability specified in **Part 4** of the Rules.

3 Application for the omission of double bottom or unusual bottom arrangements given by requirements of **4.1.1-2, Part 3** of the Rules is to be in accordance with following **(1)** and **(2)**. For example, arrangements in which parts of the double bottom do not extend for the full width of the ship or in which the inner bottom is located higher than the partial subdivision draught ( $d_p$ ) defined in **2.1.12, Part 1 of the Rules** are to be considered to be unusual bottom arrangements.

- (1) When it is assumed that such spaces are subject to a bottom damage, compartments are to be arranged to demonstrate that the factor  $s_t$ , when calculated in accordance with **2.3.6, Part 4** of the Rules, is not less than 1 for those service conditions which are the three loading conditions used to calculate the Attained Subdivision Index ( $A$ ) specified in **2.3.4-2, Part 4** of the Rules. Assumed extent of damage is to be in accordance with following **Table 3.4.1.1**. If any damage of a lesser extent than the maximum damage specified in **Table 3.4.1.1** would result in a more severe condition, such damage is to be considered.
- (2) Flooding of such spaces is not to render emergency power and lighting, internal communication, signals or other emergency devices inoperable in other parts of the ship.

Table 3.4.1.1 Assumed Extent of Damage

	For $0.3L$ from the forward perpendicular of the ship	Any other part of the ship
Longitudinal extent	$1/3 L_f^{2/3}$ or $14.5m$ , whichever is less	$1/3 L_f^{2/3}$ or $14.5m$ , whichever is less
Transverse extent	$B'/6$ or $10m$ , whichever is less	$B'/6$ or $5m$ , whichever is less
Vertical extent, measured from the keel line	$B'/20$ , to be taken not less than $0.76 m$ and not more than $2 m$	$B'/20$ , to be taken not less than $0.76 m$ and not more than $2 m$

Notes:

1. Keel line is to be in accordance with **2.1.22, Part 1 of the Rules**.
2. Ship breadth ( $B'$ ) is to be in accordance with **2.1.5-1, Part 1 of the Rules**.

4 “As deemed appropriate by the Society” stipulated in **4.1.1-4, Part 3** of the Rules means that the requirements specified in **-3(1)** above are satisfied.

5 “Protection equivalent to that afforded by a double bottom complying with this regulation” stipulated in **4.1.1-4, Part 3** of the Rules means that the requirements specified in **-3(1)** above are satisfied. However, wells for lubricating oil below main engines may protrude into the double bottom below the boundary line defined by the distance  $h$  ( $h$  is specified in **4.1.1-3, Part 3** of the Rules) provided that the vertical distance between the well bottom and a plane coinciding with the keel line is not less than  $0.5h$  or  $500 mm$ , whichever is greater.

6 With respect to the provisions of **4.1.1-5, Part 3** of the Rules, when flooding calculation is carried out in accordance with **-3** above, assuming an increased vertical extent is to be required.

## Chapter 6 WATERTIGHT BULKHEAD AND THE OPENING

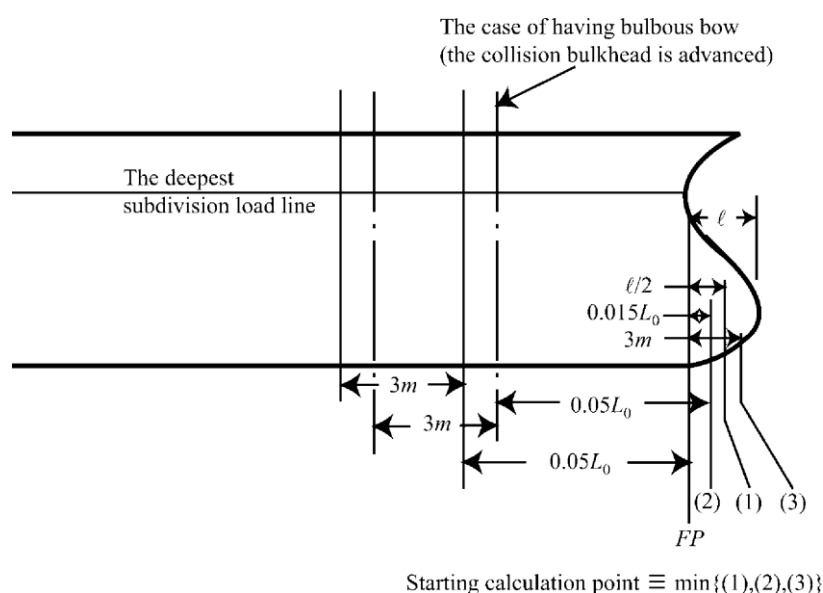
### 6.2 Watertight Bulkhead and Tunnel

#### 6.2.1 Collision Bulkhead

1 Where any part of the ship below the water-line extends forward of the forward perpendicular, the distances stipulated in this rule are to be measured from a point either (see Fig. 3.6.2.1-1):

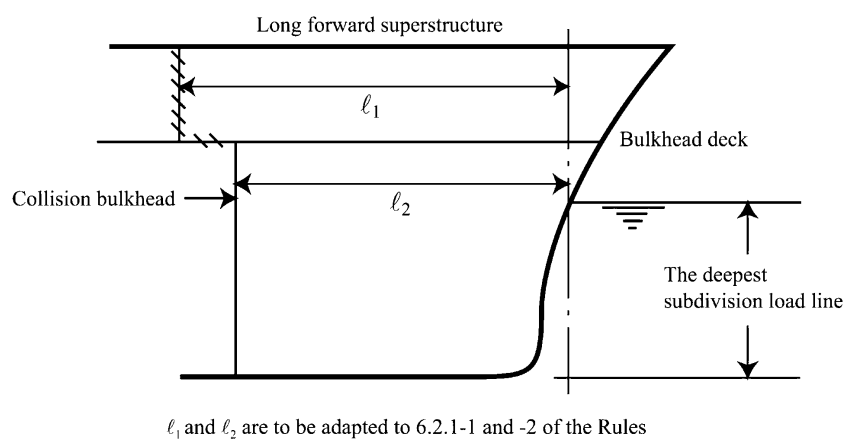
- (1) at the mid-length of such extension; or
  - (2) at a distance 1.5% of the length of the ship forward of the forward perpendicular; or
  - (3) at a distance of 3m forward of the forward perpendicular;
- whichever gives the smallest measurement.

Fig. 3.6.2.1-1 The Position of the Collision Bulkhead for Ships Having Bulbous Bow



2 “Long forward superstructure” specified in 6.2.1-4, Part 3 of the Rules means the superstructure having length not less than 0.25  $L$ .

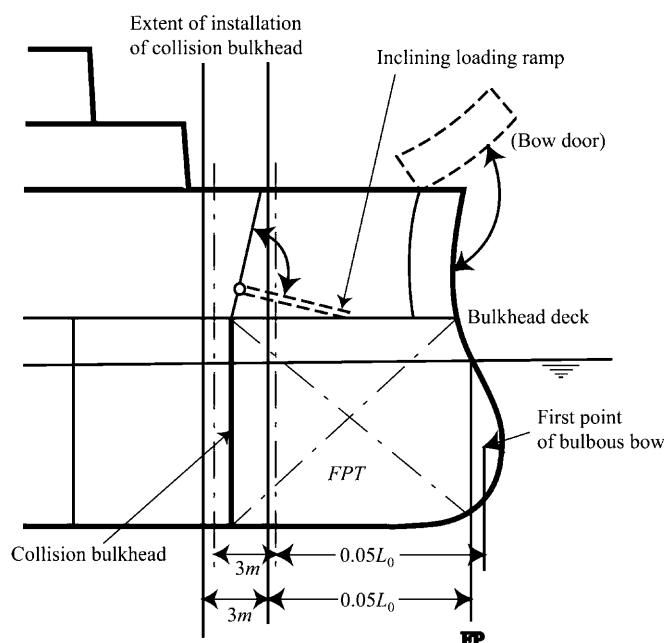
Fig. 3.6.2.1-2 Long Forward Superstructure



//// : Weather tight structure (including doors, etc.)

- 3 In ships with bow doors, the position of collision bulkhead above bulkhead deck is to be as shown in [Fig. 3.6.2.1-3](#).

Fig. 3.6.2.1-3 The Position of the Collision Bulkhead for Ships with Bow Doors



### 6.2.3 After Peak Bulkhead

Where the after peak bulkhead is terminated at a deck below the bulkhead deck, the deck is to satisfy the following requirements:

- (1) The deck is to be situated above the deepest subdivision load line;
- (2) The deck is to be water tight structure from the after peak bulkhead to the stern;
- (3) The line pulled from the upper end of after peak bulkhead in the 76mm downward is not to be immersed in the last condition after the flooding.

### 6.2.4 Tunnel

The volume of the watertight compartment in which stern tube was installed is to be confirmed by the flooding calculation that the margin line is not immersed even if the compartment is flooded by the leakage through the stern gland.

## 6.3 Openings of Watertight Bulkhead

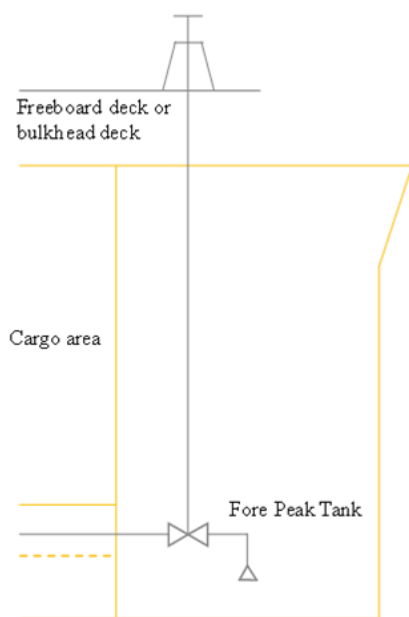
### 6.3.1 Arrangement of Openings

1 “One pipe for dealing with fluid in the fore peak tank” specified in [6.3.1-3, Part 3](#) of the Rules means the pipe for ballasting. And, a void and a similar place are not included in the place meaning the wording “readily accessible under all service conditions” in [6.3.1-3, Part 3](#) of the Rules.

2 “One door, apart from the doors to shaft tunnels, may be fitted in each main transverse bulkhead” specified in [6.3.1-5, Part 3](#) of the Rules means the entrance for access or construction. However, the entrance for construction is not to be installed in the transverse bulkhead having the openings closed by the removable plate which is fixed by the bolt.

3 The remotely controlled valves specified in [6.3.1-3, Part 3 of the Rules](#) may be of either a manual type or a mechanically powered type, provided that a fail-close arrangement is installed, as in the examples shown in [Fig. 6.3.1-3](#).

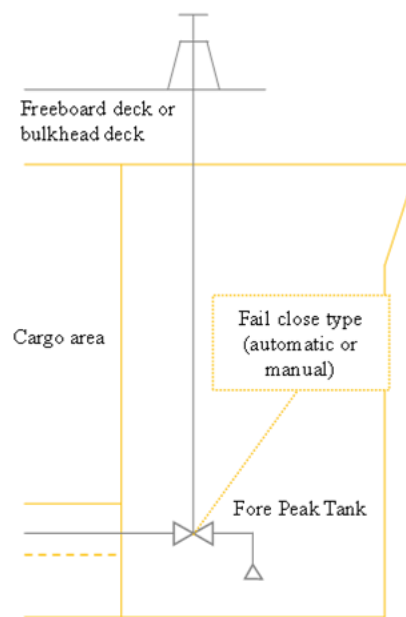
Fig. 6.3.1-3



Case 1 (Not allowable)

Manual deck stand controlled from the freeboard deck or bulkhead deck

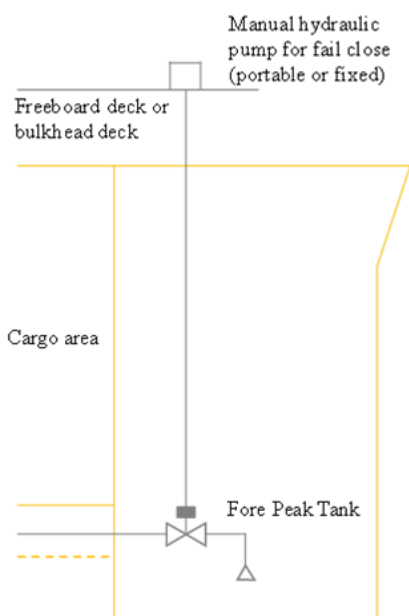
When fails, the valve remains at its current position



Case 2 (Allowable)

Manual deck stand controlled from the freeboard deck or bulkhead deck

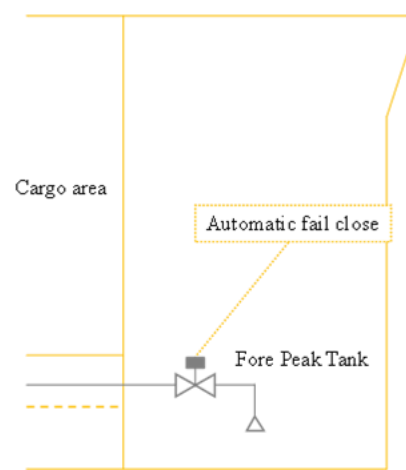
Fail-close type valve (automatic close or manual close from the freeboard deck or bulkhead deck)



Case 3 (Allowable)

Actuated mechanically and controlled remotely from cargo control room, etc.

Manual fail-close from above the freeboard deck or bulkhead deck



Case 4 (Allowable)

Actuated mechanically and controlled remotely from cargo control room, etc.

Automatic fail-close

### 6.3.2 Pipes and Penetrations

1 Valve stems of various valves are, in principle, not to penetrate through the part subjected to liquid head such as the bottom plate of shoulder tanks and tank top of double bottom used for tanks. In case where such penetrations are unavoidable, considerations are to be taken by providing such means as protection pipe to prevent liquid head from imposing on the stuffing box.

- 2 The valve and cock for dropping the drain from one compartment to another are not to be installed even if the equipment, which can operate on the bulkhead deck, is installed.
- 3 The application of **6.3.2-3, Part 3 of the Rules** is to comply with the following **(1)** to **(7)**.
- (1) “Heat sensitive materials” means non-metallic materials such as *PVC*, *FRP* and metallic materials for which the melting point is not greater than 925 °C, (e.g. aluminum alloys and copper alloys).
  - (2) “Systems” in **6.3.2-3, Part 3 of the Rules** means heat sensitive piping systems. Therefore, the requirement does not apply to cable penetrations of watertight boundaries.
  - (3) Closed piping systems which penetrate watertight boundaries are to be in accordance with the following **(a)** to **(c)**.
    - (a) “Closed piping systems” in this sub-paragraph means piping systems without openings in multiple watertight compartments.
    - (b) For closed piping systems, compliance with **6.3.2-3, Part 3 of the Rules** is achieved when approved pipe penetrations are fitted at the intersections of watertight boundaries to ensure that heat sensitive pipes outside the space affected by fire remain intact, and so that any flooding of fire affected spaces does not cause progressive flooding through piping or pipe penetrations.
    - (c) Materials used in systems are to be of sufficient strength after exposure to heat or be considered as part of the open piping systems specified in **(4)** below.
  - (4) Open piping systems which penetrate watertight boundaries are to be in accordance with following **(a)** to **(d)**.
    - (a) “Open piping systems” in this sub-paragraph means piping systems with openings in multiple watertight compartments.
    - (b) For open piping systems, compliance with **6.3.2-3, Part 3 of the Rules** is achieved when approved pipe penetrations are fitted at the intersections of watertight boundaries and pipe connections to watertight compartments are fitted with either isolation or non-return valves, as deemed appropriate, to prevent progressive flooding through piping systems after a fire.
    - (c) As an alternative to the fitting of isolation or non-return valves, pipes may be routed above damaged waterlines in such a way that progressive flooding is prevented, taking into account the dynamic movements of ships under damaged conditions.
    - (d) Closing devices using intumescent materials (i.e. materials that swell when exposed to heat) are not to be considered equivalent to the fitting of valves since fires might be located too far from such devices to create watertight seals.
  - (5) Notwithstanding **(3)** and **(4)** above, progressive flooding may be taken into account in accordance with **2.3.6-12, Part 4 of the Rules**.
  - (6) Penetrations used for the passage of heat sensitive piping systems through watertight boundaries are to be tested with heat sensitive piping and are to be approved in accordance with the following **(a)** to **(j)**.
    - (a) **Chapter 1, Part 5, Guidance for the Approval of Materials and Equipment for Marine Use** applies correspondingly to procedures for approval, tests, etc. for pipe penetrations.
    - (b) Approval of the pipe penetrations is to be included a watertightness test which is carried out after completing fire test under provision of **Chapter 1 of Part 5 of the Guidance for the Approval of Materials and Equipment for Marine Use**.
    - (c) Test pressures are to be 1.5 *times* design pressures of penetrations or higher. Design pressures are to be more than the maximum hydrostatic pressures acting upon the intended installation locations of penetrations, as calculated from intact stability and damage stability calculations. Pressures are to be applied to the same sides of divisions as applied during fire tests.
    - (d) Pipe penetrations are to be tested at test pressures for 30 *minutes*, with the test pressures being, at a minimum, 0.1 *MPa* at hydrostatic pressure. There is to be no leakage during these tests.
    - (e) Pipe penetrations are to be tested at the same test pressures for an additional 30 *minutes* after the tests in **(d)** above are carried out. There may be leakage during these tests, but it is not to exceed 1*l*.
    - (f) Watertightness tests are to be considered valid only for pipe types (e.g. thermoplastic, multilayer), pressure classes, the maximum/minimum dimensions tested as well as the types and fire ratings of the divisions tested.
    - (g) Watertightness tests need not be carried out on hot penetration arrangements. In addition, ample time may be given to prepare for watertightness tests (e.g. dismantling fire testing equipment, rigging pressure test equipment).
    - (h) Watertightness tests are to be carried out with the pipe sections used in fire tests still in place.
    - (i) Pipe insulation fitted for fire tests may be removed before watertightness tests.
  - (7) Notwithstanding **(6)** above, tests are not required when pipe penetrations comply with **9.3.1, Part R of the Rules**. However,



the watertight integrity of such pipe penetrations is to be ensured.

## 6.4 Watertight Door

### 6.4.1 General

1 “Not more than 60 seconds” specified in 6.4.1-1, Part 3 of the Rules means the necessary closing time for all power-operated watertight door in which is remote operated from the center console. The necessary closing time for each power-operated watertight door is also to be 20 seconds and over but not more than 40 seconds in accordance with the requirement in 6.4.2(7), Part 3 of the Rules.

2 In the application of 6.4.1-2, Part 3 of the Rules, prototype tests (refer to 2.2.2.3-1, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships or CS13.3.3-1, Part CS of the Guidance for the Survey and Construction of Steel Ships) are to be carried out from each side of the door to verify its closing capabilities under forces that may act upon it when water is flowing through it by applying a static head equivalent to a water height of at least 1 m above the sill of the door.

3 “The damaged portion” specified in 6.4.1-3, Part 3 of the Rules means the extent specified in 2.3.5, Part 4 of the Rules.

4 In the application of 6.4, Part 3 of the Rules, IACS Unified Interpretation SC156 (as amended) is to be satisfied in cases where watertight doors are to be fitted.

5 In the application of 6.4, Part 3 of the Rules, the relevant part of the latest IMO Resolution MSC.429(98) “REVISED EXPLANATORY NOTES TO THE SOLAS CHAPTER II-1 SUBDIVISION AND DAMAGE STABILITY REGULATIONS” is to be referred to meet the requirements of Regulation 17.2 and 17.3, Chapter II-1, SOLAS Convention.

6 Failure of the normal power supply of alarms required to be installed by 6.4.2(6) and 6.4.3-1.(d), Part 3 of the Rules is to be indicated by an audible and visual alarm. This alarm is to be located on the central operating console at the navigation bridge.

### 6.4.2 Power-operated Sliding Watertight Door

1 “Any other adequate form of power” specified in 6.4.2(3), Part 3 of the Rules is not to be included by dropping or by the action of a dropping weight.

2 “An individual hand-operated mechanism” specified in 6.4.2(4), Part 3 of the Rules means a continuation rotation crank motion mechanism. And, “Direction of rotation or other movement is to be clearly indicated at all operating positions” means that the distinction of open/close are clearly shown and that direction of the motion for manual operation mechanism is displayed by the arrow\*.

\* : For ships flying Japanese flag, the operation position of the power-operated sliding watertight door is additionally required from the upper part of bulkhead deck where can be approached.

3 In 6.4.2(5), Part 3 of the Rules, the controls by power from both side of the door is to have precedence over the control by power from the central operating console.

### 6.4.3 Power Control System

1 “Minimize the possibility of having a single failure in the hydraulic piping adversely affect the operation of more than one door” specified in 6.4.3-1(1)(c), Part 3 of the Rules means that the system is independently arranged from each power source to each power-operated sliding watertight door. The example for piping is shown in Fig. 3.6.4.3-1.

2 The accumulator is to be installed in each watertight door in accordance with the requirement in 6.4.3-1(2)(a), Part 3 of the Rules. The example for arrangement is shown in Fig. 3.6.4.3-2.

3 The low pressure group alarm alarmed loss of storage energy of the accumulator specified in 6.4.3-1(2)(c), Part 3 of the Rules is to be a visible and audible alarm.

4 The control equipment indicator and alarm system are to be separated in every watertight sliding door, and the watertight sliding door is not to be opened by the trouble, in accordance with the requirement in 6.4.3-5, Part 3 of the Rules.

5 In the requirement in 6.4.3-6, Part 3 of the Rules, each electric motor and the starter are installed closely.

### 6.4.4 Remote Control System

In the requirement in 6.4.4-3, Part 3 of the Rules, the power-operated sliding watertight doors are to be operable from both sides at the position of the door\*.

\* : For ships flying Japanese flag, however, a release from the manual remote operation place on bulkhead deck is acceptable.

### 6.4.5 Opening and Closing of Watertight Doors

In applying the requirements specified in 6.4.5-2, Part 3 of the Rules, with respect to the impact on ship operations and

survivability, reference is to be made to the MSC.1/Circ.1564 “Revised guidance for watertight doors on passenger ships which may be opened during navigation”.

#### 6.4.6 Watertight Door in Cargo Space

“Device which prevents unauthorized opening” specified in 6.4.6-2, Part 3 of the Rules means the key of the door which is kept by master.

Fig. 3.6.4.3-1 Example for Piping of Power System

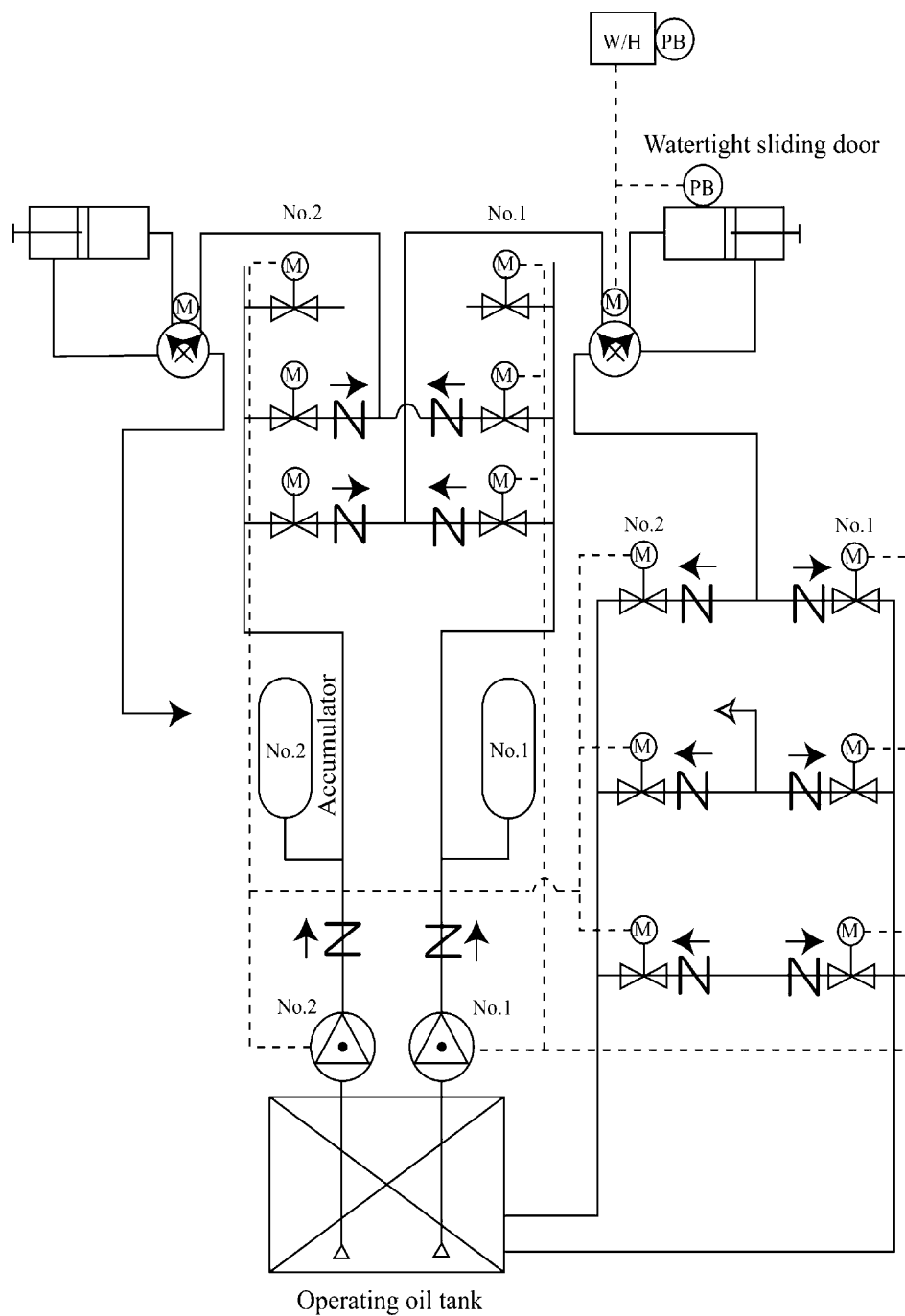
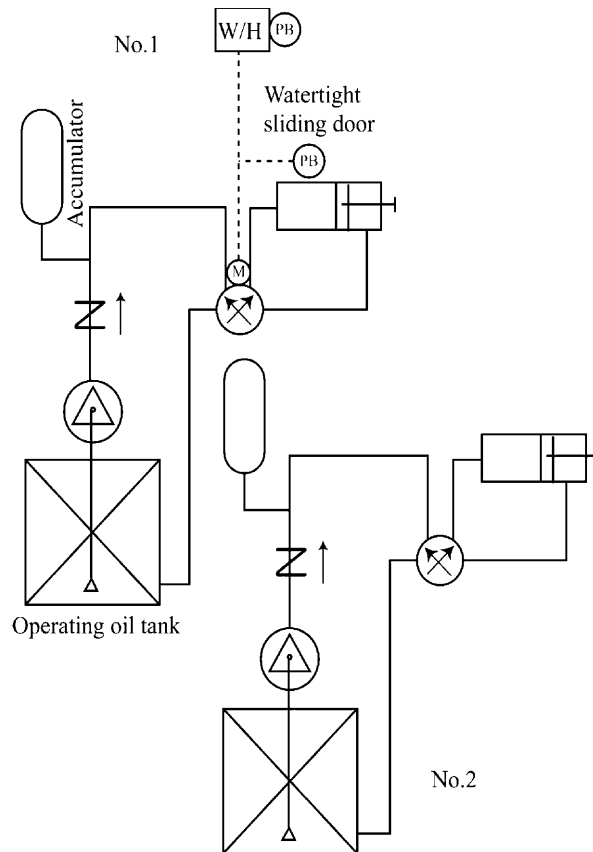


Fig. 3.6.4.3-2 Example for Piping of Accumulator



## 6.5 Trunk and Miscellaneous

### 6.5.1 Trunk

In case where the duct trunk for forced ventilation or the tunnel penetrating for transverse watertight bulkhead are installed, the penetration is to be installed in the position as high as possible, and is to be closed to the center line.

### 6.5.2 Portable Plates on Bulkhead

The power-operated watertight sliding doors which are recognized as an alternative of these portable plates on bulkhead are to satisfy the requirement in [6.4.2, Part 3](#) of the Rules, except for the scantlings of the door and the minimum time for the manual closure.

## Chapter 7 OPENINGS IN THE SHELL PLATING AND THE WATERTIGHT INTEGRITY

### 7.2 Openings below the Bulkhead Deck

#### 7.2.2 Side Scuttle

1 The fitting position of side scuttles specified in 7.2.2-1, Part 3 of the Rules is shown in Fig. 3.7.2.2-1.

2 When the side scuttles sills of which are below the margin line, the key of the side scuttles is to be provided which is kept by master.

3 The dead-lights of side scuttles in space to the carriage of cargo or passengers, the key of the dead-lights is to be provided which is kept by master.

#### 7.2.3 Gangway and Cargo Ports, etc.

Requirement of 7.2.3-1, Part 3 of the Rules applies to any hatches that are considered watertight in the damage stability calculations.

### 7.3 Watertight Integrity and Openings above Bulkhead Deck

#### 7.3.1 Watertight Integrity above Bulkhead Deck

The relevant part of *IMO Resolution MSC.429(98)* “REVISED EXPLANATORY NOTES TO THE SOLAS CHAPTER II-1 SUBDIVISION AND DAMAGE STABILITY REGULATIONS” is to be referred to meet the requirements of Regulation 17.1, Chapter II-1 of *SOLAS*.

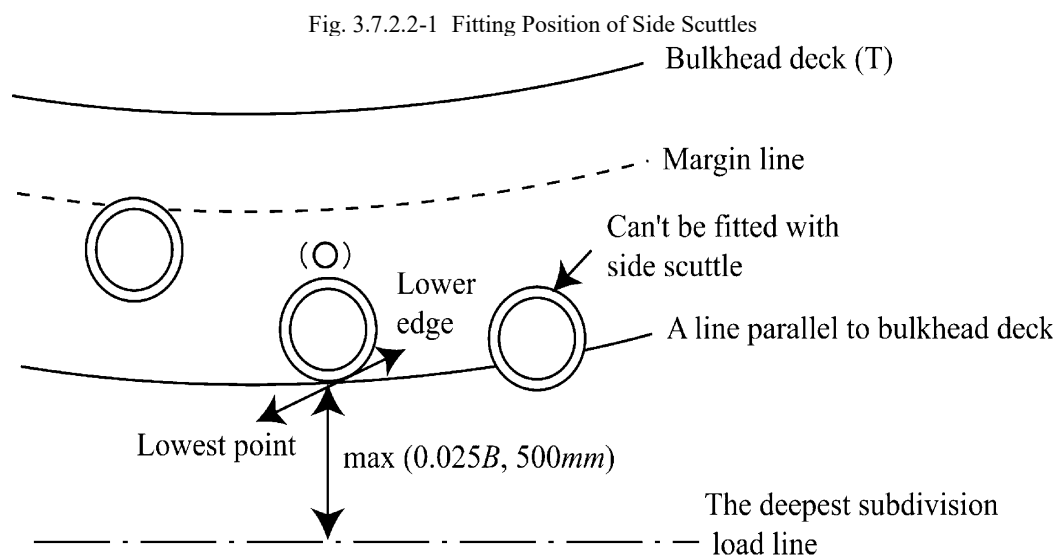
### 7.4 Watertight Integrity of Ro-ro Passenger Ships

#### 7.4.1 Watertight Integrity from the Ro-ro Deck (Bulkhead Deck) to Spaces Below

If a non-watertight vehicle ramp closure is assumed to restrict the flow of water during the calculation of the attained subdivision index (*A*), the vehicle ramp opening is to be in accordance with 2.3.6-11(4), Part 4 of the Rules.

#### 7.4.3 Openings in the Shell Plating

“Fail-safe” specified in 7.4.3-1, Part 3 of the Rules means the system which does not misunderstand that the side door has been closed even if the display unit is out of order by wire disconnection. For example, lamp of the door is turn on in the closing condition and turn off in the opening or abnormal condition.



## **Part 4 SUBDIVISION AND STABILITY**

### **Chapter 1 GENERAL**

#### **1.1 General**

##### **1.1.1 Application**

- 1** “Registered for restricted service” mentioned in **1.1.1-2, Part 4 of the Rules** means to registered with class notations, “*Coasting Service*” or “*Smooth Water Service*”
- 2** The subdivision, damage control plan and intact stability of ships registered for restricted service are in accordance with **2.1.1, 3.1.1** and **4.1.1** respectively.

## Chapter 2 SUBDIVISION

### 2.1 General

#### 2.1.1 Application

The requirements in this chapter need not be applied to the ships registered for restricted service.

### 2.3 Damage Stability

#### 2.3.2 Permeabilities of Compartments

1 With regarding to the application of the regulation of [2.3.4, Part 4 of the Rules](#), the permeabilities specified in this Rules is to be used notwithstanding of loading conditions of passengers, cargoes, stores and liquid.

2 The surface permeability means the percentage between the area of free surface in a flooding compartment and the area of the compartment. Moment of inertia of surface is to be used by the same free surface.

3 The permeability of the cargo area where vehicles or container and others are loaded is to be given in accordance with [Table 2.3.2](#), corresponding to the draughts specified in [2.1.10](#) to [2.1.12, Part 1 of the Rules](#). Vehicles and containers are to be treated as non-watertight.

Table 2.3.2 Permeability of Cargo Compartment

Space for	Permeability at draught $d_s$	Permeability at draught $d_p$	Permeability at draught $d_l$
Dry cargo spaces	0.70	0.80	0.95
Container spaces	0.70	0.80	0.95
Ro-ro spaces	0.90	0.90	0.95
Cargo liquids	0.70	0.80	0.95

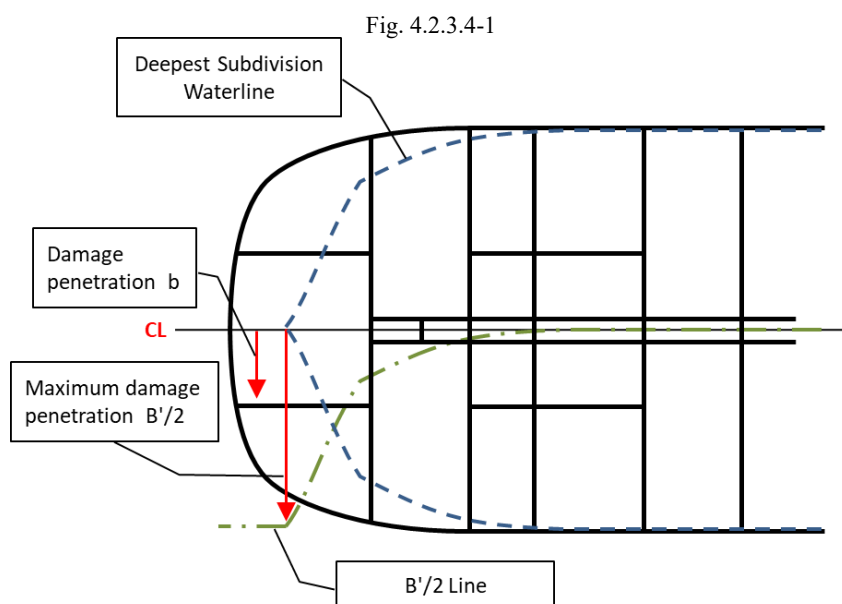
#### 2.3.4 Subdivision Index

1 Where penetrations for piping, ventilation, electrical cables, etc. are provided in bulkheads, decks and shells forming a compartment, the watertight integrity of the penetrations are to be at least equivalent to the parts they penetrate.

2 With the same intent as wing tanks, the summation of the attained index  $A$  is to reflect effects caused by all watertight bulkheads and flooding boundaries within the damaged zone. It is not correct to assume damage only to one half of the ship's breadth ( $B'$ ) and ignore changes in subdivision that would reflect lesser contributions.

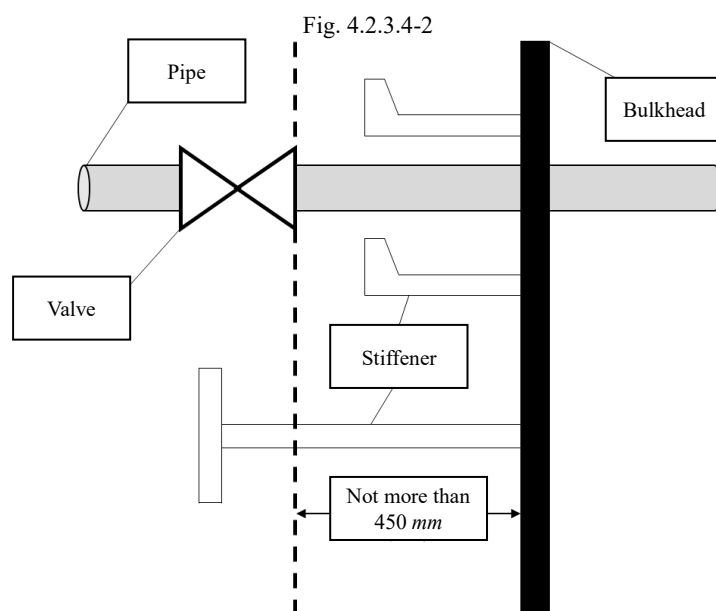
3 In the forward and aft ends of the ship where the sectional breadth is less than the ship's breadth ( $B'$ ) specified in [2.1.5-1, Part 1](#) of the Rules, transverse damage penetration may extend beyond the centreline bulkhead.

4 Where, at the extreme ends of the ship, the subdivision exceeds the waterline at the deepest subdivision draught, the damage penetration  $b$  or  $B'/2$  is to be taken from centreline. [Fig.4.2.3.4-1](#) illustrates the shape of the  $B'/2$  line.



5 Where longitudinal corrugated bulkheads are fitted in wing compartments or on the centreline, they may be treated as equivalent plane bulkheads provided the corrugation depth is of the same order as the stiffening structure. The same principle may also be applied to transverse corrugated bulkheads.

6 Pipes and valves directly adjacent or situated as close as practicable to a bulkhead or to a deck can be considered to be part of the bulkhead or deck, provided the separation distance on either side of the bulkhead or deck is of the same order as the bulkhead or deck stiffening structure. The same applies for small recesses, drain wells, etc. In no case is the separation distance on either side of the bulkhead or deck to be more than 450 mm measured from the valve's near end to the bulkhead or deck. An example is shown in Fig. 4.2.3.4-2.



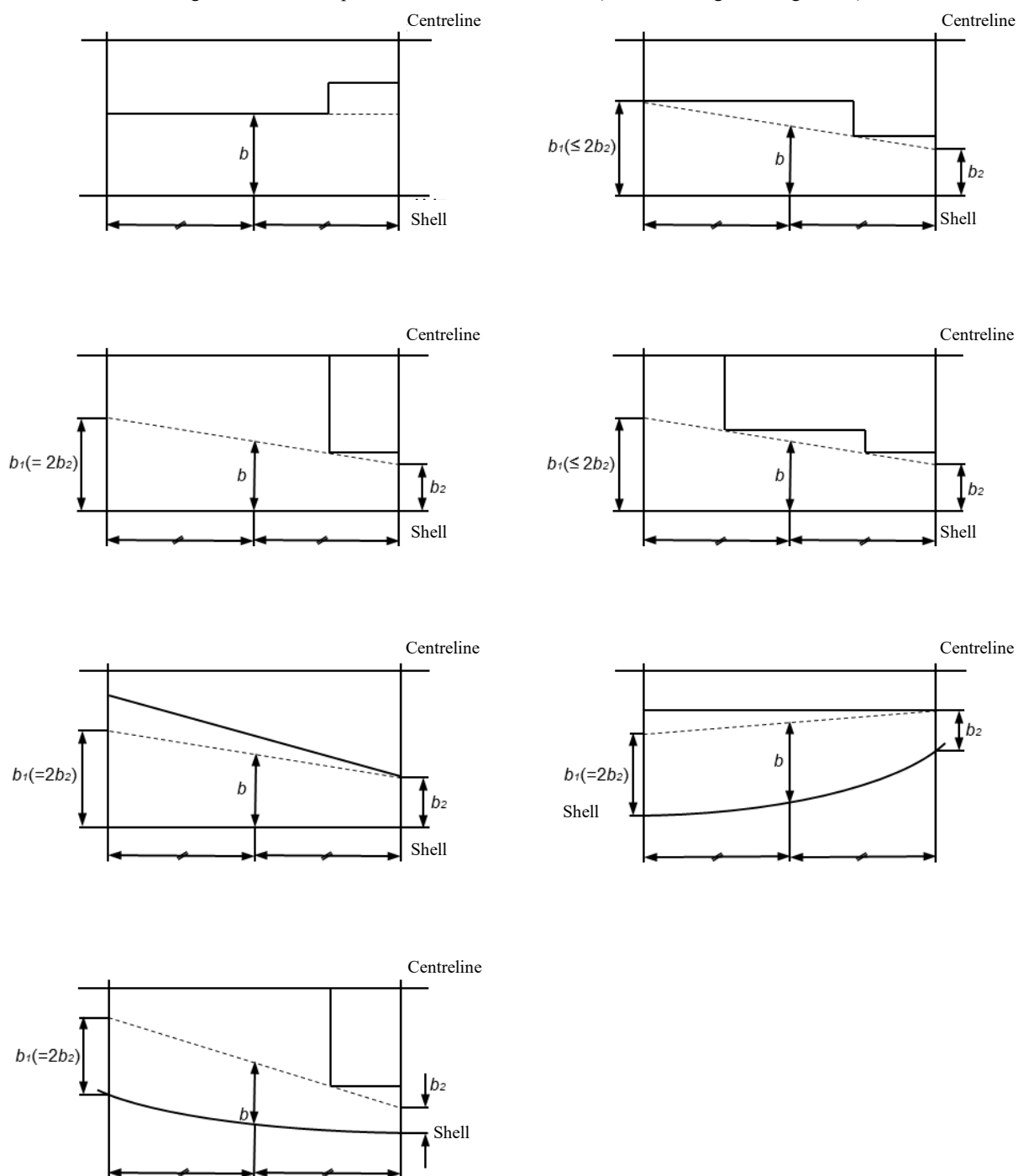
7 For ships up to  $L_f = 150$  m the provision for allowing the “minor progressive flooding” specified in 2.3.4-4, Part 4 of the Rules is to be limited to pipes penetrating a watertight subdivision with a total cross-sectional area of not more than  $710 \text{ mm}^2$  between any two watertight compartments. For ships of  $L_f = 150$  m and upwards the total cross-sectional area of pipes is not to exceed the cross-sectional area of one pipe with a diameter of  $L_f/5000$  m.

### 2.3.5 Compartment Flooding Probability ( $p_i$ )

In application of the requirement of 2.3.5-1, Part 4 of the Rules, in case where the longitudinal bulkhead is not paralleled to the side shell plating, the assumed vertical plane which is considered in the determination of transverse distance ( $b$ ) between

longitudinal bulkhead and side shell plating is to be refer to a example specified in [Fig. 4.2.3.5](#).

Fig. 4.2.3.5 Examples of Assumed Vertical Plane (In case of Single Damage Zone)



### 2.3.6 Probability of Survival ( $s_i$ ) (SOLAS Chap.II-1 Reg.7-2)

1 In applying  $\theta_v$  specified in [2.3.6-2, Part 4 of the Rules](#), an “opening incapable of being closed weathertight” includes ventilators provided with weathertight closing appliances in accordance with the requirements of [7.1.1-1, Part 3 of the Rules](#) that for operational reasons have to remain open to supply air to the engine room, emergency generator room or closed ro-ro and vehicle spaces (if the same is considered buoyant in the stability calculation or protecting openings leading below) for the effective operation of the ship. Where it is not technically feasible to treat some closed ro-ro and vehicle space ventilators as unprotected openings, an alternative arrangement that provides an equivalent level of safety may be used provided that it is deemed appropriate by the Administration.

2 In applying the requirements specified in [2.3.6-8, Part 4 of the Rules](#), with respect to equalization devices, reference is to be



made to the *IMO Res. MSC.362(92) "Revised Recommendation on a standard method for evaluating cross-flooding arrangements"*, as amended.

3 If the final waterline immerses the lower edge of any opening through which progressive flooding takes place, the factor "s" may be recalculated taking such flooding into account. However, in this case the s value is also to be calculated without taking into account progressive flooding and corresponding opening. The smallest s value is to be retained for the contribution to the attained index.

## 2.5 Capability after Flooding

### 2.5.1 General

1 The onboard stability computers and shore-based support specified in **2.5.1(2), Part 4 of the Rules** are to comply with one of the following.

- (1) Passenger ships which had been at the beginning stage of construction before 1 January 2014 are to be in accordance with **Annex 4-1 "GUIDELINES ON OPERATIONAL INFORMATION FOR MASTERS IN CASE OF FLOODING FOR PASSENGER SHIPS CONSTRUCTED BEFORE 1 JANUARY 2014 (MSC.1/Circ.1589)"**.
- (2) Passenger ships which had been at the beginning stage of construction on or after 1 January 2014 but before 13 May 2016 are to be in accordance with **Annex 4-2 "GUIDELINES ON OPERATIONAL INFORMATION FOR MASTERS OF PASSENGER SHIPS FOR SAFE RETURN TO PORT BY OWN POWER OR UNDER TOW (MSC.1/Circ.1400)"**.
- (3) Passenger ships which are at the beginning stage of construction on or after 13 May 2016 are to be in accordance with **Annex 4-3 "REVISED GUIDELINES ON OPERATIONAL INFORMATION FOR MASTERS OF PASSENGER SHIPS FOR SAFE RETURN TO PORT (MSC.1/Circ.1532/Rev.1)"**.

2 In addition to the requirements in -1 above, stability computers for passenger ships contracted for construction on or after 1 July 2018 are to comply with the following requirements. In ships which have an onboard stability computer and shore-based support, such software need not be identical. Unless otherwise specified, stability computers are to comply with the requirements in **Annex U1.2.2 "GUIDANCE FOR STABILITY COMPUTER", Part U of the Guidance for the Survey and Construction of Steel Ships**.

- (1) Software (Type 4)

Software calculating damage stability associated with an actual loading condition and actual flooding case, using direct application of user defined damage, for the purpose of providing operational information for safe return to port (SRtP). Damage stability is to be based on a hull form model, that is, directly calculated from a full three-dimensional geometric model.

- (2) Functional requirements for software

- (a) The normal (type 1, 2 and 3, which are defined in **1.2.1, Annex U1.2.2 "GUIDANCE FOR STABILITY COMPUTER", Part U of the Guidance for the Survey and Construction of Steel Ships**) and SRtP (type 4) software need not be "totally separated". Where the normal and SRtP software are not totally separated, they are to comply with the following i) to iii):

- i) The function of switching between normal software and type 4 software is to be provided.
- ii) The actual intact loading condition is to be the same for both functions (normal operation and SRtP).
- iii) The SRtP module needs only to be activated in case of an incident.

- (b) Computational function for software is to comply with the following i) to v):

- i) The system is to be pre-loaded with a detailed computer model of the complete hull, including appendages, all compartments, tanks and the relevant parts of the superstructure considered in the damage stability calculation, wind profile, down-flooding and up-flooding openings, cross-flooding arrangements, internal compartment and escape routes. Each internal space is to be assigned its permeability as shown in **Table 2.5.1**, unless a more accurate permeability has been reflected in the approved stability information.
- ii) The system is to be capable of accounting for applied moments such as wind, lifeboat launching, cargo shifts and passenger relocation.
- iii) The system is to account for the effect of wind by using the method in **2.3.6-5(2), Part 4 of the Rules** as the default, but allow for manual input of the wind speed/pressure if the on-scene pressure is significantly different ( $P=120 \text{ N/m}^2$  equates to Beaufort 6; approximately  $13.8 \text{ m/s}$  or  $27 \text{ knots}$ ).
- iv) The system is to be capable of assessing the impact of open main watertight doors on stability (e.g., for each damage

- case provided for verification, additional damage stability calculation is to be done and presented, taking into account any watertight door located within the damaged compartment(s)).
- v) The system is to utilize the latest approved lightship weight and centre of gravity information.
- (c) The output of the software defined in **(1)** above is to be such that it provides the master with sufficient clear unambiguous information to enable quick and accurate assessment of the stability of the vessel for any actual damage, the impact of flooding on the means of escape and the controls of devices necessary for managing and/or controlling the stability of the ship.
- i) When the actual loading condition is input in the SRtP software, the following output (intact stability) is to be available.
    - 1) Deadweight data
    - 2) Lightship data
    - 3) Trim
    - 4) Heel
    - 5) Draft at the draft marks and perpendiculars
    - 6) Summary of loading condition displacement, *VCG*, *LCG* and, if applicable, *TCG*
    - 7) Downflooding angle and corresponding downflooding opening
    - 8) Free surfaces
    - 9) *GM* value
    - 10) *GZ* values relevant to an adequate range of heeling (not less than 60 *degrees*) available indicatively at the following intervals: 0 5 10 15 20 25 30 40 50 60 *degrees*
    - 11) Compliance with relevant intact stability criteria: listing of all calculated intact stability criteria, the limiting values, the obtained values and the evaluation (criteria fulfilled or not fulfilled)
    - 12) *KG/GM* limiting curve according to **4.3.2-1, Part 4 of the Rules**
    - 13) Other outputs deemed necessary by the Society
  - ii) When the actual loading condition is associated to the actual damage case(s) due to the casualty, the following output (damage stability) is to be available.
    - 1) Trim
    - 2) Heel
    - 3) Draft at the draft marks and perpendiculars
    - 4) Progressive flooding angle and corresponding progressive flooding openings
    - 5) *GM* value
    - 6) *GZ* values relevant to an adequate range of heeling (not less than 60 *degrees*) available indicatively at the following intervals: 0 5 10 15 20 25 30 40 50 60 *degrees*
    - 7) Compliance with stability criteria: listing of all calculated stability criteria, the limit values, the obtained values and the conclusions (criteria fulfilled or not fulfilled)
    - 8) The survivability criteria determined by the Society
    - 9) Relevant flooding points (unprotected or weathertight) with the distance from the damage waterline to each point
    - 10) List of all flooded compartments with the permeability considered
    - 11) Amount of water in each flooded compartment
    - 12) Escape route immersion angles
    - 13) A profile view, deck views and cross-sections of the ship indicating the flooded waterplane and the damaged compartments
    - 14) Other outputs deemed necessary by the Society
- (d) For ro-ro passenger ships subject to the Stockholm Agreement (*IMO* Circular Letter No. 1891), there are to be algorithms in the software for estimating the effect of water accumulation on deck (*WOD*). For example, the following requirements in **i)** and **ii)** are to be complied with.
- i) In addition to the predefined significant wave height taken from the approved stability document, there is to be

possibility for the crew to input manually the significant wave height of the ship navigation area in the system.

- ii) In addition to the predefined significant wave height taken from the approved stability document, calculations with two additional significant wave heights are to be submitted to the Society for checking the correctness of the algorithms in the software for estimating the effect of *WOD*.

(3) Computational accuracy of program

The computational accuracy of the program for the particular ship is to be verified so that the calculation results are within the acceptable tolerances specified in 1.2.3-1 or 1.2.3-2, Annex U1.2.2 “GUIDANCE FOR STABILITY COMPUTER”, Part U of the Guidance for the Survey and Construction of Steel Ships as applicable. Such calculation is to be made by using actual ship data for at least three damage cases, each of them associated with at least three loading conditions which are selected from the ship’s approved stability information booklet. Output of the software is to be compared with results of corresponding load/damage case in the approved damage stability booklet or an alternative independent software source.

(4) Approval of software

Approval of software is to comply with 1.2.4, Annex U1.2.2 “GUIDANCE FOR STABILITY COMPUTER”, Part U of the Guidance for the Survey and Construction of Steel Ships. Approval of type 4 (SRtP) software is for stability only.

Table 2.5.1 Permeability

Spaces	Permeability			
	Default	Full	Partially filled	Empty
Container spaces	0.95	0.70	0.80	0.95
Dry cargo spaces	0.95	0.70	0.80	0.95
Ro-Ro spaces	0.95	0.90	0.90	0.95
Cargo liquids	0.95	0.70	0.80	0.95
Intended for consumable liquids	0.95	0.95	0.95	0.95
Stores	0.95	0.60	(0.60)	0.95
Occupied by machinery	0.85			
Void spaces	0.95			
Occupied by accommodation	0.95			

## Chapter 3 DAMAGE CONTROL PLANS

### 3.1 General

#### 3.1.1 Application

The regulations in this chapter need not be applied to ships registered for restricted service.

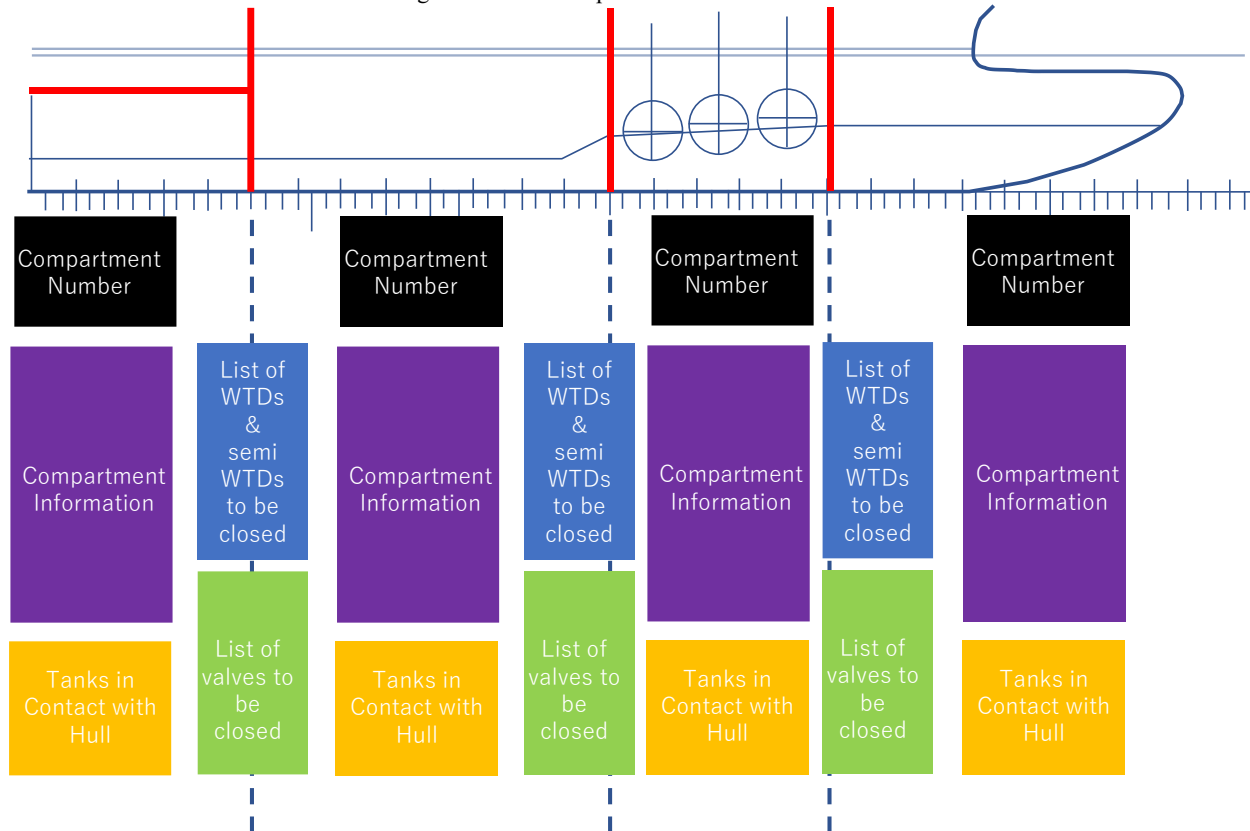
### 3.2 Booklet and Plan for Damage Control

#### 3.2.1 Damage Control Plans

Damage control plans are to be prepared in consideration of the following:

- (1) Provide the plan in colour and ensure that it is legible when printed;
- (2) Provide a legend describing each symbol used within the plan;
- (3) Clearly identify the location of damage control equipment and damage equipment lockers on the plan;
- (4) Provide compartment identification consistent with the damage control booklet and the stability computer information, as applicable;
- (5) Highlight access points (stairways and ladders) as follows:
  - (a) Indicate the compartment and deck to be accessed;
  - (b) Indicate whether an access point represents both up and down or only one way transit (at the bottom of the stair or ladder); and
  - (c) Indicate all hatches;
- (6) Shading of key features may be used on the damage control plan to clearly depict essential information regarding the ship's watertight subdivision and related equipment;
- (7) Depict watertight doors and semi-watertight doors;
- (8) Indicate the locations of sounding pipes for all spaces with a sounding pipe, including void spaces;
- (9) In addition to the bilge and ballast pumps, indicate the location of any other relevant pumps referred to in the damage control booklet; and
- (10) The inboard profile plan is to indicate the compartment boundaries with the list of watertight closing appliances necessary to ensure the watertight integrity of the compartment and the list of tanks and description of spaces within the compartment (See [Fig. 4.3.2.1](#)).
- (11) Where fittings or equipment are common in both fire and damage control plans of passenger ships, the graphical symbols used in damage control plans are to be in accordance with the “*Graphical symbols for shipboard fire control plans*” (IMO Resolution A.952(23)).

Fig. 4.3.2.1 Example of Inboard Profile Plan



## Chapter 4 INTACT STABILITY

### 4.1 General

#### 4.1.1 Application

Special consideration may be given to the ships registration for a restricted service.

### 4.3 Stability Information

#### 4.3.1 General

In order that inclining test specified in [4.3.1-1, Part 4 of the Rules](#) is effective, ships are to have scales of draughts marked clearly at the bow and stern. In the case where the draught marks are not located where they are easily readable, or operational constraints for a particular trade make it difficult to read the draught marks, then the ship is also to be fitted with a reliable draught indicating system by which the bow and stern draughts can be determined.

#### 4.3.2 Stability Information

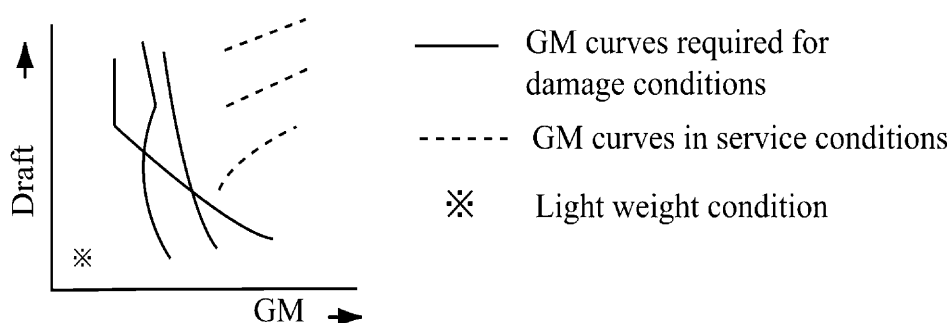
1 Metacentric height  $GM$  in the following service conditions (1) to (6) is to be calculated in order to make sure that the requirements for damage stability is satisfied under all service conditions. In the case that the inclining test has not been done and  $GM$  under the condition (6) is unknown,  $GM$  in the conditions (1) to (5) are to be calculated by means of estimated values, and then these  $GM$  are to be recalculated and modified after the actual values are known.

- (1) Each condition in service from arrival to departure, corresponding to consumption (0%, 50% - 80% and 100%) of fuel, fresh water, foods, etc.
- (2) Assumed loading condition in case of loading cargo oil in cargo tank, using a pool, loading a special cargo, etc other than full load condition (1)
- (3) Load conditions assumed in service (one-third or half of cargo loading)
- (4) Owner light weight condition (lightweight condition + officers, officer's baggage, service water)
- (5) Ballast condition (owner lightweight condition + fuel, fresh water, foods)
- (6) Lightweight condition

2 In preceding -1, [Fig.4.3.2-1](#) is to be drawn in order to confirm that  $GM$  in service is greater than  $GM$  required by intact stability.

3 In preceding -1(1) to (3), for ships which have the service condition where  $GM$  in service is less than the required  $GM$ , it is to be confirmed that  $GM$  is maintained to be equal to required  $GM$  at least by means of doing reasonable and practicable method such as restricting to load fixed ballast, cargoes, fuel, etc. and loading water ballast corresponding to consumption of fuel, fresh water, etc. In this case, the volume of water ballast in oil/ballast tank is not to be half-greater than the volume of the tank.

Fig.4.3.2-1 Allowable GM Curve



## Part 5 MACHINERY INSTALLATIONS

### Chapter 1 GENERAL

#### 1.1 General

##### 1.1.1 Scope

**1** In **Part 5 of the Rules**, “main propulsion machinery” means the following machinery which generates or converts motive power capable of propelling a ship at the speed specified in **2.1.8, Part A of the Rules for the Survey and Construction of Steel Ships**:

- (1) Reciprocating internal combustion engines (including superchargers)
- (2) Steam turbines (including main condensers)
- (3) Gas turbines (including combustors)
- (4) Generating plants and motors for propulsion (excluding **Chapter 18, Part D of the Rules for the Survey and Construction of Steel Ships**)

**2** Means provided to complement the motive power generated by main propulsion machinery specified in **-1**, which is connected directly to the propulsion shafting system is to be included in the shafting system, and the rest of the portion is to be regarded as auxiliary machinery essential for main propulsion.

## Chapter 2 SCUPPERS, SANITARY DISCHARGES ETC., BILGE AND BALLAST PIPING SYSTEMS

### 2.2 Scuppers, Sanitary Discharges, etc.

#### 2.2.1 General

##### 1 Scupper piping within superstructures

The scupper piping within the superstructure is not to be connected to the scupper piping on the weather deck.

##### 2 Inboard open end of scupper piping

In case where small compartments of end parts of ships such as steering gear compartments, boatswain's stores and chain lockers etc., are drained by hand pumps or eductors, the inboard open end of scupper piping is to be of the highest position of these piping.

### 2.3 Bilge and Ballast Piping

#### 2.3.1 General

##### 1 Alternatives to or the omission of bilge piping

With respect to the bilge piping required by **2.3.1-1, Part 5 of the Rules**, the Society may accept the other measures described in the following (1) and (2).

- (1) For spaces where it is difficult to install bilge piping, other drainage arrangements such as drain plugs may be allowed to be installed as an alternative to the bilge piping.
- (2) For small spaces where there is no risk of water accumulation, the omission of bilge piping may be allowed.

##### 2 Bilge suction pipes and ballast suction pipes penetrating through deep tanks

The bilge suction pipes and ballast suction pipes penetrating through deep tanks are to be dealt with under the following requirements:

- (1) Suction pipes such as the bilge suction pipes and ballast suction pipes are not to penetrate through deep tanks carrying cargo oil, except where the pipes are installed in pipe tunnels provided within the deep tanks.
- (2) For the bilge suction pipes passing through deep tank serving as the permanent ballast tank, welded pipe joints may not be required if flange joints corresponding to one rank higher nominal pressure than that according to the design pressure are used.
- (3) In case where gravitational ballasting/deballasting is intended by using sea chests provided in the permanent ballast tanks, double stop valves being operable from a position on the bulkhead deck are to be provided.
- (4) In the application of the requirements specified in (1) to (3) above, bilge hoppers are to be regarded as deep tanks.

##### 3 Valves on bilge suction piping

Valves on the bilge suction piping are to be operable from a position in the engine room or shaft tunnel, or to be capable of being remotely controlled from a readily accessible place.

4 The situation of the bilge suction pipe prescribed in **2.3.1-5(1), Part 5 of the Rules** is to be in accordance with the examples in **Fig. 5.2.3.1-1**.

5 Where an emergency bilge pumping system is provided in addition to the main bilge pumping system specified in **2.3.1-8, Part 5 of the Rules**, it is to be independent of the main system and so arranged that a pump is capable of operating on any compartment under flooding condition as specified in **2.3.1-2, Part 5 of the Rules**. In this case, the requirements in **2.3.1-8, Part 5 of the Rules** may not apply, provided that the valves necessary for the operation of the emergency bilge piping system is capable of being operated above the bulkhead deck and the open and close indicator of the valves are fitted and capable of indicating clearly at the operating position.

6 The wording "where as deemed appropriate by the Society" specified in **2.3.1-18, Part 5 of the Rules** means the case where an oily-water separator with an appropriate processing capacity or no openings for the discharging ballast water to the ocean is provided and the oily ballast water is intended to discharge on the shore.

#### 2.3.6 Bilge Drainage from Top of Deep Tanks, Fore and After Peak Tanks and Chain Lockers

In case where hold bilges are drained to the engine room or shaft tunnel adjacent thereto through the watertight construction



as shown in Fig. 5.2.3.6-1, the bilge drainage piping is to be led to spaces readily accessible and self-closing valve or cock is to be provided. Where such bilge is led to the watertight bilge tanks, the above-mentioned valve or cock may be omitted, however where the hold is located below the load water line, a non-return valve is to be provided. In case where hold bilges are led to the shaft tunnel, no sounding pipe may be required, however the diameter of the drainage pipes are not to be less than the value specified for bilge suction pipes.

### 2.3.8 Bilge Wells

Where bilge tanks are provided instead of bilge wells, drain piping led directly to bilge tanks are to be provided with an automatic non-return valve or a stop valve which can be closed at readily accessible place above the bulkhead deck. However, where the open end of a drain piping is not located below the bulkhead deck, these valves may be omitted.

Fig. 5.2.3.1-1 Examples of a Non-return Valve to be Fitted to the Pipe in the Compartment Containing the Open End

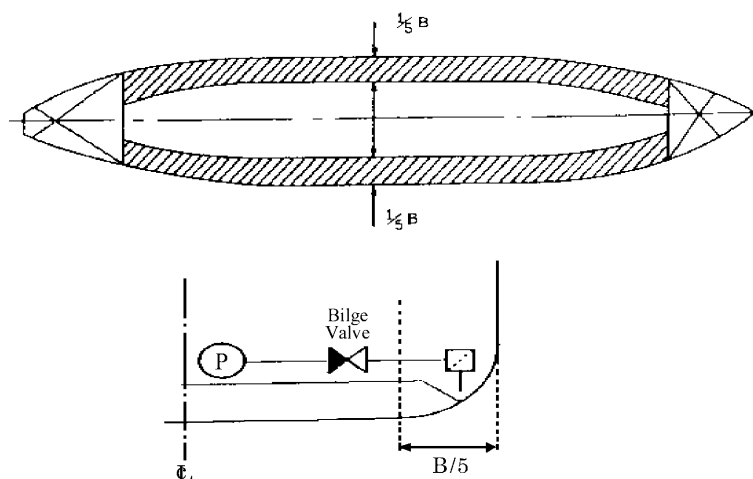
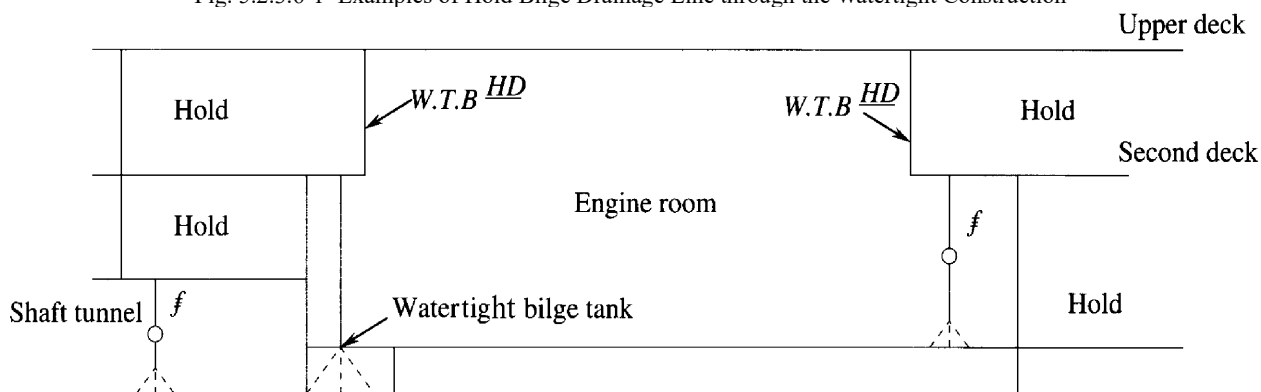


Fig. 5.2.3.6-1 Examples of Hold Bilge Drainage Line through the Watertight Construction



$f$ : Valve or cock with self-closing device

## 2.4 Flooding Detection Systems

### 2.4.1 General

1 Flooding detection systems required in 2.4.1, Part 5 of the Rules are to be in accordance with the following (1) to (11).

#### (1) Definitions

- (a) *Flooding detection system* means a system of sensors and alarms that detect and warn of water ingress into watertight spaces. Continuous flood level monitoring may be provided, but is not required.
- (b) *Sensor* means a device fitted at the location being monitored that activates a signal to identify the presence of water at the location.

(c) *Alarm* means an audible and visual signal which announces a flooding condition requiring attention.

- (2) The number and location of flooding detection sensors is to be sufficient to ensure that any substantial water ingress into a watertight space requiring a flooding detection system is detected under reasonable angles of trim and heel. Generally, flooding detection sensors are to be installed as indicated below.

(a) Vertical location

Sensors are to be installed as low as practicable in the watertight space.

(b) Longitudinal location

In watertight spaces located forward of the mid-length, sensors are generally to be installed at the forward end of the space. In watertight spaces located aft of the mid-length, sensors are generally to be installed at the aft end of the space. For watertight spaces located in the vicinity of the mid-length, consideration is to be given to the appropriate longitudinal location of the sensor. In addition, any watertight space of more than  $L_s/5$  in length or with arrangements that would seriously restrict the longitudinal flow of water is to be provided with sensors at both the forward and aft ends.

(c) Transverse location

Sensors are generally to be installed at the centreline of the space (or alternatively at both the port and starboard sides). In addition, any watertight space that extends the full breadth of the ship or with arrangements that would seriously restrict the transverse flow of water is to be provided with sensors at both the port and starboard sides.

- (3) Where a watertight space extends in height over more than one deck, there are to be at least one flooding detection sensor at each deck level. This provision is not applicable in cases where a continuous flood level monitoring system is installed.
- (4) For watertight spaces with unusual arrangements or in other cases where the requirements in (2) and (3) would not achieve the intended purpose, the number and location of flooding detection sensors are to be subject to special consideration.
- (5) Each flooding detection system is to give an audible and visual alarm at the navigation bridge and the safety centre, if located in a separate space from the navigation bridge. These alarms are to indicate which watertight space is flooded.
- (6) Visual and audible alarms are to be capable of being distinguished from other alarms.
- (7) The flooding detection system and equipment are to be suitably designed to withstand supply voltage variation and transients, ambient temperature changes, vibration, humidity, shock, impact and corrosion normally encountered in ships. Sensor cabling and junction boxes are to be suitably rated to ensure operability of the detection system in a flooded condition. In addition, the detection system is to be designed on the fail-to-safety principle, where an open sensor circuit is to result in an alarm condition.
- (8) The flooding detection system is to be continuously powered and to have an automatic change-over to a stand-by power supply in case of loss of the normal power supply. Failure of the normal power supply is to be indicated by an alarm.
- (9) Documented operating, maintenance and testing procedures for the flooding detection system are to be kept on board and be readily accessible.
- (10) Flooding detection system sensors and equipment are to be installed where they are accessible for testing, maintenance and repair.
- (11) The flooding detection system is to be capable of being functionally tested using either direct or indirect methods. Records of testing are to be retained on board.

**2** Any watertight spaces that are separately equipped with a liquid level monitoring system (such as fresh water, ballast water, fuel, etc.), with an indicator panel or other means of monitoring at the navigation bridge (and the safety centre if located in a separate space from the navigation bridge), need not to comply with the requirement of -1 above.

**3** The liquid level monitoring systems specified in -2, which are used as, or to replace, flooding detection systems are to comply with Regulation 21.4, Chapter II-2, *SOLAS* Convention.

## Chapter 3 STEERING GEARS

### 3.1 General

#### 3.1.1 Scope

1 Manual steering gears are to be in accordance with the requirements of 3.1 and 3.2, **Part 5 of the Rules**, and 15.1.2 through 15.1.5, 15.2.8 through 15.2.10, 15.3.1, 15.4 (excluding 15.4.8-2) and 15.5, **Part D of the Rules for the Survey and Construction of Steel Ships** and the requirements applicable of this **Chapter 3**.

2 Quadrants, chains, rods and leading-block of manual steering gears are to be as specified in the following requirements:

(1) The scantlings of quadrants are to comply with the following requirements in (a) to (c).

(a) Where three arms are provided, the scantlings of quadrants are not to be less than those given in the following;

i) Boss:

$$H_C = 4.27 \cdot \sqrt[3]{T_R K_Q} \text{ (mm)}$$

$$D_C = 7.69 \cdot \sqrt[3]{T_R K_Q} \text{ (mm)}$$

ii) Arm at its root:

$$B_C = 3.29 \cdot \sqrt[3]{T_R K_Q} \text{ (mm)}$$

$$T_C = 1.67 \cdot \sqrt[3]{T_R K_Q} \text{ (mm)}$$

iii) Arm at its outer end:

$$B_0 = 2.22 \cdot \sqrt[3]{T_R K_Q} \text{ (mm)}$$

$$T_0 = 1.07 \cdot \sqrt[3]{T_R K_Q} \text{ (mm)}$$

where:

$T_R$  : Rudder torque specified in 13.2.3, **Part 1, Part C of the Rules for the Survey and Construction of Steel Ships** (N-m)

$K_Q$  : Material coefficient of the quadrant, specified in 13.2.1.2, **Part 1, Part C of the Rules for the Survey and Construction of Steel Ships**.

$H_C$  : Required depth of boss (mm)

$D_C$  : Required outer diameter of boss (mm)

$B_C$  : Required breadth of arm at its root (mm)

$T_C$  : Required thickness of arm at its root (mm)

$B_0$  : Required breadth of arm at its end (mm)

$T_0$  : Required thickness of arm at its end (mm)

(b) Where two arms are provided, the breadth and thickness of arms are to be not less than 1.1 *times* those specified in (a).

Where four arms are provided, the breadth and thickness of arms may be reduced to 0.9 *times* those specified in (a).

(c) Where loose quadrants are used in addition to the tiller fixed to the rudder stocks, arms of loose quadrants may be of the dimensions given in (a)iii throughout their length.

(2) The diameter of studless steering chains is not to be less than 9.5mm or that obtained from the following formula, whichever is the greater.

$$d_S = 3.36 \sqrt{\frac{T_R K_c}{R}} \text{ (mm)}$$

where

$d_S$  : Requirement diameter of steering chains (mm)

$T_R$  : Rudder torque specified in 13.2.3, **Part 1, Part C of the Rules for the Survey and Construction of Steel Ships**. (N-m)

$K_C$  : Material coefficient of the chain, specified in **13.2.1.2, Part 1 Part C of the Rules for the Survey and Construction of Steel Ships**.

$R$  : Length of tiller or radius of quadrant measured from the centre of rudder stock to the centre line of steering chains ( $mm$ )

- (3) The diameter of steering rods is to be 1.25 *times* or more of the diameter of the steering chains obtained from (1) above.
- (4) The leading blocks of steering chains are to be so arranged as to make the length of steering chains as short as practicable, and to lead the chains easily to the quadrant, and to avoid sharp bends.
- (5) The diameter of lead block sheaves, measured at the centre line of steering chains, is to be of 16 *times* or more of the diameter of chains. The diameter of sheave pins is to be two times or more of that of chains.
- (6) In case where the steering chain is led at an angle less than  $120^\circ$ , the diameters of sheaves and pins are to be made 1.25 *times* or more of those specified in (4) above respectively.
- (7) The frames, base plates, pins and other parts of the blocks subjected to mechanical shocks are not to be of cast iron. Further, the sum of sectional areas of bolts connecting the blocks to the hull is to be of the value or more obtained by following formula:

$$A_B = 2.4d_S^2 \text{ (cm}^2\text{)}$$

Where:

$A_B$  : Required total sectional area of bolts ( $cm^2$ )

$d_S$  : Required diameter of steering chains ( $mm$ )

- (8) For sheaves intended to be used with steering wire ropes, the radius of rope groove is to be of the value obtained by adding 0.8 $mm$  to the radius of rope, and the radius of sheaves is to be 14 *times* or more of that of the rope.

## 3.2 Performance and Arrangement of Steering Gears

### 3.2.1 Number of Steering Gears

- 1 An adequate installation of blocks and tackles operating a tiller or a quadrant may be accepted as an auxiliary steering gear.
- 2 In case where a manual steering gear is used as the main steering gear, a spare of steering chains for the portion connected to the tiller are to be provided.
- 3 In case where the auxiliary steering gear as specified in **3.2.1-1, Part 5 of the Rules** is of hydraulic type, the rudder actuator may serve in common with that for the main steering gear. Further, part of the hydraulic piping of the rudder actuator of the main steering gear may be used in common with that for the auxiliary steering gear. In this case, however, the pipe length of the common part is to be as short as practicable.

### 3.2.3 Performance of Auxiliary Steering Gear

For auxiliary steering gears in ships whose speed as defined in **2.1.8, Part A of the Rules for the Survey and Construction of Steel Ships** is less than 7 *knots*, the requirement of **3.2.3(1), Part 5 of the Rules** apply by construing the wording “at one half of the speed specified in **2.1.8, Part A of the Rules for the Survey and Construction of Steel Ships** or 7 *knots*, whichever is the greater” as “at navigable speed.”

## Part 6 ELECTRICAL INSTALLATIONS

### Chapter 1 GENERAL

#### 1.1 General

##### 1.1.1 Scope

- 1 In accordance with **1.1.1-3, Part 6 of the Rules**, requirements in **2.9.11-2, Part H of the Rules for the Survey and Construction of Steel Ships** are to be arranged as follows:
  - (1) The wording “high fire risk areas” defined in **2.9.11-6, Part H of the Rules for the Survey and Construction of Steel Ships** includes main vertical zones.
  - (2) Where ships are carrying more than 36 passengers, **(1)** and **(3)** of the “other high fire risk areas” defined in **H2.9.11-5, Part H of the Guidance for the Survey and Construction of Steel Ships** are to be interpreted as follows.
    - (a) the cargo spaces defined in **2.1.34, Part A of the Rules**, except cargo tanks for liquids with flashpoint above 60 °C and except cargo spaces exempted in accordance with Regulation 10.7.1.2 or 10.7.1.4 of *SOLAS* Chapter II-2 including the following:  
Those areas containing above cargo spaces (e.g. cargo oil tanks which flashpoint is below 60 °C) within the “auxiliary machinery spaces, cargo spaces, cargo and other oil tanks and other similar spaces of moderate fire risk” defined in Regulation 9.2.3.3.2.2(11) of *SOLAS* Chapter II-2.
    - (b) Areas containing flammable liquids:
      - (i) Those areas containing flammable liquids (e.g. fuel oil tanks) within the “auxiliary machinery spaces, cargo spaces, cargo and other oil tanks and other similar spaces of moderate fire risk” as defined in Regulation 9.2.2.3.2.2(11) of *SOLAS* Chapter II-2.
      - (ii) Those areas containing flammable liquids (e.g. paint lockers) within the “other spaces in which flammable liquids are stowed” as defined in Regulation 9.2.2.3.2.2(14) of *SOLAS* Chapter II-2.
  - (3) For ships carrying not more than 36 passengers, “spaces containing flammable liquids” in **(3)** of the “other high fire risk areas” defined in **H2.9.11-5, Part H of the Guidance for the Survey and Construction of Steel Ships** are to be interpreted as follows.  
Those areas containing flammable liquids (e.g. paint lockers) within the “service spaces (high risk)” defined in Regulation 9.2.2.4.2.2(9), *SOLAS* Chapter II-2.

## Chapter 2 DESIGN OF INSTALLATIONS

### 2.1 General

#### 2.1.2 Design and Construction

The wording “other electrical services as deemed necessary by the Society” in **2.1.2(1), Part 6 of the Rules**, includes the following items:

- (1) In ships carrying diving systems meeting the requirements of the **Rules for Diving Systems**, essential electrical installations relating to diving systems.
- (2) In ships carrying the supporting equipment meeting the requirements of **Part T of the Rules for Survey and Construction of Steel Ships** electrical installations relating to **4.3.7(2)(d), 4.3.7(2)(e), 6.1.1-1(1) and 6.1.1-1(3)**.

### 2.2 Main Source of Electrical Power and Lighting Systems

#### 2.2.1 Main Source of Electrical Power

**1** In ships in which reciprocating internal combustion engines are used as main propulsion machinery (excluding electric propulsion ships), the generator driven by propulsion plant is to comply with the following requirements **(1) to (5)** if it is provided as one of main source of electrical power specified in **2.2.1-1, Part 6 of the Rules**:

- (1) Main source of electrical power is to be such that generating capacity of the generator(s) specified in **2.2.1-2, Part 6 of the Rules** is capable of being maintained under all sailing and manoeuvring conditions crash stop in the event of any one generating set being stopped. When there are only two generators, one of which is driven by propulsion plant, means is to be provided so that the propulsion machine can be started without resource to those generators.
- (2) Where generating set(s) is necessary to be controlled according to the ship's speed, *e.g.*, ahead, stop, astern, the control of generating set(s) is to be along with the control of the propulsion plant and to be capable of operating manually from the position where the propulsion plant being controlled. In this case, electrical power supply is not to be interrupted by this control.
- (3) Means is to be provided so that a quick restoration of electrical power supply can be obtained after an electrical power interruption caused inevitable by the speed variation of propulsion plant *e.g.* due to a sudden stop or speed reduction of propulsion plant.
- (4) In a ship which is so designed that the propulsion plant is controlled from navigating bridge during the generator driven by the propulsion plant is being used, a device to indicate the running of the generator and other devices indicating information necessary for operation of the generator are to be provided on the navigating bridge.
- (5) The generator driven by propulsion plant is not to be less effective and reliable than those consisted of only the separately driven generators.

**2** In ships in which reciprocating internal combustion engines are used as main propulsion machinery (excluding electric propulsion ships), the generator driven by propulsion plant provided on board ship in addition to the main source of electrical power required by **2.2.1-1, Part 6 of the Rules** is to comply with the following **(1) and (2)** if it is used for services specified in **2.1.2(1), Part 6 of the Rules**:

- (1) Means is to be provided so that a quick restoration of power supply can be obtained after an electrical power interruption caused inevitably by the speed variation of propulsion plant *e.g.* due to a sudden stop or speed reduction of propulsion plant.
- (2) In a ship which is so designed that the propulsion plant is controlled from navigating bridge during the generator driven by the propulsion plant is being used, following means or equivalent thereto are to be provided:
  - (a) Means is to be provided to maintain the voltage and frequency of the generator concerned within the pre-set range unless an alarm device is provided on the navigating bridge to operate when the voltage or frequency deviates from the specified range.
  - (b) Main source of electrical power is to be such that operation of generating set(s) is so changed automatically or by the remote operation from the navigating bridge as to operate generating set(s) not depending upon the propulsion plant

when the voltage or frequency of the generator concerned has deviated or is expected to deviate from the pre-set range. In this case the time involved for changing of operation of generating set(s) is not to be longer than 45 *seconds* if electrical power supply is interrupted.

- (c) The following items are to be indicated at the position near the remote control lever for propulsion plant on the navigating bridge. Those are to be indicated automatically or by the remote operation from the main control station of propulsion plant when the generator concerned is brought into operation:
  - i) Running of the generator driven by propulsion plant
  - ii) Speed range of propulsion plant within which generator driven by propulsion plant is serviceable.

**3** The wording “those services necessary to provide normal operational conditions of propulsion and safety and other electrical services as deemed necessary by the Society” in **2.2.1-2, Part 6 of the Rules** means that the following items of electrical installations are excluded from “all electrical auxiliary services necessary for maintaining the ship in normal operational and habitable conditions and other electrical services as deemed necessary by the Society”.

- (1) Thrusters not forming part of main propulsion plant. Note, however, that the thruster used for the dynamic positioning system (*DPS*) is to be dealt with as the one forming part of main propulsion machinery.
- (2) Windlasses
- (3) Mooring winches
- (4) Refrigerating compressors for air conditioning installations
- (5) Others as deemed acceptable by the Society

**4** In **2.2.1-5** and **2.3.2-3, Part 6 of the Rules**, procedures from a dead ship condition to starting the main propulsion plant are to comply with the requirements specified in **D1.3.1-3, Part D of the Guidance for the Survey and Construction of Steel Ships**.

**5** Provisions for maintaining or immediately restoring the electrical supply to equipment for propulsion and steering specified in **2.2.1-3, Part 6 of the Rules** are to comply with followings:

- (1) Where the electrical power can normally be supplied by one generator, the following requirements are to be complied.
  - (a) An adequate provision is to be made for automatic starting and connecting to the main switchboard of a standby generator of sufficient capacity to permit propulsion and steering and to ensure safety of the ship with automatic restarting of the important auxiliaries including sequential operations in case of loss of electrical power of the generator in operation.
  - (b) The time for automatic starting and connecting to the main switchboard of a standby generator specified in (a) above is to be not more than 45 *seconds* after loss of power.
- (2) If the electrical power is normally supplied by more than one generator simultaneously in parallel operation, provision is to be made to ensure that, in case of loss of electrical power of one of these generating sets, the remaining ones are kept in operation without overload to permit propulsion and steering, and to ensure safety of the ship. (See **2.3.6, Part H of the Rules for the Survey and Construction of Steel Ships**)
- (3) Other provisions deemed appropriate by the Society.

## **2.2.2 Number and Ratings of Transformers**

**1** In case where transformers are to supply power to the electrical auxiliaries services necessary for maintaining the ship in normal operational and habitable conditions, at least two transformers are to be provided. Note, however, that in transformer used exclusively for a specific load where such is deemed acceptable by the Society, one set of transformer may be accepted.

**2** The capacities of transformers specified in **-1** are to be such that power feeding necessary for services to provide normal operational conditions of propulsion and safety even in the event of failure on one set of transformer is available. Further, at least the minimum habitable conditions are secured with the equipment including the items for cooking, heating, provision refrigeration, mechanical ventilation, sanitary and fresh water services.

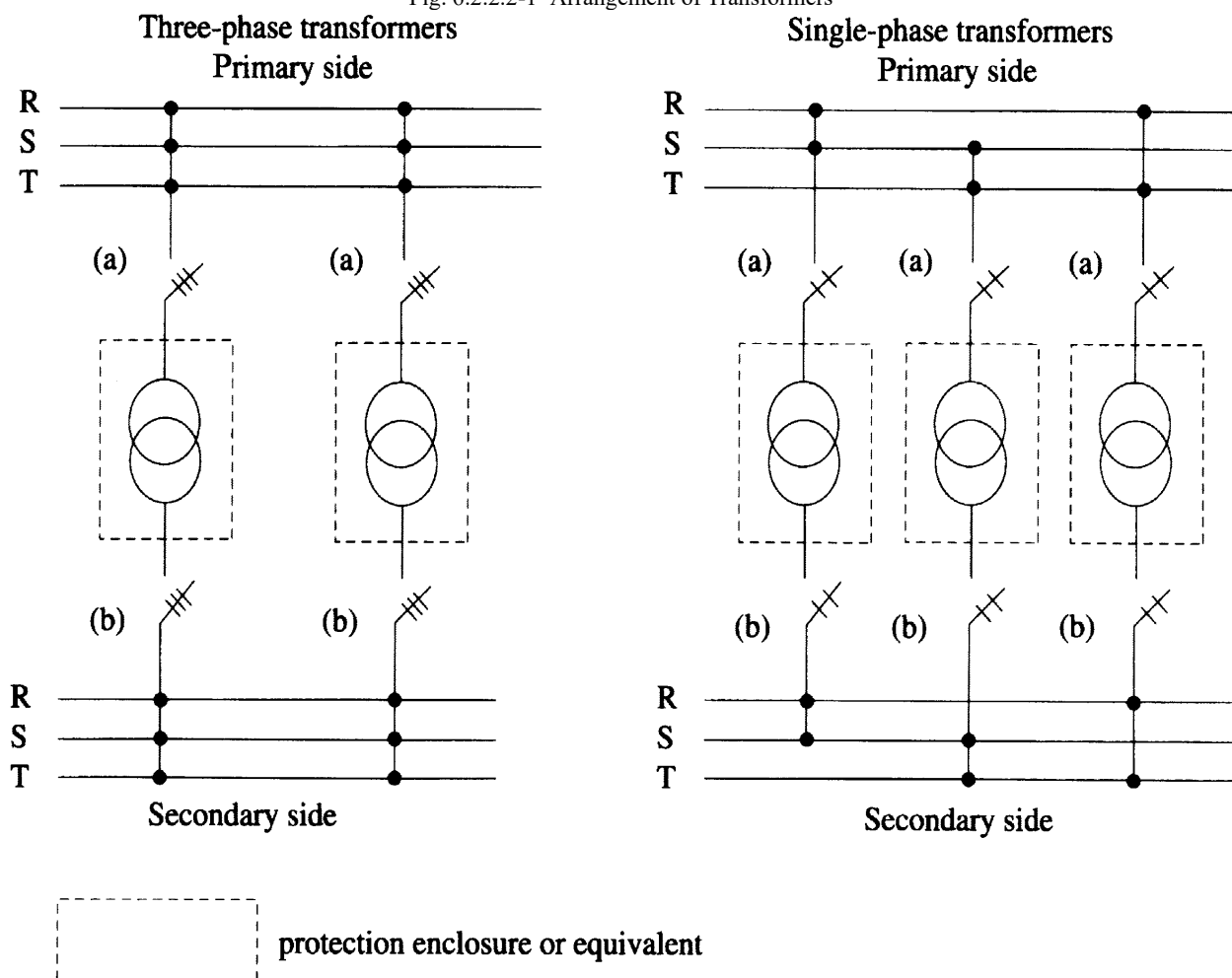
**3** Notwithstanding the requirements in **-1**, one set of transformers is acceptable if the respective primary and secondary sides of three single phase transformers are formed by delta connections, and if necessary power can be supplied as transformers of V connections in case either one of the transformers fails.

**4** Arrangement of transformers are to be as follows. (See **Fig. 6.2.2.2-1**)

- (1) Each transformer is to be located as a separate unit with separate enclosure or equivalent thereto.
- (2) Each transformer is to be served by separate circuits on the primary and secondary side.
- (3) Each primary circuit is to be provided with a protection device and a multipole isolating switch.

- (4) Each secondary circuit is to be provided with a multipole isolating switch.

Fig. 6.2.2.2-1 Arrangement of Transformers



- (a) a protection device and multipole isolating switch  
(b) a multipole isolating switch

### 2.2.3 Lighting Systems

1 The wording “Ro-Ro passenger ship” specified in 2.2.3-4, Part 6 of the Rules means a ship with Ro-Ro cargo spaces or special category spaces.

2 “Portable rechargeable battery operated lamp” specified in 2.2.3-4(2), Part 6 of the Rules is to be operated at least 3 hours and continuously charged from electrical sources, e.g., the main source of electrical power.

### 2.2.4 Location of Main Switchboard

Location of the main switchboard specified in 2.2.4, Part 6 of the Rules is to comply with the requirements of (1) to (3) below. Where these requirements are applied, “machinery space” is regarded as a space extending to the extreme main transverse watertight bulkheads, bounding the spaces containing the main and auxiliary propulsion machinery, boilers serving the needs of propulsion, and all permanent coal bunkers. In the case of unusual arrangements, the limits are deemed appropriate by the Society.

- (1) The main generating station specified in 2.2.4, Part 6 of the Rules is to be situated within the machinery space, i.e. within the extreme main transverse watertight bulkheads. Any bulkhead between the extreme main transverse watertight bulkheads is not regarded as separating the equipment in the main generating station provided that there is access between the spaces.
- (2) The main switchboard is to be located as close as practicable to the main generating station specified in (1) above, within the same machinery space and the same vertical and horizontal fire boundaries.



- (3) Where essential services for steering and propulsion are supplied from section boards, these and any transformers, converters and similar appliances constituting an essential part of electrical supply system are also to satisfy the requirement of (2) above.

## 2.3 Emergency Source of Electrical Power

### 2.3.1 General

1 Whilst the ship is under the following conditions, the ship is regarded as being under the exceptional condition for short periods specified in **2.3.1-4, Part 6 of the Rules**, and the emergency generator may be used to supply non-emergency circuits.

- (1) Blackout condition
- (2) Dead-ship condition
- (3) Routine use for testing
- (4) Short-term parallel operation with the main source of electrical power for the purpose of load transfer
- (5) When the emergency generator is used for the supply of the ship mains during lay time in port (permitted only for satisfying **-2** below)

2 In case where the emergency generator is used for the supply of the ship mains during lay time in port, the emergency generator and its associated equipment are to comply with the following requirements.

- (1) In order to prevent the generator or its prime mover from becoming overloaded when used in port, arrangements are to be provided to shed sufficient non-emergency loads to ensure its continued safe operation.
- (2) The reciprocating internal combustion engine driving the emergency generator is to be equipped with devices for alarms and automatic trip specified in **2.4.1-4** and **2.5.5-1, Part D of the Rules for the Survey and Construction of Steel Ships**.  
The alarms are to be activated independently in the emergency generator room. If the emergency generator room is unattended during lay time in port, the alarms are also to be activated in the space where crews are likely to be attended, e.g., navigation bridge, machinery control space.
- (3) The fuel oil supply tank to the prime mover is to be provided with a low level alarm, arranged at a level ensuring sufficient fuel oil capacity for the emergency services for the period of time as required by **2.3.2, Part 6 of the Rules**. In addition, the alarm is to be activated in the space specified in (2) above.
- (4) Fire detectors complied with **Part 7 of the Rules** are to be installed in the space where the emergency generator set and emergency switchboard are installed.
- (5) Means are to be provided to readily change over to emergency operation.
- (6) Control, monitoring and supply circuits, for the purpose of the use of the emergency generator in port, are to be so arranged and protected that any electrical fault will not influence the operation of the main and emergency services. When necessary for safe operation, the emergency switchboard is to be fitted with switches to isolate the circuits.
- (7) Instructions are to be provided on board to ensure that when the vessel is under way all control devices, e.g., valves, switches, are in a correct position for the independent emergency operation.

### 2.3.2 Capacity of Emergency Source of Power

1 “The navigation lights and other lights” specified in **2.3.2-2(2), Part 6 of the Rules** includes the following lights. Only for navigation lights listed in (1) to (3), a period of time for being supplied from the emergency source of electrical power may be reduced to 3 hours subject to the permission of the flag government.

- (1) Masthead light
- (2) Sidelight
- (3) Sternlight
- (4) All-round white light
- (5) All-round red light
- (6) All-round flashing red light

2 “Installations as required by Chapter IV of SOLAS” as specified in **2.3.2-2(3), Part 6 of the Rules** are the installations which are required by GMDSS (*Global Maritime Distress and Safety System*).

3 “All internal communication equipment as required in an emergency” specified in **2.3.2-2(4), Part 6 of the Rules** includes the following equipment:

- (1) The means of communication which is provided between the navigation bridge and the steering gear room specified in **15.2.9, Part D of the Rules for the Survey and Construction of Steel Ships**.
- (2) The means of communication which is provided between the navigation bridge and the engine control room specified in **1.3.7(1), Part D of the Rules for the Survey and Construction of Steel Ships**.
- (3) The public address system or other effective means of communication specified in **2.5.4, Part 6 of the Rules**.
- (4) The means of communication which is provided between the navigation bridge and the main fire control station specified in **2.1.22, Part 1 of the Rules**.
- (5) On-board communication specified in **2.5.5, Part 6 of the Rules**.
- (6) The means of communication specified in **4.3.2 of the Rules for Automatic and Remote Control Systems**.
- (7) Other means of communication as deemed necessary by the Society.

### **2.3.3 Kind and Performance of Emergency Source of Electrical Power**

**1** The automatic starting system specified in **2.3.3(1)(c), Part 6 of the Rules** is to comply with the following requirements:

- (1) The source of stored energy is to have such a capacity which is capable of starting the prime mover at least six times.
- (2) In case where the automatic starting system consists of the consecutive starts, the number of starts is to be three or less.
- (3) For automatic starting system, means are to be provided to maintain the source of energy capable of starting the prime mover for three times after the initial consecutive starts.

**2** With respect to the requirements **2.3.3(2)(a), Part 6 of the Rules**, where the inverter or converter is connected to the output circuit of the batteries (consumer side), the maximum permitted voltage fluctuations may be taken as those specified in **Table H2.1(a)** or **Table H2.1(b), 3.2.1.2-3, Part H of the Rules for the Survey of Steel Ships** respectively, notwithstanding the voltage drop on the battery.

**3** The wording “to be deemed appropriate by the Society” in **2.3.3(3), Part 6 of the Rules** means **Annex 3.3.3(3), Part H of the Rules for the Survey and Construction of Steel Ships**.

### **2.3.4 Transitional Source of Emergency Electrical Power**

With respect to the requirements **2.3.4(1), Part 6 of the Rules**, where the inverter or converter is connected to the output circuit of the batteries (consumer side), the requirements specified in **2.3.3-2** may be applied.

## Chapter 3      **ADDITIONAL REQUIREMENTS FOR SHIPS CARRYING SPECIAL CARGOES**

### 3.1      **General**

#### 3.1.1      **Scope**

“Closed Ro-Ro cargo spaces” and “open Ro-Ro cargo spaces” other than special category space specified in **3.1.1(1), Part 6 of the Rules** and cargo space intended for the carriage of motor vehicles with fuel in their tanks for their own propulsion specified in **3.1.1(2), Part 6 of the Rules** may not comply with **Chapter 3, Part 6 of the Rules**.

### 3.2      **Special Category Spaces**

#### 3.2.1      **Electrical Installations in Special Category Spaces**

**1** The wording “electrical installations are to be of a type suitable for use in explosive gas atmosphere concerned” in **3.2.1-2, Part 6 of the Rules** means electrical installations are to have explosion-protective construction certified as Apparatus Group *IIA* and Temperature Class *T3* or higher as specified in *IEC 60079* or Explosion Class *d1* and Ignition Group *G3* or higher as specified in the Recommended Practices for Explosion-Protected Electrical Installations in General Industries (NIIS-TR-NO.39 (2006)) issued by National Institute of Industrial Safety in Japan, or equivalent thereto, and having a construction suitable for use in zone 1 area specified in *IEC 60079*, e.g., intrinsically safe, flameproof, pressurized, increased safe type construction.

**2** The electrical equipment so enclosed and protected as to prevent the escape of sparks” specified in **3.2.1-3., Part 6 of the Rules** is to be of the following **(1)** or **(2)**.

- (1)** The electrical equipment with a protection degree of at least IP55 as defined in **H2.1.3-4, Part H of the Guidance for the Survey and Construction of Steel Ships**.
- (2)** The electrical equipment suitable for use in zone 2 (e.g., type “n” construction) and with Temperature Class *T3* as defined in *IEC 60079* or Ignition Group *G3*.

**3** The wording “the platforms with openings of sufficient size permitting penetration of petrol gases downwards” specified in **3.2.1-3., Part 6 of the Rules** means, for example, a grating deck.

**4** The wording “a type approved by the Society” in **3.2.1-4, Part 6 of the Rules** means a type described in **-1** above.

### 3.3      **Vehicle Spaces other than Special Category Spaces**

#### 3.3.1      **Electrical Installations in Cargo Spaces**

**1** The wording “electrical installations are to be of a type suitable for use in explosive gas atmosphere concerned” in **3.3.1-2, Part 6 of the Rules** means installations are to have explosion-protective construction certified as Apparatus Group *IIA* and Temperature Class *T3* or higher as specified in *IEC 60079* or Explosion Class *d1* and Ignition Group *G3* or higher as specified in the Recommended Practices for Explosion-Protected Electrical Installations in General Industries (NIIS-TR-NO.39 (2006)) issued by National Institute of Industrial Safety in Japan, or equivalent thereto, and having a construction suitable for use in zone 1 area specified in *IEC 60079*, e.g., intrinsically safe, flameproof, pressurized, increased safe type construction.

**2** The wording “a type approved by the Society” in **3.3.1-4, Part 6 of the Rules** means a type described in **-1** above.

## Part 7 FIRE SAFETY MEASURES

### Chapter 1 GENERAL

#### 1.1 General

##### 1.1.1 Application

1 The wording “passenger ships which are intended for the service in restricted areas” specified in [1.1.1-2, Part 7 of the Rules](#) means those ships to be registered under their classification character affixed with “*Coasting Service*” or “*Smooth Water Service*” or other similar notations.

2 For passenger ships which are not engaged in international voyage, the requirements of construction for fire protection are to comply with [2.1.1-1](#), the requirements of means of escape are to comply with [3.1.1-1](#), the requirements of fire detection and extinction are to comply with [4.1.1-1](#), the requirements of fire control plans are to comply with [5.1.1-1](#).

## Chapter 2 CONSTRUCTION FOR FIRE PROTECTION

### 2.1 General

#### 2.1.1 Application

1 For construction for fire protection for passenger ships which are not engaged on international voyages, the following requirements may apply in lieu of those specified in **Chapter 2, Part 7 of the Rules**.

- (1) Passenger ships other than those registered under their classification character affixed with “*Coasting Service*” or “*Smooth Water Service*”, are to comply with the following **(a)** to **(f)**.
  - (a) The helicopter winching deck (a winching area for helicopter on a weather deck) provided in Ro-Ro passenger ships are to comply with the requirements specified in **Chapter 18, Part R of the Rules for the Survey and Construction of Steel Ships** relating to the fire protection.  
(Regulation 18, Chapter II-2 and Regulation 28, Chapter III, *SOLAS* Convention)
  - (b) The fire integrity of bulkheads and decks which separate spaces is to comply with **Table 7.2.1.1-1** and **Table 7.2.1.1-2** in accordance with the adjacent spaces. However, the requirement for the fire integrity of bulkheads and decks for passenger ships carrying less than 36 may be modified by the Society.  
(Regulations 9.2.2.3.1, 9.2.2.3.2, 9.2.2.4.1 and 9.2.2.4.2, Chapter II-2, *SOLAS* Convention)
  - (c) Furniture is not to be provided in corridor and stairways as far as practicable.  
(Regulation 5.3.3, Chapter II-2, *SOLAS* Convention)
  - (d) Stairway enclosures in accommodation spaces and service spaces are to have direct access to corridors and not to confuse passengers’ judgement in emergency. In addition, stairway enclosures are not to have direct access to passenger spaces, crew spaces, spaces for the stowage of fireman’s outfit, etc. or enclosed spaces containing combustibles of fire risk.  
(Regulation 13.3.2.3, Chapter II-2, *SOLAS* Convention)
  - (e) The fire integrity of bulkheads and decks at boundaries adjacent to special category spaces is to comply with **Table 7.2.1.1-3**.  
(Regulation 20.5, Chapter II-2, *SOLAS* Convention)
  - (f) The other requirements in accordance with the following Regulation, Chapter II-2, *SOLAS* Convention are to apply correspondingly.
    - i) Regulation 4 (Excluding paragraphs 4.1, 4.2 and 5.)
    - ii) Regulation 5 (Excluding paragraph 3.3.)
    - iii) Regulation 6
    - iv) Regulation 8
    - v) Regulation 9 (Excluding paragraphs 2.2.1, 2.2.2.1, 2.2.3.1, 2.2.3.2, 2.2.3.4, 2.3, 2.4, 4.1.1.4.7 to 4.1.1.4.11, 4.1.1.7, 4.1.1.8, 4.1.2.2, 4.2, 6.1 to 6.3, 6.5 and 7.4.2. Sub-paragraph 2.2.2.2 may apply to corridor bulkheads where not required to be “A” class, notwithstanding the number of passengers. In applying paragraph 2.2.2.3, where continuous “B” class ceilings and linings are used, they need not to be of at least the same fire resistance as the bulkhead. In applying 2.2.5.1.1, fire integrity of the stairway enclosure may be that complies with **Table 7.2.1.1-2** or **Table 7.2.1.1-3**. Paragraph 4.1.1.5 may apply, notwithstanding the number of passengers. Paragraph 7.5.2 applies only to the exhaust ducts from galley ranges passing through accommodation spaces or spaces containing combustible materials.)
    - vi) Regulation 20, paragraphs 2.2.1, 2.2.3 and 3
- (2) Passenger ships registered under their classification character affixed with “*Coasting Service*” or “*Smooth Water Service*”, are to comply with the following **(a)** to **(h)**.
  - (a) Furniture and furnishing provided in accommodation spaces and control stations are to be of those restrict fire risk.  
(Regulation 3.40, Chapter II-2, *SOLAS* Convention)
  - (b) For passenger ships having special category spaces, the fire integrity of bulkheads and decks at boundary adjacent to

machinery space category *A* and galley is to comply with [Table 7.2.1.1-2](#) and [Table 7.2.1.1-3](#) in accordance with the adjacent spaces.

(Regulations 9.2.2.3.1, 9.2.2.3.2, 9.2.2.4.1 and 9.2.2.4.2, Chapter II-2, *SOLAS* Convention)

- (c) Furniture is not to be provided in corridor and stairways as far as practicable.  
(Regulation 5.3.5, Chapter II-2, *SOLAS* Convention)
- (d) “*A*” class doors in bulkheads at boundaries adjacent to special category spaces other than power-operated watertight door or key locked doors are to be of self closing type and to be capable of closing under an against inclination of 3.5 degrees.  
(Regulation 9.4.1.1.4, Chapter II-2, *SOLAS* Convention)
- (e) For passenger ships of less than 1,000 *gross tonnage* registered under classification character affixed with “*Coasting Service*”, materials for exposed surfaces of corridors and stairway enclosures, ceilings and linings in accommodation spaces and control stations are to have low flame-spread characteristics.  
(Regulation 5.3.2.4.1, Chapter II-2, *SOLAS* Convention)
- (f) The fire integrity of bulkheads and decks at the boundaries between special category spaces are to comply with [Table 7.2.1.1-3](#).  
(Regulations 9.6 and 20.5, Chapter II-2, *SOLAS* Convention)
- (g) Regulation 9.7.5.2 applies only to the exhaust ducts from galley ranges passing through accommodation spaces or spaces containing combustible materials.  
(Regulations 9.7.5.2, Chapter II-2, *SOLAS* Convention)
- (h) The other requirements in accordance with the following Regulation in Chapter II-2 of *SOLAS* Convention are to apply correspondingly.
  - i) Regulation 6, paragraph 2.
  - ii) Regulations 4.4.4, 5.3.1, 5.3.2 and 6.4 apply to passenger ships of 1,000 *gross tonnage* and over, registered under classification character affixed with “*Coasting Service*”.
  - iii) Regulation 9, paragraphs 3.1, 4.1.1.1, 4.1.1.2, 4.1.1.3, 4.1.1.5 and 6.4 apply only to passenger ships having special category spaces. Paragraph 4.1.1.5 may apply to, notwithstanding the number of passengers.
  - iv) Regulation 20, paragraphs 3.1.1.1, 3.1.2.1, 3.1.2.3, 3.1.2.4, 3.1.5, 3.2 and 3.3. However, for paragraph 3.1.5, spaces in a superstructure above cargo spaces or accommodation spaces, service spaces or control stations in a deckhouse may be excluded.

**2** Interpretations of provision of Chapter II-2, *SOLAS* Convention applied to under the requirements in [2.1.1](#), [Part 7](#) of the Rules are to comply with [Annex 7-1](#) “INTERPRETATION OF PROVISION OF CHAPTER II-2, *SOLAS* CONVENTION ON PASSENGER SHIPS”.

Table 7.2.1.1-1 Fire Integrity of Bulkheads Separating Adjacent Spaces

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Control stations	Stairways	Corridors	Evacuation stations	Open deck spaces	Accommodation spaces of minor fire risk	Accommodation spaces of moderate fire risk	Accommodation spaces of greater fire risk	Sanitary spaces	Auxiliary machinery spaces of little or no fire risk	Auxiliary machinery spaces of moderate fire risk	Machinery spaces	Store rooms	Other spaces in which flammable liquids are stowed
(1) Control stations	<b>B0</b>	<i>A0</i>	<i>A0</i>	<i>A0</i>	<i>A0</i> <b>B0</b>	<i>A60</i>	<i>A60</i>	<i>A60</i>	<i>A0</i>	<i>A0</i>	<i>A60</i>	<i>A60</i>	<i>A60</i>	<i>A60</i>
(2) Stairways		<i>A0</i>	<i>A0</i>	<i>A0</i>	<i>A0</i>	<i>A0</i>	<i>A15</i> <i>A0</i>	<i>A30</i> <i>A0</i>	<i>A0</i>	<i>A0</i>	<i>A15</i>	<i>A30</i>	<i>A15</i> <i>A0</i>	<i>A30</i>
(3) Corridors			<b>C</b>	<i>A0</i>	<i>A0</i> <b>B0</b>	<b>B0</b>	<b>B15</b> <b>B0</b>	<b>B15</b> <b>B0</b>	<b>B0</b>	<i>A0</i>	<i>A15</i>	<i>A30</i>	<i>A0</i>	<i>A30</i> <i>A0</i>
(4) Evacuation stations, etc.				-	-	<i>A0</i> <sup>5</sup>	<i>A0</i> <sup>5</sup>	<i>A0</i> <sup>5</sup>	<i>A0</i> <sup>5</sup>	<i>A0</i>	<i>A0</i>	<i>A15</i>	<i>A0</i>	<i>A15</i> <i>A0</i>
(5) Open deck spaces					-	<i>A0</i> <b>B0</b>	<i>A0</i> <b>B0</b>	<i>A0</i> <b>B0</b>	<i>A0</i> <b>B0</b>	<i>A0</i>	<i>A0</i>	<i>A0</i>	<i>A0</i> <b>B0</b>	<i>A0</i>
(6) Accommodation spaces of minor fire risk						<b>B0</b> <b>C</b>	<b>B15</b> <b>C</b>	<b>B15</b> <b>C</b>	<b>B0</b> <b>C</b>	<i>A0</i>	<i>A15</i> <i>A0</i>	<i>A30</i>	<i>A0</i>	<i>A30</i> <i>A0</i>
(7) Accommodation spaces of moderate fire risk							<b>B15</b> <b>C</b>	<b>B15</b> <b>C</b>	<b>B0</b> <b>C</b>	<i>A0</i>	<i>A15</i> <i>A0</i>	<i>A60</i>	<i>A15</i> <i>A0</i>	<i>A60</i> <i>A15</i>
(8) Accommodation spaces of greater fire risk								<b>B15</b> <b>C</b>	<b>B0</b> <b>C</b>	<i>A0</i>	<i>A30</i> <i>A0</i>	<i>A60</i>	<i>A15</i> <i>A0</i>	<i>A60</i> <i>A15</i>
(9) Sanitary and similar spaces									<b>C</b>	<i>A0</i>	<i>A0</i>	<i>A0</i>	<i>A0</i>	<i>A0</i>
(10) Auxiliary machinery spaces, etc. having little or no fire risk										<i>A0</i> <sup>3</sup>	<i>A0</i>	<i>A0</i>	<i>A0</i>	<i>A0</i>
(11) Auxiliary machinery spaces, etc. of moderate fire risk											<i>A0</i>	<i>A0</i>	<i>A0</i>	<i>A30</i> <sup>7</sup> <i>A15</i>
(12) Machinery spaces												<i>A0</i> <sup>3</sup>	<i>A0</i>	<i>A60</i>
(13) Store rooms													<i>A0</i> <sup>3</sup>	<i>A0</i>
(14) Other spaces in which flammable liquids are stowed														<i>A30</i> <sup>7</sup> <i>A15</i>

Notes:

1. Each spaces in the table are to comply with Regulation 26, Chapter II-2, *SOLAS* Convention, except for the following.
  - (3) Corridors
    - Corridors and lobbies
  - (4) Embarkation spaces
    - Open deck spaces and enclosed promenades forming lifeboat or liferaft embarkation and lowering stations
  - (5) Open deck spaces
    - Open deck spaces and enclosed promenades clear of lifeboat and liferaft embarkation lowering stations and the spaces clear of spaces outside superstructures and lowering stations.
2. The superscript [3] and [5] to the notations in the table are as specified below.
  - [3]: Where adjacent spaces are of the same numerical category, a bulkhead or deck of the rating shown in the table is only required when the adjacent spaces are for a different purpose.
  - [5]: Where all bulkheads are divisions at boundary adjacent to muster stations, the division may be “B-0” rating.
3. “C” rating shown in the table is “C” class division or non-combustible division constructed of combustible materials where the spaces in both sides of bulkheads are fitted with automatic sprinkler system.
4. “-” rating shown in the table may be division other than “A”, “B” and “C” class division.
5. Where two divisions in the table appear, the divisions are to comply with the following.
  - (a) The division is to be one upper tier of two divisions in the table.
  - (b) Notwithstanding (a), the division at boundary between two spaces which is protected by an automatic sprinkler system may be one in lower tier of two divisions in the table.
  - (c) Notwithstanding (a), where superscript [7] appears, the division at boundary between space which is protected by an automatic sprinkler system and space which is not protected by an automatic sprinkler system may be one in lower tier of two divisions in the table.



Table 7.2.1.1-2 Fire Integrity of Decks Separating Adjacent Spaces

Spaces above deck	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Spaces below deck	Control stations	Stairways	Corridors	Evacuation stations	Open deck spaces	Accommodation spaces of minor fire risk	Accommodation spaces of moderate fire risk	Accommodation spaces of greater fire risk	Sanitary spaces	Auxiliary machinery spaces of little or no fire risk	Auxiliary machinery spaces of moderate fire risk	Machinery spaces	Store rooms	Other spaces in which flammable liquids are stowed
(1) Control stations	A30 A0	A30 A0	A15 A0	A0	A0 B0	A0	A15 A0	A30 A0	A0	A0	A0	A60	A0	A60 A15
(2) Stairways	A0	A0	A0	A0	A0 B0	A0	A0	A0	A0	A0	A0	A30	A0	A30 A0
(3) Corridors	A15 A0	A0	A0 B0	A0	A0 B0	A0 B0	A15 B0	A15 B0	A0 B0	A0	A0	A30	A0	A30 A0
(4) Evacuation stations, etc.	A0	A0	A0	A0	-	A0 B0	A0 B0	A0 B0	A0 B0	A0	A0	A0	A0	A0
(5) Open deck spaces	A0	A0	A0 B0	A0	-	A0 B0	A0 B0	A0 B0	A0 B0	A0	A0	A0	A0 B0	A0
(6) Accommodation spaces of minor fire risk	A60	A15 A0	A0	A0	A0 B0	A0 B0	A0 B0	A0 B0	A0 B0	A0	A0	A15 A0	A0	A15 A0
(7) Accommodation spaces of moderate fire risk	A60	A30 A0	A15 A0	A15 A0	A0 B0	A0 B0	A15 B0	A30 B0	A0 B0	A0	A15 A0	A30 A0	A0	A30 A0
(8) Accommodation spaces of greater fire risk	A60	A60 A15	A60 A0	A30 A0	A0 B0	A15 B0	A30 B0	A60 B0	A0 B0	A0	A30 A0	A30 A0	A0	A30 A0
(9) Sanitary and similar spaces	A0	A0	A0 B0	A0	A0 B0	A0 B0	A0 B0	A0 B0	A0 B0	A0	A0	A0	A0	A0
(10) Auxiliary machinery spaces, etc. having little or no fire risk	A0	A0	A0	A0	A0	A0	A0	A0	A0	A0 <sup>3</sup>	A0	A0	A0	A0
(11) Auxiliary machinery spaces, etc. of moderate fire risk	A60	A60 A15	A60 A15	A30 A0	A0	A0	A15 A0	A30 A0	A0	A0	A0 <sup>3</sup>	A0	A0	A30 <sup>7</sup> A15
(12) Machinery spaces	A60	A60	A60	A60	A0	A60	A60	A60	A0	A0	A30	A30 <sup>3</sup>	A0	A60
(13) Store rooms	A60	A30 A0	A15 A0	A15 A0	A0 B0	A15 A0	A30 A0	A30 A0	A0 B0	A0	A0	A0	A0	A15 <sup>7</sup> A0
(14) Other spaces in which flammable liquids are stowed	A60	A60 A30	A60 A30	A60	A0	A30 A0	A60 A15	A60 A15	A0	A0	A30 <sup>7</sup> A0	A30 <sup>7</sup> A0	A0	A30 <sup>7</sup> A0

Notes:

- See note 1 in [Table 7.2.1.1-1](#).
- The case where superscript [3] appears is the case where adjacent spaces are of the same numerical category, a deck of the rating shown in the table is only required when the adjacent spaces are for a different purpose.
- “-” rating shown in the table may be division other than “A”, “B” and “C” class division.
- Where two divisions in the table appear, the division is to comply with the following.
  - The division is to be one upper tier of two divisions in the table.
  - Notwithstanding (a), the division at boundary between two spaces which are protected by an automatic sprinkler system may be one in lower tier of two divisions in the table.
  - Notwithstanding (a), where superscript [7] appears, the division at boundary between space which is protected by an automatic sprinkler system and space which is not protected by an automatic sprinkler system may be one in lower tier of two divisions in the table.

Table 7.2.1.1-3 Fire Integrity of Bulkheads and Decks Separating Adjacent Space from Special Category Spaces

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Control stations	Stairways	Corridors	Evacuation stations	Open deck spaces	Accommodation spaces of minor fire risk	Accommodation spaces of moderate fire risk	Accommodation spaces of greater fire risk	Sanitary spaces	Auxiliary machinery spaces of little or no fire risk	Auxiliary machinery spaces of moderate fire risk	Machinery spaces	Store rooms	Other spaces in which flammable liquids are stowed
Bulkheads	A60	A30	A30	A0	A0	A15 A0	A30 A0	A60 A15	A0	A0	A0	A60	A0	A60
Decks above special category spaces	A60	A60	A60	A60	A0	A30 A0	A60 A15	A60 A15	A0	A0	A0	A30	A30 <sup>7</sup> A0	A30
Decks below special category spaces	A30	A0	A0	A0	A0	A15 A0	A30 A0	A30 A0	A0	A0	A0	A60	A0	A60

Notes:

- See note 1 in [Table 7.2.1.1-1](#).
- Where two divisions in the table appear, the division is to comply with the following.
  - The division is to be one upper tier of two divisions in the table.
  - Notwithstanding (a), the division at boundary between two spaces which are protected by an automatic sprinkler system may be one in lower tier of two divisions in the table.
  - Notwithstanding (a), where superscript [7] appears, the division at boundary between space which is protected by an automatic sprinkler system and space which is not protected by an automatic sprinkler system may be one in lower tier of two divisions in the table.

## Chapter 3 MEANS OF ESCAPE

### 3.1 General

#### 3.1.1 Application

1 The means of escape for passenger ships which are not engaged on international voyages are to comply with **3.1, Part 7** of the Rules except those specified in the following.

- (1) For passenger ships other than those registered under their classification character affixed with “*Coasting Service*” or “*Smooth Water Service*” and Ro-Ro passenger ships, the following (a) to (c) may apply.
  - (a) Dead-end corridors are not to exceed 7m in length.  
(Regulation 13.3.1.2, Chapter II-2, *SOLAS* Convention)
  - (b) For ships of less than 1,000 *gross tonnage*, the escape routes from machinery spaces of category *A* may be of two exits and two sets of ladders widely separated each other as far as practicable.  
(Regulation 13.4.1.1 and 13.4.1.2, Chapter II-2, *SOLAS* Convention)
  - (c) Means of escape from a machinery control room located within a machinery space may be 1 or more.  
(Regulation 13.4.1.4, Chapter II-2, *SOLAS* Convention)
- (2) For passenger ships registered under their classification character affixed with “*Coasting Service*” or “*Smooth Water Service*”, the following (a) to (c) may apply.
  - (a) Passenger ships other than Ro-Ro passenger ships may not be provided with low location lighting systems and fire equipment location markings on escape route. For Ro-Ro passenger ships of less than 1,000 *gross tonnage*, escape instruction and fire equipment location markings on escape route may not be of photoluminescent material nor marked by lighting.  
(Regulation 13.3.2.5, Chapter II-2, *SOLAS* Convention)
  - (b) The escape routes from machinery spaces of category *A* may be of two exits and two sets of ladders widely separated each other as far as practicable.  
(Regulation 13.4.1.1 and 13.4.1.2, Chapter II-2, *SOLAS* Convention)
  - (c) The emergency escape breathing devices (EEBDs) may be in accordance with the following i) to iv):
    - i) Passenger ships of less than 1,600 *gross tonnage* need not be provided with EEBDs.
    - ii) For passenger ships of 1,600 *gross tonnage* or more, 2 sets of EEBDs are to be provided for machinery spaces containing internal combustion machinery used for main propulsion.
    - iii) Where the accommodation spaces are not located under the lowest open deck and have escape routes direct to open decks at each deck level, EEBDs are not required for such spaces.
    - iv) In addition to the provisions of ii) above, 1 set of spare EEBD is to be provided.  
(Regulations 13.3.4 and 13.4.3, Chapter II-2, *SOLAS* Convention)

2 Interpretations of provision of Chapter II-2, *SOLAS* Convention applied to under the requirements in **3.1.1, Part 7** of the Rules are to comply with **Annex 7-1** “INTERPRETATION OF PROVISION OF CHAPTER II-2, *SOLAS* CONVENTION ON PASSENGER SHIPS”, **Annex 7-2** “STANDARDS FOR THE CALCULATION OF THE WIDTH OF STAIRWAYS FORMING MEANS OF ESCAPE ON PASSENGER SHIPS” and **Annex 7-3** “GUIDANCE FOR EVALUATION, TESTING AND APPLICATION OF LOW-LOCATION LIGHTING ON PASSENGER SHIPS”.

## Chapter 4 FIRE PROTECTION APPARATUS

### 4.1 General

#### 4.1.1 Application

1 The fire detection and extinction for passenger ships which are not engaged on international voyages are to comply with **4.1.1, Part 7** of the Rules except those specified in the following.

- (1) For passenger ships other than those registered under their classification character affixed with “*Coasting Service*” or “*Smooth Water Service*”, the following (a) to (g) may apply.
  - (a) In passenger ships of less than 3,000 *gross tonnage*, a fixed emergency fire pump to comply with the following requirements may be accepted when provided in such a compartment that a fire in any one compartment will not render all fire pumps inoperable. In passenger ships of less than 1,000 *gross tonnage*, the emergency fire pump may not be of fixed type.  
(Regulation 10.2.2.3, Chapter II-2, *SOLAS* Convention)
    - i) The emergency fire pump is to comply with Regulation 10.2.2.3.1.2, Chapter II-2, *SOLAS* Convention and its source of power and sea connection are not to be provided in machinery spaces of category *A*.
    - ii) The emergency fire pump is to be arranged aft of the collision bulkhead. Where the pump is provided in the space separated from the spaces always attended by the crew, means are to be provided to be remotely operated at the navigation bridge or the fire control station in addition to the local operation.
  - (b) For passenger ships carrying not more than 36 passengers, the fire hoses may not be permanently connected with the fire hydrants.  
(Regulation 10.2.1.2 and 10.2.3.1.1, Chapter II-2, *SOLAS* Convention)
  - (c) For passenger ships carrying not more than 36 passenger, three water fog applicators may be accepted when provided in a conspicuous position in the enclosed space of the vehicle spaces.  
(Regulations 10.5.5 and 10.10.2.2.2, Chapter II-2, *SOLAS* Convention)
  - (d) The number of fire-fighter’s outfits may be each two sets of fire-fighter’s outfits and personal equipment for every 80m, or part thereof, of the aggregate of the length of all passenger 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.  
(Regulations 10.10.2.2.1 and 10.10.2.3, Part II-2, *SOLAS* Convention)
  - (e) For ro-ro passenger ships, the fire fighting appliances specified in **18.5, Part R of the Rules for the Survey and Construction of Steel Ships** are to be provided on the helicopter winching deck.  
(Regulation 18, Chapter II-2, *SOLAS* Convention)
  - (f) A fixed high-expansion foam fire-extinguishing system may be provided as a fixed fire-extinguishing system in the special category space.  
(Regulations 20.6.1.2 and 20.6.1.3, Chapter II-2, *SOLAS* Convention)
  - (g) Regulation 10.2.1.7, Chapter II-2, *SOLAS* Convention may not apply.
- (2) For passenger ships registered under their classification character affixed with “*Coasting Service*” or “*Smooth Water Service*”, the following (a) to (o) may apply.
  - (a) In passenger ships of less than 1,000 *gross tonnage*, one independently power driven fire pump may be accepted. The fire pumps are to be capable of delivering a quantity of water more than two thirds of quantity which bilge pumps can draw, and maintaining 0.3 MPa pressure at all hydrants. In passenger ships of less than 100 *gross tonnage*, 4 buckets or bailers painted in red may be accepted when widely separated for immediate use. (For passenger ships registered under their classification character affixed with “*Smooth Water Service*”, the number of buckets or bailers may be reduced to 2.)  
(Regulation 10.2.2.4.1, Chapter II-2, *SOLAS* Convention)
  - (b) Except special category spaces, the number and position of hydrants may be such that at least one jet of water may reach any part of the ship normally accessible to the passenger or crew while the ship is being navigated and any part of any

cargo space (when empty).

(Regulation 10.2.1.5.1, Chapter II-2, *SOLAS* Convention)

- (c) Fire hoses may not be permanently connected with the fire hydrants.  
(Regulation 10.2.1.2 and 10.2.3.1.1, Chapter II-2, *SOLAS* Convention)
- (d) For passenger ships of less than 1,000 *gross tonnage*, the number of portable liquid fire extinguisher, foam fire extinguisher or powder fire extinguisher (only the extinguisher which extinguishing medium is phosphate) may be such that no point in the accommodation space and service space is more than 15m walking distance from any extinguisher and that there are at least two such extinguishers in each decks.  
(Regulation 10.3.2.1, Chapter II-2, *SOLAS* Convention)
- (e) For passenger ships of less than 1,000 *gross tonnage*, a fixed fire extinguishing system may not be provided in spaces only having oil fuel units.  
(Regulation 10.5.1.1, Chapter II-2, *SOLAS* Convention)
- (f) Either foam fire extinguisher of 45l capacity, carbon dioxide gas fire extinguisher with a mass of 16kg or powder fire extinguisher with a mass of 23kg may be accepted in the boiler room containing oil-fired boilers.  
(Regulation 10.5.1.2.2, Chapter II-2, *SOLAS* Convention)
- (g) Either a portable foam extinguisher, carbon dioxide gas fire extinguisher or powder fire extinguisher may be accepted in each firing space in the boiler room and in each space in which a part of oil fuel installation is situated.  
(Regulation 10.5.1.2.3, Chapter II-2, *SOLAS* Convention)
- (h) Either a portable foam fire extinguisher of 45l capacity, carbon dioxide gas fire extinguisher with a mass of 16kg or powder fire extinguisher with a mass of 23kg may be accepted in spaces containing internal combustion machinery (main engine or auxiliary which has in the aggregate a total power output of not less than 750kW). Additionally the number of portable foam fire extinguisher, carbon dioxide gas fire extinguisher or powder fire extinguisher may be such that no point in that spaces is more than 10m walking distance from any extinguisher and that there are at least two such extinguishers in that spaces. For ships having special category spaces and the main propulsion machinery which has in the aggregate a total power output of not less than 750kW, a fixed fire extinguishing system is to be provided.  
(Regulation 10.5.2, Chapter II-2, *SOLAS* Convention)
- (i) Only each two sets of fire-fighter's outfits and personal equipment are accepted provided that they are ready for use and stored in an easily accessible and widely separated position.  
(Regulation 10.10.3, Chapter II-2, *SOLAS* Convention)
- (j) Either a portable foam fire extinguisher, carbon dioxide gas fire extinguisher or powder fire extinguisher may be accepted at outside the entrance of paint lockers and lump rooms.  
(Regulation 10.6.3, Chapter II-2, *SOLAS* Convention)
- (k) An automatic sprinkler, fire detection and fire alarm system may not be required in the space except for special category spaces and machinery spaces in ships to which the requirement in **(m)** does not apply.  
(Regulations 10.5.1.2 and 10.6.1.1, Chapter II-2, *SOLAS* Convention)
- (l) A fixed high-expansion foam fire-extinguishing system may be accepted as a fixed fire-extinguishing system in special category spaces.  
(Regulations 20.6.1.2 and 20.6.1.3, Chapter II-2, *SOLAS* Convention)
- (m) For passenger ships having ro-ro cargo spaces or spaces other than cargo spaces for carriage of motor vehicles with fuel for their own propulsion, whose main propulsion machinery has in the aggregate a total power output of not less than 750kW, the fixed fire detection and fire alarm systems may not be required in the machinery spaces.  
(Regulation 7.4.1, Chapter II-2, *SOLAS* Convention),
- (n) Passenger ships registered under their classification character affixed with "Coasting Service" of less than 2,000 *gross tonnage* and passenger ships registered under their classification character affixed with "Smooth Water Service" may not be required manually operated call points in accommodation spaces, service spaces and control stations.  
(Regulation 7.7, Chapter II-2, *SOLAS* Convention)
- (o) The following Regulation in Chapter II-2 of *SOLAS* Convention may not apply.
  - i) Regulation 10, paragraphs 2.1.2.1.2, 2.1.2.2.1, 2.1.5.2.2, 2.1.7, 5.1.2, 5.4 (excluding **(h)** above), 5.5, 5.6, 10.2.2 and

10.2.3

ii) Regulation 20, paragraphs 4.3.2 and 6.3.2

**2** Interpretations of provision of Chapter II-2, *SOLAS* Convention applied to under the requirements in **4.1.1**, **Part 7** of the Rules are to comply with **Annex 7-1** “INTERPRETATION OF PROVISION OF CHAPTER II-2, *SOLAS* CONVENTION ON PASSENGER SHIPS”.

## Chapter 5 FIRE CONTROL ETC.

### 5.1 General

#### 5.1.1 Application

1 The requirements relating to fire control plans in this Chapter may not apply to passenger ships which are not engaged on international voyages when deemed appropriate by the Society.

2 Interpretations of provision in Chapter II-2, *SOLAS* Convention applied to under the requirements in [5.1.1](#), [Part 7 of the Rules](#) are to comply with [Annex 7-1](#) “INTERPRETATION OF PROVISION OF CHAPTER II-2, *SOLAS* CONVENTION ON PASSENGER SHIPS”

## **Part 10 PASSENGER SUBMERSIBLE CRAFT**

### **Chapter 1 GENERAL**

#### **1.1 General**

##### **1.1.4 Additional Requirements**

The wording “additional requirements where deemed necessary” in [1.1.4, Part 10 of the Rules](#) means, for example, the case the Government of the State whose flag the submersible is entitled to fly has national regulations.



## Chapter 2      SURVEYS OF SUBMERSIBLES

### 2.2      Classification Survey during Construction

#### 2.2.3      Presence of the Surveyor

The wording “items specified otherwise by the Society” and the wording “survey methods which it considers to be appropriate” in **2.2.3, Part 10 of the Rules** mean to be in accordance with the following **(1)** and **(2)** respectively:

- (1) The wording “items specified otherwise by the Society” means surveys of the tests specified in **2.2.3(1), 7.2.1** and **7.2.2, Part 10 of the Rules**.
- (2) The wording “survey methods which it considers to be appropriate” means to be in accordance with **2.1.4-2(2), Part 2**.

## Chapter 3 HULL CONSTRUCTION

### 3.1 General

#### 3.1.1 Freeboard while being Surface

The wording “sufficient height above the water surface” in **3.1.1-2, Part 10 of the Rules** means 45cm or more above the upper deck.

#### 3.1.2 Stability

The “all service conditions including drop weights being jettisoned” in **3.1.2-2, Part 10 of the Rules** includes the following conditions.

- (1) The condition that the buoyancy tanks (the volume of the maximum tank or that of one half of the total volume of tanks, whichever is larger) are filled with sea water and the drop weights are jettisoned and the expected number of persons at embarking or disembarking are standing on the freeboard deck while being surface.
- (2) The condition that all buoyancy tanks are blown off and the drop weights are still fastened and all persons on board are standing on the freeboard deck while being surface.

#### 3.1.4 Special Consideration against Damages from Outside

The wording “properly protected against collision, etc. with foreign objects” in **3.1.4-2, Part 10 of the Rules** means such a protection for the pressure hull as to be capable of absorbing the energy of collision at a speed of 1.0m/sec. for the fore-aft direction and a speed of 0.5m/sec. for the up-down and right-left directions between the submersible and a rigid flat wall.

### 3.2 Materials and Welding

#### 3.2.1 Materials

The “standard considered appropriate by the Society” in **3.2.1-2, Part 10 of the Rules** is, where acrylic plastic castings are used for view port windows, the latest edition of The American Society of Mechanical Engineers Safety Standard for Pressure Vessels for Human Occupancy (hereinafter referred to as “*ASME PVHO*” in this Chapter) Section 2 Viewports and Section 3 Window Fabricators.

### 3.3 Pressure Hulls and Pressure Enclosures

#### 3.3.1 Fire-proof Materials

The “tests considered appropriate by the Society” in **3.3.1-2, Part 10 of the Rules** are “Smoke and Toxicity Test” and “Test for Surface Flammability” carried out in accordance with the *FTP* Code defined in SOLAS regulation II-2/3 or the equivalent thereto.

#### 3.3.4 Windows

The “construction and strength considered appropriate by the Society” in **3.3.4-2, Part 10 of the Rules** are those to comply with the requirements specified in the latest edition of *ASME PVHO* by accounting the design pressure and the design temperature as follows.

- (1) Design pressure

The design pressure is to be a pressure corresponding to the design diving depth or more.

- (2) Design temperature

The design temperature is not to be less than 25°C.

## Chapter 4 MANOEUVRING SYSTEMS, ETC.

### 4.1 Manoeuvring Systems, etc.

#### 4.1.2 Buoyancy Control Systems

1 The wording “properly protected against damages from outside” in **4.1.2-1(2), Part 10 of the Rules** means such arrangements considering independency in order to fulfill the followings.

- (1) The loss of surfacing function is to be limited so that not less than one half of the total volume of the buoyancy tanks are possible to blow off in case that one of high pressure bottles containing compressed air or their pipings (excluding the part in the pressure hull or the pressure enclosure) is damaged.
- (2) Any excessive trim is not to be caused even in such a case of loss of surfacing function mentioned above.

2 The “another surfacing means considered appropriate by the Society” in **4.1.2-3(2), Part 10 of the Rules** is such means as lifting the submersible directly by using wires, separating accommodation compartment from all other parts of the system including appendages, and surfacing by the positive buoyancy of the released compartment, etc.

### 4.3 Electrical Installations

#### 4.3.11 Cables

The wording “the test deemed appropriate by the Society” in **4.3.11-1, Part 10 of the Rules** is the flame-retardant test specified in **H2.5.3-2, Part H of the Guidance for the Survey and Construction of Steel Ships**.

### 4.5 Communication Systems

#### 4.5.1 General

The wording “external communication systems which are effective” in **4.5.1-1, Part 10 of the Rules** means those listed below.

- (1) Two-channel transmitter/receiver, intended to be used when the submersible is on the surface, one of the channels of which operates on safety channel 16-*VHF*, while the other is used as a “working channel” for communication between the submersible and its support systems.
- (2) Single channel side-band underwater telephone system, intended to be used when the submersible is submerged, capable of maintaining the communication with the support systems when it is at a distance equivalent to twice the maximum diving depth of the submersible.

## **Chapter 5      LIFE SUPPORT SYSTEMS, ACCOMMODATION, MEANS OF ESCAPE AND LIFE-SAVING APPLIANCES**

### **5.1      Life Support Systems**

#### **5.1.2      Breathing Gas Systems**

The breathing gas systems in **5.1.2, Part 10 of the Rules** is to comply with the followings.

- (1) The systems are to be designed based upon an hourly per man  $O_2$  consumption of  $0.038kg$  and  $CO_2$  production of  $0.0523kg$ .
- (2) The systems are to be capable of maintaining the  $O_2$  content of the interior atmosphere within the range of 19% to 23% by volume.
- (3) The systems are to be capable of maintaining the  $CO_2$  content at or below 0.5% by volume.
- (4) The systems are to be composed of at least a shut-off valve, a flowmeter and two flow regulating devices arranged ready for use in case of failure of one device.

#### **5.1.3      Reserve Breathing Gas Systems**

The reserve breathing gas systems in **5.1.3, Part 10 of the Rules** are to be in accordance with those in **5.1.2**.

### **5.3      Means of Escape**

#### **5.3.1      General**

The wording “when considered unavoidable by the Society” in **5.3.1-2, Part 10 of the Rules** means the case when the length of the pressure hull is  $10m$  or less.

## Chapter 6 SUPPORT SYSTEMS

### 6.1 Support Systems

#### 6.1.1 General

**1** Ropes, hooks, shackles, blocks and the like used for the launch and recovery systems or cranes in **6.1.1-1(2), Part 10 of the Rules** are to comply with the followings.

- (1) Ropes are to have such strength that the safety factor for the breaking stress is not less than 5 at the design lifting load of the submersible and to be passed through tests deemed appropriate by the Society.
- (2) Hooks, shackles, blocks and the like are to have sufficient strength for the design lifting load of the submersible and to be passed through tests deemed appropriate by the Society.

**2** When floating docks are used for the means of housing for the submersible, the docks are to be designed and constructed in accordance with the requirements of the **Rules for Floating Docks** or the equivalent thereto.

## Chapter 7 TESTS

### 7.2 Tests

#### 7.2.1 Tests for Pressure Hulls and Pressure Enclosures

The “an allowable tolerance deemed appropriate by the Society” in **7.2.1(2), Part 10 of the Rules** is to be in accordance with the followings except when another standard of fabrication tolerance is used under approval by the Society by submitting documents concerned.

- (1) The alignment at butt welded edges on the cylindrical pressure hull is to be such that the maximum offset is not more than 1/10 of the thickness for longitudinal joints and 1/5 for circumferencial joints, or 3mm whichever is less. The alignment at butt welded edges for the spherical pressure hull is to be such that the maximum offset is not more than 1/10 of the thickness or 3mm whichever is less.
- (2) The amount of the sidelong falling of the frames on the cylindrical pressure hull is not to exceed 1/40 of the frame depth for the outside frame and 1/50 for the inside frame or 3mm whichever is less.
- (3) The alignment at butt welded edges of the face bar of the frames is to be such that the maximum offset is not more than 2mm in both directions of depth and width.
- (4) As a result of measurements of diameter around circumference inside the pressure hull, absolute values of  $e_1$ ,  $e_2$  and  $e_3$  in relation to the deviations from a true circle are not to exceed those specified below.
  - (a) 1/2 of the thickness of the pressure hull or 10mm whichever is less for all values
  - (b) The design values used in the strength calculation of the pressure hull for absolute value of  $e_2$

Where,

$e_1$  is a distance from a point on the inner side of the pressure hull to the centre of the mean circle by subtracting a radius of the mean circle (mm).

$e_2$  is a maximum absolute value of differences between values of  $e_1$  at a certain point and at another point which are located within a range of an arc length on the inner side of the pressure hull equal to 1/2 of the loblength for cylindrical pressure hulls and equal to the marginal panel width for spherical pressure hulls (mm).

$e_3$  is a difference between a radius of the mean circle and that of the designed circle (mm).

In the above, mean circle is an ideal circle whose inner area is equal to that of the pressure hull and a mean value of differences between a radius of the mean circle and that of the pressure hull is minimum.

Design circle is a circle which has a design diameter of the pressure hull.

The 1/2 of the lob-length is an arc length defined as  $\sqrt[4]{Dl^2t}$

The marginal panel width is an arc length defined as;

$$\frac{3.1\sqrt{R_1 t}}{\sqrt[4]{3(1-v^2)}}$$

$D$  : diameter of designed circle (mm)

$R_1$  : local inner radius within the marginal panel width (mm)

$t$  : thickness of pressure hull (mm)

$l$  : frame space (mm)

$v$  : Poisson's ratio

## Chapter 8 OPERATIONAL REQUIREMENTS

### 8.1 General

#### 8.1.3 Training

The wording “to be trained as deemed appropriate by the Society” in **8.1.3, Part 10 of the Rules** means to undergo the training including all applicable subjects listed in **(1)** to **(8)** below.

(1) Life support

The properties and effects of  $CO_2$ , high and low levels of  $O_2$ ,  $CO$  and other gases which could be present in the submersibles, gas concentrations, oxygen systems, color coding of gas bottles, methods of  $CO_2$  removal and effects of humidity and shelf life on the efficiency of the  $CO_2$  absorbent.

(2) Buoyancy and stability

Buoyancy, payload, basic stability and factors affecting stability in both normal and emergency situations.

(3) Navigation

The use of surface and underwater navigational equipment, effects of currents and tides, seamanship and Collision Regulations.

(4) Communications

Surface and underwater communication systems, effects of thermal layering on underwater communications and the use of standard communication vocabulary.

(5) Power sources and electrical arrangements

Batteries and battery charging, explosive hazards and ignition sources, particularly in battery compartments, circuit protection devices, emergency power sources, ground/earth fault detection, fault currents from batteries and pressure compensating arrangements for batteries exposed to sea pressure.

(6) Emergency planning

Fire and their causes, fire extinguishing systems and their environmental effects, flooding, entanglement, available life support, toxic hazards, loss of communication, loss of power, physical and physiological effects on passengers and crew subject to prolonged periods underwater when subject to sensory, perceptive or thermal deprivation, control of passengers and means to avoid panic, claustrophobia and hypothermia.

(7) Personnel responsibilities

Allocation of duties, chain of command in normal and emergency situations, familiarization with local, national and international requirements.

(8) Practical and operational training

The operational training of crew members is to be under direct supervision of an experienced pilot and culminate in practical and operational tests including simulated emergency situations.

## **Annex 4-1 GUIDELINES ON OPERATIONAL INFORMATION FOR MASTERS IN CASE OF FLOODING FOR PASSENGER SHIPS CONSTRUCTED BEFORE 1 JANUARY 2014 (MSC.1/Circ.1589)**

### **1.1 General**

1 When an onboard stability computer is provided in accordance with **Regulation 8-1.3.1.1, Chapter II-1 of SOLAS**, the system referred to in these Guidelines should comprise an onboard stability computer capable of receiving and processing data to provide the master with regularly updated operational information on the residual damage stability of the ship after a flooding casualty.

2 When shore-based support is provided in accordance with **Regulation 8-1.3.1.2, Chapter II-1 of SOLAS**, the system referred to in these Guidelines should comprise two-way communication links to the shore-based support with a stability computer capable of receiving and processing data to provide the master with regularly updated operational information on the residual damage stability of the ship after a flooding casualty.

3 Stability computer software should use an accurate and detailed computer model of the entire hull, the pre-damage loading condition and the status of the watertight doors to calculate the residual damage stability following any flooding casualty by processing data to provide operational information required by the master.

### **1.2 System Overview**

1 At least two independent stability computers should be available at all times (either two on board, or two through shore-based support, or one of each), which are capable of receiving and processing the data necessary to provide operational information to the master.

2 The onboard system should have an uninterruptible power supply (UPS) connected to both the main and the emergency switchboards.

### **1.3 Input**

1 The system should be pre-loaded with a detailed computer model of the complete hull including:

- (1) appendages, compartments, tanks and the relevant parts of the superstructure considered in the damage stability calculation;
- (2) wind profile;
- (3) openings generating progressive flooding;
- (4) internal compartment connections;
- (5) cross-flooding arrangements; and
- (6) escape routes or margin line (where applicable).

Each internal space should be assigned the same permeability used in the approved damage stability calculations, unless a more accurate permeability has been calculated.

2 The system should utilize the latest approved lightship weight and centre of gravity information.

3 Details of the damage location(s) and extent(s) or the damaged compartments should be input manually and combined with data from electronic sensors such as draught gauges, tank level devices, watertight door indicators and flooding level sensors, when available.

4 When electronic sensors providing direct data inputs are fitted, if it is considered at any time that a sensor or sensors are faulty, or have been damaged, it should be possible to override the sensor data with manually input data. The system should clearly indicate to its operator if a sensor that should be available is being manually overridden.

5 The system should be updated with the loading condition before the voyage commences and on a daily basis during navigation.



## 1.4 Calculation Methods

- 1 The system should utilize software capable of analysing the damage stability following any real flooding casualty including multi-compartment, non-linked breaches (see **1.1-3, Annex 4-1 of the Guidance**).
- 2 The system should use the actual pre-damage loading condition.
- 3 The system should be capable of accounting for applied moments such as wind, lifeboat launching, cargo shifts and passenger relocation.
- 4 The system should account for the effect of wind by using the method in **Regulation 7-2.4.1.2, Chapter II-1 of SOLAS** as the default, but allow for manual input of the wind speed/pressure if the on-scene pressure is significantly different ( $P = 120 \text{ N/m}^2$  equates to Beaufort 6, i.e. approximately  $13.8 \text{ m/s}$  or  $27 \text{ knots}$ ).
- 5 The system should be capable of assessing the impact of open watertight doors on stability.
- 6 The system should have the capability of using the same detailed hull model for damage control drills or to assess potential damage and stability scenarios during a flooding casualty. This should not interfere with the ability of the onboard computer or shore-based support to monitor the actual situation and provide operational information to the master.

## 1.5 Output

- 1 The system should output the residual *GZ* curve both graphically and numerically. It should also provide the following information:
  - (1) draughts (forward, amidships and aft);
  - (2) trim;
  - (3) heel angle;
  - (4) *GZ* max;
  - (5) *GZ* range;
  - (6) angle of vanishing stability;
  - (7) down-flooding immersion angles; and
  - (8) immersion angles of escape routes or margin line (where applicable).
- 2 The output format and units of the information supplied to the operators of the system should be consistent with the format and units of the approved stability booklet in order to facilitate easy comparison. The output should be within the tolerances specified in the “*Guidelines for the approval of stability instruments*” (MSC.1/Circ.1229). Deviation from these tolerances should not be accepted unless there is an explanation satisfactory to the Administration.
- 3 The system should show a profile view, deck views and cross-sections of the ship indicating the flooded water-plane and the damaged compartments.

## 1.6 Other Issues

- 1 An operation manual should be provided for the system software, printed in a language in which the operators of the system are fully conversant. The manual should also indicate the limitations of the system.
- 2 At least two crew members should be competent in the operation of the system including the communication links to the shore-based support, when provided. They should be capable of interpreting the output of the system in order to provide the required operational information to the master.
- 3 When shore-based support is provided in accordance with **Regulation 8-1.3.1.2, Chapter II-1 of SOLAS**:
  - (1) there should be a contract for the supply of shore-based support at all times during the validity of the Passenger Ship Safety Certificate;
  - (2) the shore-based support should be manned by adequately qualified persons with regard to stability, i.e. no less than two qualified persons should be available to be on call at all times; and
  - (3) the shore-based support should be operational within one hour (i.e. with the ability to input details of the condition of the ship, as instructed).

**1.7 Ro-ro Passenger Ships**

If applicable (e.g., the Stockholm Agreement (*IMO* Circular Letter No.1891) is applied.), there should be algorithms in the software for estimating the effect of water accumulation on deck.

**1.8 Approval and Testing**

The stability aspects of the system should be initially approved and periodically checked against validated test conditions based on a number of loading/damage scenarios from the approved stability information book to ensure that it is operating correctly and that the stored data has not been subject to unauthorized alteration.

**1.9 Limitations of the System**

**1** The system is not intended to compute transient asymmetrical flooding whereby the ship could capsize under the immediate inrush of floodwater before there is time for equalization measures to take effect.

**2** The system is not intended to make any allowance for the motion of the ship in a seaway, including the effects of tide, current or wave action.

**1.10 Equivalence**

Equivalent arrangements to the provisions in these Guidelines may be employed to the satisfaction of the Administration.

**1.11 Ships Fitted with Onboard Damage Stability Computers before Required by SOLAS Regulation II-1/8-1.3**

The Administration should be advised by the company, as defined in **Regulation 1.2, Chapter IX of SOLAS**, of any ships fitted with systems before they are required by **Regulation 8-1.3, Chapter II-1 of SOLAS**, which may not fully comply with these Guidelines, to allow for a decision to be made on what further action, if any, is necessary. As a minimum, the system should have the functionality described under “Calculation Methods” (see [1.4](#)), “Output” (see [1.5](#)) and, if applicable, “Ro-ro Passenger Ships” (see [1.7](#)).

## **Annex 4-2 GUIDELINES ON OPERATIONAL INFORMATION FOR MASTERS OF PASSENGER SHIPS FOR SAFE RETURN TO PORT BY OWN POWER OR UNDER TOW (MSC.1/Circ1400)**

### **1.1 General**

1 Stability information provided to the Master should be sourced from an approved stability computer situated on board the vessel or from a shore-based system and should be capable of providing information at any time.

2 The output format and units of the information supplied should be consistent with the format and units of the stability booklet in order to facilitate easy comparison.

3 Accuracy of programs using hull form with its subdivision models as their basis for stability calculations should have tolerances in accordance with the Guidelines for the approval of stability instruments (*MSC.1/Circ.1229*), when compared with the approved stability information; this applies equally to onboard and shore-based systems.

### **1.2 Onboard Stability Computers**

1 At least two independent stability computers capable of processing the data and providing the necessary information should be installed.

2 Onboard stability computers should have an uninterruptible power supply (UPS) connected to both main and emergency switchboards.

3 The output should be within the tolerances specified in the Guidelines for the approval of stability instruments (*MSC.1/Circ.1229*).

4 Details of the loading condition of the ship at each departure should be input to the stability computer in order to encourage familiarity with the operation of the system and to save time on data input in the event of a casualty.

5 At least two crew members should be competent in the operation of the stability computer and capable of interpretation of the output in order to provide the required information.

6 An operation manual should be provided for the stability computer software. The manual should be printed in a language in which the operators are fully conversant.

### **1.3 Shore-based Support**

1 Owners or operators of passenger ships should ensure that their ships have prearranged, prompt access to computerized, shore-based damage stability and residual structural strength calculation programs. The output should be within the tolerances specified in the Guidelines for the approval of stability instruments (*MSC.1/Circ.1229*). Access to the shore-based calculation program should be available 24 hours a day. The computer model of the ship and its subdivision arrangements should be input at the commencement of the contract.

2 There should be a contract for the supply of shore-based support at all times during the validity of ship certification.

3 Shore-based support should be operational within one hour; whereby operational means the ability to input details of the conditions of the ship as instructed.

4 Shore-based support should be manned by adequately qualified persons with regard to stability and ship strength; no less than two qualified persons should be available to be on call at all times.

5 At least two independent computers capable of carrying out stability and global strength calculations should be available at all times.

6 The ship should be fitted with sufficiently reliable equipment to allow for communication with the supplier of shore-based support for all intended areas of operation.

## 1.4 Minimum Stability and Additional Information Requirements

1 Taking into account the most recent known loading and flooded condition of the ship and taking into account any measures that may be proposed to improve or affect the survivability of the ship, the following information should be provided:

- (1)  $GM$  transverse in any loading condition;
- (2)  $GZ$  and range;
- (3) area under the  $GZ$  curve;
- (4) maximum and actual values of free surface moments of all tanks and spaces below the bulkhead deck;
- (5) location of flooding level indicators within tanks;
- (6) draughts forward, midships and aft;
- (7) angles of heel and trim;
- (8) the effect of flooding and heel and trim angles on:
  - (a) operation of essential equipment;
  - (b) escape routes and evacuation times; and
  - (c) effective deployment of life saving appliances;
- (9) profile areas of the ship both above and below the waterline, and means to establish their centres, in order to estimate the effects of wind pressure;
- (10) currently applied global bending moment and sheer force;
- (11) fuel consumption data accounting for estimates of increased resistance due to flooding; and
- (12) ship specific particulars relating to the Guidelines for damage control plans and information to the master (*MSC.1/Circ.1245*).

## **Annex 4-3      REVISED GUIDELINES ON OPERATIONAL INFORMATION FOR MASTERS OF PASSENGER SHIPS FOR SAFE RETURN TO PORT (MSC.1/Circ.1532/Rev.1)**

### **1.1      General**

1 When an onboard stability computer is provided in accordance with **Regulation 8-1.3.1.1, Chapter II-1 of SOLAS**, the system referred to in these Guidelines should comprise an onboard stability computer capable of receiving and processing manual and electronic data to provide the master with regularly updated operational information on the residual damage stability of the ship after a flooding casualty. Two-way communication links to shore-based support should also be available to provide the master with post-damage residual structural strength information.

2 When shore-based support is provided in accordance with **Regulation 8-1.3.1.2, Chapter II-1 of SOLAS**, the system referred to in these Guidelines should comprise two-way communication links to the shore-based support with a stability computer capable of receiving and processing manual and electronic data to provide the master with regularly updated operational information on the residual damage stability of the ship after a flooding casualty. In addition, the shore-based support should also have the capability to provide the master with post-damage residual structural strength information.

3 The stability computers should utilize software with the following capabilities:

Using the pre-damage loading condition, software calculating the residual damage stability following any flooding casualty by processing data from both manual entry and from sensor readings to compute operational information required by the master using an accurate and detailed computer model of the entire hull, including superstructures and appendages, all internal compartments and tanks, etc. together with up-flooding/down-flooding points, cross-flooding arrangements, escape routes, ship profile and watertight door status (i.e. open or closed).

### **1.2      System Overview**

1 At least two independent stability computers should be available at all times (either two onboard, or two through shore-based support, or one each), which are capable of receiving and processing the data necessary to provide operational information to the master.

2 The onboard system should have an uninterruptible power supply (*UPS*) connected to both main and emergency switchboards.

### **1.3      Input**

1 The system should be pre-loaded with a detailed computer model of the complete hull, including appendages, all compartments, tanks and the relevant parts of the superstructure considered in the damage stability calculation; wind profile; down-flooding and up-flooding openings; cross-flooding arrangements; internal compartment connections; and escape routes. Each internal space should be assigned its standard **Regulation 7-3, Chapter II-1 of SOLAS** permeability, unless a more accurate permeability has been calculated.

2 The system should utilize the latest approved lightship weight and centre of gravity information.

3 Details of the damage location(s) and extent(s) or the damaged compartments should be input manually by the ship's staff and combined with data from electronic sensors such as draught gauges, tank level devices, watertight door indicators and flooding level sensors.

4 If it is considered at any time that a sensor or sensors are faulty, or have been damaged, the ship's staff should be able to override the sensor data with manual data. The system should clearly indicate to the operator if a sensor that should be available is being manually overridden.

5 The system should always be updated to the current loading condition which will form the basis of any damage stability calculation.

## 1.4 Calculation Methods

- 1 The system should utilize software (see **1.1-3, Annex 4-3 of the Guidance**) capable of analysing the damage stability following any real flooding casualty including multi-compartment, non-linked breaches.
- 2 The system should use the actual pre-damage loading state obtained from the routine operations mode.
- 3 The system should be capable of accounting for applied moments such as wind, lifeboat launching, cargo shifts and passenger relocation.
- 4 The system should account for the effect of wind by using the method in **Regulation 7-2.4.1.2, Chapter II-1 of SOLAS** as the default, but allow for manual input of the wind speed/pressure if the on-scene pressure is significantly different ( $P = 120 \text{ N/m}^2$  equates to Beaufort 6; approximately  $13.8 \text{ m/s}$  or  $27 \text{ knots}$ ).
- 5 The system should be capable of assessing the impact of open main watertight doors on stability.
- 6 The system should have the capability of using the same detailed hull model for damage control drills or to assess potential damage and stability scenarios during a flooding casualty. This should not interfere with the ability of the onboard computer or shore-based support to monitor the actual situation and provide operational information to the master.

## 1.5 Output

- 1 The system should output the residual  $GZ$  curve both graphically and numerically. It should also provide the following information: draught (forward, midships and aft), trim, heel angle,  $GZ$  max,  $GZ$  range, angle of vanishing stability, down-flooding immersion angles and escape route immersion angles.
- 2 The output format and units of the information supplied by the ship's staff or shore-based support team should be consistent with the format and units of the approved stability booklet in order to facilitate easy comparison. The output should be within the tolerances specified in the "*Guidelines for the approval of stability instruments*" (MSC.1/Circ.1229).
- 3 The system should show a profile view, deck views and cross-sections of the ship, indicating the flooded water-plane and the damaged compartments.

## 1.6 Other Issues

- 1 An operation manual should be provided for the system software printed in a language in which the ship's staff are fully conversant. The manual should also indicate the limitations of the system.
- 2 At least two crew members should be competent in the operation of the system including the communication links to the shore-based support. They should be capable of interpreting the output of the system in order to provide the required operational information to the master.
- 3 When shore-based support is provided in accordance with **Regulation 8-1.3.1.2, Chapter II-1 of SOLAS**, there should be a contract for the supply of shore-based support at all times during the validity of the ship's certificate.
- 4 When shore-based support is provided in accordance with **Regulation 8-1.3.1.2, Chapter II-1 of SOLAS**, the shore-based support should be manned by adequately qualified persons with regard to stability and ship strength; no less than two qualified persons should be available to be on call at all times.
- 5 When shore-based support is provided in accordance with **Regulation 8-1.3.1.2, Chapter II-1 of SOLAS**, the shore-based support should be operational within one hour (i.e. with the ability to input details of the condition of the ship, including structural damage, as instructed).

## 1.7 Strength

- 1 The system should have the capability of two-way communication with the shore-based team with an agreed method of specifying and transmitting details of structural loss and/or degradation.
- 2 The strength aspects of the shore-based computer should be at the Society's discretion.

## **1.8 Ro-ro Passenger Ships**

There should be algorithms in the software for estimating the effect of water accumulation on deck (*WOD*).

## **1.9 Approval and Testing**

The stability aspects of the system should be initially approved and periodically checked against validated test conditions based on a number of loading/damage scenarios from the approved stability information book to ensure that it is operating correctly and that the stored data has not been subject to unauthorized alteration.

## **1.10 Limitations of the System**

**1** The system is not intended to compute transient asymmetrical flooding whereby the ship could capsize under the immediate inrush of floodwater before there is time for equalization measures to take effect.

**2** The system is not intended to make any allowance for the motion of the ship in a seaway, including the effects of tide, current or wave action.

## **1.11 Equivalence**

Equivalent arrangements for the provision of operational information to the master following a flooding casualty may be employed to the satisfaction of the Administration.

## Annex 7-1 INTERPRETATION OF PROVISION OF CHAPTER II-2, SOLAS CONVENTION ON PASSENGER SHIPS

### 1 INTERPRETATION OF PROVISION OF CHAPTER II-2, SOLAS CONVENTION

#### 1.1 Interpretation

Interpretation of provision of Chapter II-2, SOLAS Convention (Amendments of Res. MSC.99(73) ) on passenger ships are to be in accordance with **Table 7-1-A1**. Figures and tables referred to in provision and interpretation of provision are to comply with **1.2** respectively.

Table 7-1-A1 Interpretation of SOLAS II-2

Number	SOLAS	Interpretation
3.1	Accommodation spaces are those spaces used for public spaces, corridors, lavatories, cabins, offices, hospitals, cinemas, games and hobbies rooms, barber shops, <i>pantries containing no cooking appliances</i> * <sup>1</sup> and <i>similar spaces</i> * <sup>2</sup> .	<p>*1:The following devices (1) and (2) may be provided in “pantries containing no cooking appliances” However, a dining room containing such appliances are not to be regarded as a pantry.</p> <p>(1) Toasters, microwave ovens, induction heaters and similar appliances each of them with a maximum power of 5 kW. However, coffee machines, dish washers and water boilers with no exposed hot surfaces may be provided in these pantries regardless of their power; and</p> <p>(2) Electrically heated cooking plates and hot plates for keeping food warm each of them with a maximum power of 2 kW and a surface temperature not above 150°C.</p> <p>*2: Examples of “similar spaces” are passenger spaces, crew spaces, beauty parlors, pharmacies, baths, water closets, showers, consultation rooms, operating rooms, gymnasium and nursery.</p>
3.2	<p>“A” class divisions are those divisions formed by bulkheads and decks which comply with the following criteria:</p> <p>.1 they are constructed of steel or other equivalent material;</p> <p>.2 they are <i>suitably stiffened</i>*;</p> <p>.3 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:</p>	<p>*: The wording “suitably stiffened” means reinforcement in order to have the strength of which the partition is sufficient in proportion to the load of the use position adequately.</p> <p>*: Bulkheads or deck which is constructed by the steel plate of 4.5mm and over adequately reinforced may be recognized as “A class division” (A-0).</p>



	<p>class “A-60” 60 min</p> <p>class “A-30” 30 min</p> <p>class “A-15” 15 min</p> <p>class “A-0” 0 min</p> <p>.4 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; and</p> <p>.5 the Administration has required a test of a prototype bulkhead or deck in accordance with the Fire Test Procedures Code to ensure that it meets the above requirements for integrity and temperature rise.</p>	
3.4	<p>“B” class divisions are <i>those divisions formed by bulkheads, decks, ceiling or linings which comply with the following criteria</i>*1:</p> <p>.1 they are constructed of approved non-combustible materials and all materials used in the construction and <i>erection</i>*2 of “B” class divisions are non-combustible, with the exception that combustible veneers may be permitted provided they meet other appropriate requirements of this chapter;</p> <p>.2 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:</p> <p>class “B-15” 15 min</p> <p>class “B-0” 0 min</p> <p>.3 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; and</p> <p>.4 the Administration has required a test of a prototype division, in accordance with the Fire Test Procedures Code, to ensure that it meets the above requirements for integrity and temperature rise.</p>	<p>*1: A division constructed of non-combustible core materials but coated with combustible veneers may be accepted as a “B” class division provided that the following conditions are satisfied:</p> <ol style="list-style-type: none"> <li>(1) the non-combustible core is tested in accordance with Part 1, Annex 1 of the FTP Code;</li> <li>(2) the “B” class division is tested in accordance with Part 3, Annex 1 of the FTP Code; and</li> <li>(3) the veneers are tested in accordance with Part 2 (if applicable) and Part 5, Annex 1 of the FTP Code.</li> </ol> <p>*2: Materials of joint entering into the construction of B class division are also to be non-combustible materials.</p>
3.9	<p>Central control station is a control station in which the following control and indicator functions are centralized:</p> <p>.1 fixed fire detection and fire alarm systems;</p> <p>.2 automatic sprinklers, fire detection and fire alarm systems;</p> <p>.3 fire door indicator panels;</p> <p>.4 fire door closure;</p> <p>.5 watertight door indicator panels;</p> <p>.6 watertight door closures;</p> <p>.7 ventilation fans;</p> <p>.8 general/fire alarms;</p> <p>.9 <i>communication systems including telephones</i>*;</p>	<p>*: The communication systems here mean only internal</p>

	and .10 microphones to public address systems.	communication systems which are required by the regulations.
3.10	“C” class divisions are <i>divisions constructed of approved non-combustible materials</i> <sup>*1*2</sup> . They need meet neither requirements relative to the passage of smoke and flame nor limitations relative to the temperature rise. <i>Combustible veneers</i> <sup>*3</sup> are permitted provided they meet the requirements of this chapter.	<p>*1: Materials of panels and joints entering into construction of C class divisions are to be non-combustible. However, where sprinklers are provided on the both sides of C class divisions or bulkheads, combustible materials may be permitted for construction.</p> <p>*2: A division constructed of non-combustible core material but coated with combustible veneers may be accepted as a C class division provided the following conditions are satisfied:</p> <ul style="list-style-type: none"> <li>(1) the non-combustible core material are tested in accordance with Part 1, Annex 1 of the FTP Code; and</li> <li>(2) the veneers are tested in accordance with Part 2 (if applicable) and Part 5, Annex 1 of the FTP Code.</li> </ul> <p>*3: They are to have low flame-spread characteristics.</p>
3.18	Control stations are those spaces in which the ship's radio or <i>main navigating equipment</i> <sup>*1</sup> or <i>the emergency source of power is located</i> <sup>*2</sup> or where <i>the fire recording or fire control equipment is centralized</i> <sup>*3</sup> . Spaces where the fire recording or fire control equipment is centralized are also considered to be a fire control station.	<p>*1: The wording “main navigating equipment” means the steering stand and the compass and radar equipment.</p> <p>*2: Steering gear rooms containing an emergency steering position are not considered to be control stations.</p> <p>*2: Spaces containing, for instance, the following battery sources may be regarded as control stations regardless of the battery capacity:</p> <ul style="list-style-type: none"> <li>(1) emergency batteries in separate battery room for power supply from black-out till start of the emergency generator;</li> <li>(2) emergency batteries in separate battery room as reserve source of energy to radiotelegraph installation;</li> <li>(3) batteries for start of the emergency generator; and</li> <li>(4) in general, all emergency batteries required in pursuance of regulation II-1/42 or regulation II-1/43.</li> </ul> <p>*3: Where in the regulations of chapter II-2 relevant to fixed fire-extinguishing systems there are no specific requirements for the centralization 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.</p>
3.28	Lightweight is the displacement of a ship in tonnes without cargo, fuel, lubricating oil, ballast water, fresh water and feed water in tanks, consumable stores, and passengers and crew and their effects.	The weight of mediums on board for the fixed firefighting systems (e.g. freshwater, CO <sub>2</sub> , dry chemical powder, foam concentrate, etc.) is to be included in the lightweight.
3.30	Machinery spaces are machinery spaces of category A and other spaces containing propulsion machinery, boilers, oil fuel units, steam and internal combustion engines, generators and <i>major electrical machinery</i> <sup>*1</sup> , oil filling stations, refrigerating, stabilizing, ventilation and air conditioning machinery, and <i>similar spaces</i> <sup>*2</sup> , and trunks to such spaces.	<p>*1: The wording “major electrical machinery” means generator, switchboard, transformer and electric motor which are directly relative to propulsion, drainage, firefighting or other safety of the ship.</p> <p>*2: Example of “similar spaces” are windlass room, steering gear room, hydraulic pump room, lift motor and inert gas fan room.</p>
3.31	Machinery spaces of category A are those spaces and	

	trunks to such spaces which contain either: .1 internal combustion machinery used for main propulsion; .2 internal combustion machinery used for purposes other than main propulsion where such machinery has in the aggregate <b>a total power output*</b> of not less than 375kW; or .3 any oil-fired boiler or oil fuel unit, or any oil-fired equipment other than boilers, such as inert gas generators, incinerators, etc.	*: The wording “total power output” means the total aggregate of the maximum continuous power output of each internal combustion machinery.
3.32	Main vertical zones are those sections into which the hull, superstructure, and deckhouses are divided by “A” class divisions, <b>the mean length and width of which on any deck does not in general exceed 40m*</b> .	*: Refer to interpretations of regulation <b>9.2.2.1.1</b> and <b>9.2.2.1.2</b> . *: The “mean length” means average length obtained from the area on the deck. (See <b>Fig. 7-1-A1</b> ).
3.33	<b>Non-combustible material*</b> is a 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 Fire Test Procedures Code.	*: The following materials are considered being non-combustible: (1) glass; (2) concrete; (3) ceramic products; (4) natural stone; (5) masonry units; and (6) common metals and metal alloys (except magnesium and magnesium alloys).
3.34	<b>Oil fuel unit*</b> is the equipment used for the preparation of oil fuel for delivery to an oil-fired boiler, or equipment used for the preparation for delivery of heated oil to an internal combustion engine, and includes any oil pressure pumps, filters and heaters dealing with oil at a pressure of more than 0.18N/mm <sup>2</sup> .	*: “Oil fuel unit” includes any equipment used for the preparation and delivery of oil fuel, heated or not, to boilers (including inert gas generators) and engines (including gas turbines) at a pressure of more than 0.18N/mm <sup>2</sup> . Oil fuel transfer pumps are not considered as oil fuel units.
3.39	<b>Public spaces*</b> <sup>1</sup> are those portions of the accommodation which are used for halls, dining rooms, lounges and <b>similar permanently enclosed spaces*</b> <sup>2</sup> .	*1: Public spaces are rooms for large number of passengers to utilize to some extent time and to escape safely in short time, and are not to include barber shops and beauty parlors. Two means of escape are to be provided at living spaces over 8 persons for sleeping in the crew spaces and passenger spaces like public spaces. *2: Examples of “similar permanently enclosed spaces” are smoking rooms, bars, tea rooms and sales shops.
3.40	Rooms containing furniture and furnishings of <b>restricted fire risk*</b> <sup>1</sup> , for the purpose of regulation <b>9</b> , are those rooms containing furniture and furnishings of restricted fire risk (whether cabins, public spaces, offices or other types of accommodation) in which: .1 case furniture such as desks, wardrobes, dressing tables, bureaux, dressers, are constructed entirely of approved non-combustible materials, except that <b>a combustible veneer*</b> <sup>2</sup> not exceeding 2 mm may be used on the working surface of such articles; .2 <b>free-standing furniture*</b> <sup>3</sup> such as chairs, sofas,	*1: The fixed furniture (furniture installed in the condition that the circumference is not fixed on the wall in the room) are to be in accordance with requirements of case furniture specified in regulation <b>3.40.1</b> and are to be constructed of only non-combustible material. However, fabric on the surface, leather, equivalent materials to leather (including synthetic leather) and padding are to pass “Test for upholstered furniture” carried out in accordance with the <b>FTP code</b> or to be “fire retardant veneers” specified in <b>R5.3.2-2, Part R of the Guidance for the Survey and Construction of Steel Ships</b> .

	<p>tables, are constructed with frames of non-combustible materials;</p> <p>.3 <i>draperies, curtains and other suspended textile materials</i><sup>*4</sup> have qualities of resistance to the propagation of flame not inferior to those of wool having a mass of <math>0.8\text{kg/m}^2</math>; this being determined in accordance with the Fire Test Procedures Code.</p> <p>.4 <i>floor coverings have low flame-spread characteristics</i><sup>*5</sup>;</p> <p>.5 <i>exposed surfaces of bulkheads, linings and ceilings</i><sup>*6</sup> have low flame-spread characteristics;</p> <p>.6 <i>upholstered furniture</i><sup>*7</sup> has qualities of resistance to the ignition and propagation of flame, this being determined in accordance with the Fire Test Procedures Code; and</p> <p>.7 <i>bedding components</i><sup>*8</sup> have qualities of resistance to the ignition and propagation of flame, this being determined in accordance with the Fire Test Procedures Code.</p>	<p>*2: A combustible veneer used on these furniture are not considered exposed surface specified in regulation <b>5.3.2.4.1</b> and <b>6.2</b>.</p> <p>*3: The wording “free-standing furniture” means the furniture installed in the condition that the circumference is not fixed on the wall in the room. (However, the fastening to the floor is not asked.)</p> <p>*4: The draperies, curtains and other suspended textile materials are to pass “Test for vertically supported textiles and films” carried out in accordance with the <b>FTP code</b>. In applying paragraphs <b>3.1.1</b> and <b>3.1.2</b> of Part 7 of Annex 1 and paragraph <b>6.2.2</b> of Appendix 1 to Part 7 of Annex 1 to the <b>FTP Code</b>, the performance criteria for curtains, draperies of free-hanging product, as described in paragraphs <b>3.1.1</b> and <b>3.1.2</b> of Part 7 of Annex 1, are also applicable with an edge application of the pilot flame.</p> <p>*5: Floor coverings are to pass “Test for surface flammability” carried out in accordance with the <b>FTP code</b>. The rooms using tatami mat are not categories the rooms containing furniture and furnishings of restricted fire risk.</p> <p>*6: Exposed surface of bulkheads, linings and ceilings are to be “fire retardant veneers” specified in <b>R5.3.2-2, Part R of the Guidance for the Survey and Construction of Steel Ships</b>.</p> <p>*7: Whether fixed or not fixed furniture, fabric and padding (including upholster and padding such as back and seat of chair and sofa) are to pass “Test for upholstered furniture” carried out in accordance with the <b>FTP code</b>.</p> <p>*8: The bedding such as futon, mattress, blanket, bed sheet and pillow are to pass “Test for bedding components” carried out in accordance with the <b>FTP code</b>.</p>
3.41	<p>Ro-ro spaces are spaces not normally <i>subdivided</i><sup>*1</sup> in any way and normally extending to either a <i>substantial length</i><sup>*2</sup> 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 or on rail or road cars, vehicles (including road or rail tankers), 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.</p>	<p>*1: The wording “subdivided” means to divide by gastight bulkhead (including the bulkhead having openings to keep closed at sea).</p> <p>*2: The wording “substantial length of the ship” means the length at spaces to be loaded with cargoes (spaces between decks or spaces on open deck not included spaces other than spaces to be loaded with cargoes between from the fore end to the aft end) from the fore bulkhead to the aft bulkhead or the length which is very approximate to the its length.</p>
3.43	<p>Steel or other equivalent material means any non-combustible material which, by itself or due to insulation provided, has <i>structural and integrity properties equivalent to steel</i><sup>*</sup> at the end of the applicable exposure to the standard fire test (e.g. aluminium alloy with appropriate insulation).</p>	<p>*: The wording “structural and integrity properties equivalent to steel” means the following:</p> <p>(1) The wording “structural properties” means properties such as mechanical strength, deflection, elongation, etc. and the materials which are not inferior to steel for these properties after standard fire test are considered as equivalent material to steel. For</p>

		<p>example, the use of the aluminum alloy that adequately insulated may be permitted partly, limited use position.</p> <p>(2) The wording “integrity properties” means properties which stop the passage of frame and smoke (for “B” class division, frame only).</p>
3.45	<p>Service spaces are those spaces used for galleys, <b>pantries containing cooking appliances</b><sup>*1</sup>, lockers, mail and specie rooms, storerooms, workshops other than those forming part of the machinery spaces, and <b>similar spaces</b><sup>*2</sup> and trunks to such spaces.</p>	<p>*1: The following devices <b>(1)</b> and <b>(2)</b> may be provided in “pantries containing cooking appliances”. However, spaces containing any electrically heated cooking plate or hot plates for keeping food warm with a power of more than <i>5kW</i> are to be regarded as galleys.</p> <p>(1) Toasters, microwave ovens, induction heaters and similar appliances each of them with a power of more than <i>5kW</i>. However, coffee machines, dish washers and water boilers may be provided in these pantries regardless of their power; and</p> <p>(2) electrically heated cooking plates and hot plates for keeping food warm each of them with a maximum power of <i>5kW</i>.</p> <p>*2: Examples of “similar spaces” are motion picture projection and film stowage rooms, laundry rooms, baggage rooms, food stores, refrigeration compartments, paint rooms, lamp rooms, warehouse, garbage rooms, tool housing places, drying rooms and workshops.</p>
4.2.1	<p>The following limitations shall apply to the use of oil as fuel:</p> <p>.1 except as otherwise permitted by this paragraph, no oil fuel with a flashpoint of less than 60°C shall be used;</p> <p>.2 in emergency generators oil fuel with a flashpoint of not less than 43°C may be used;</p> <p><b>.3 the use of oil fuel having a flashpoint of less than 60 °C but not less than 43 °C<sup>*1</sup></b> may be permitted (e.g., for feeding the emergency fire pump’s engines and the auxiliary machines which are not located in the machinery spaces of category <i>A</i>) subject to the following:</p> <p>.3.1 fuel oil tanks except those arranged in double bottom compartments shall be located outside of machinery spaces of category <i>A</i>;</p> <p>.3.2 provisions for the measurement of oil temperature are provided on the suction pipe of the oil fuel pump;</p> <p>.3.3 stop valves and/or cocks are provided on the inlet side and outlet side of the oil fuel strainers; and</p> <p>.3.4 pipe joints of welded construction or of circular cone type or spherical type union joint are</p>	<p>*1: Oil fuel pipings to use for having a flashpoint of less than 60°C but not less than 43°C are to be in accordance with above requirements and requirements in <b>4.2.1</b> and <b>4.2.2, Part R of the Rules for the Survey and Construction of Steel Ships</b> and <b>R4.2.1, Part R of the Guidance for the Survey and Construction of Steel Ships</b>.</p> <p>*2: For use of fuel oil having a flashpoint of 43°C or less and crude oil or slop for tanker boilers, machineries and piping systems for such oils are to comply with the followings. Reference is also made to IACS UR M24 “Requirements concerning use of crude oil or slops as fuel</p>

	<p>applied as much as possible; and</p> <p>.4 in cargo ships the use of <b><i>fuel having a lower flashpoint than otherwise specified in paragraph 2.1*2</i></b>, for example crude oil, may be permitted provided that such fuel is not stored in any machinery space and subject to the approval by the Administration of the complete installation.</p>	<p>for tanker boilers”.</p> <ol style="list-style-type: none"> <li>(1) Provisions for the measurement of oil temperature are to be provided on the suction pipe of oil fuel pump.</li> <li>(2) Stop valves and/or cocks are to be provided to the inlet side and outlet side of the oil fuel strainers.</li> <li>(3) Pipe joints of welded construction or of circular cone type or spherical type union joint are to be applied as much as possible.</li> </ol>
4.2.2.3.2	<p><b><i>As far as practicable, oil fuel tanks shall be part of the ships structure*</i></b> and shall be located outside machinery spaces of category <i>A</i>. Where oil fuel tanks, other than double bottom tanks, are necessarily located adjacent to or within machinery spaces of category <i>A</i>, at least one of their vertical sides shall be contiguous to the machinery space boundaries, and shall preferably have a common boundary with the double bottom tanks, and the area of the tank boundary common with the machinery spaces shall be kept to a minimum. Where such tanks are situated within the boundaries of machinery spaces of category <i>A</i> they shall not contain oil fuel having a flashpoint of less than 60°C. In general, the use of free-standing oil fuel tanks shall be avoided. When such tanks are employed their use shall be prohibited in category <i>A</i> machinery spaces on passenger ships. Where permitted, they shall be placed in an oil-tight spill tray of ample size having a suitable drain pipe leading to a suitably sized spill oil tank.</p>	<p>*: The one shown in <b>Fig. R4.2.2-1, Part R of the Guidance for the Survey and Construction of Steel Ships</b> is to be referred to as the standard arrangement of oil fuel tanks in machinery spaces of category <i>A</i> to meet the regulation <b>4.2.2.3.2</b>.</p>
4.2.2.3.4	<p>Oil fuel pipe, which, if damaged, would allow oil to escape from a storage, settling or daily service tank having a capacity of 500l and above situated above the double bottom, shall <b><i>be fitted with a cock or valve directly on the tank*1</i></b> 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 shall be fitted, but control in the event of fire may be effected 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 shall be operated from a position outside this space. The controls for remote operation of the valve for the emergency generator fuel tank shall be in a <b><i>separate location*2</i></b> from the controls for remote operation of other valves for tanks located in machinery spaces.</p>	<p>*1: Refer to <b>R4.2.2-8, Part R of the Guidance for the Survey and Construction of Steel Ships</b>.</p> <p>*2: The wording “separate location” does not mean separate spaces.</p>
4.2.2.3.5	<p><b><i>Safe and efficient means*1</i></b> of ascertaining the amount</p>	<p>*1: Refer to <b>R4.2.2-9 and -10, Part R of the Guidance for</b></p>

	<p>of oil fuel contained in any oil fuel tank shall be provided.</p> <p>.1 Where sounding pipes are used, they shall not terminate <i>in any space where the risk of ignition of spillage from the sounding pipe might arise</i><sup>*2</sup>. In particular, they shall not terminate in passenger or crew spaces. As a general rule, they shall not terminate in machinery spaces. However, where the 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:</p> <ul style="list-style-type: none"> <li>.1 an oil-level gauge is provided meeting the requirements of subparagraph <b>2.2.3.5.2</b>;</li> <li>.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; and</li> <li>.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. Provision shall be made so as to ensure that any spillage of oil fuel through the control cock involves no ignition hazard.</li> </ul> <p>.2 Other oil-level gauges may be used in place of sounding pipes subject to the following conditions:</p> <ul style="list-style-type: none"> <li>.1 in passenger ships, such gauges shall not require penetration below the top of the tank and their failure or overfilling of the tanks shall not permit release of fuel; and</li> <li>.2 in cargo ships, the failure of such gauges or overfilling of the tank shall not permit release of fuel into the space. The use of cylindrical gauge glasses is prohibited. The Administration may permit the use of oil-level gauges with flat glasses and self-closing valves between the gauges and fuel tanks.</li> </ul> <p>.3 The means prescribed in subparagraph <b>2.2.3.5.2</b> <i>which are acceptable to the Administration</i><sup>*3</sup> shall be maintained in the proper condition to ensure their continued accurate functioning in service.</p>	<p><b>the Survey and Construction of Steel Ships.</b></p> <p>*2: The upper ends of sounding pipes to tanks for fuel oil, lubricating oil and other flammable oils are not to terminate in accommodation spaces and adjacent to the electrical equipment, boilers and other heated surface.</p>
4.2.2.4	Provision shall be made to prevent overpressure in any	<p>*3: Refer to <b>4.2.2(3)(e)(ii), Part R of the Rules for the Survey and Construction of Steel Ships.</b></p>

	oil tank or in any part of the oil fuel system, including the filling pipes served by pumps on board. <i>Air and overflow pipes and relief valves shall discharge to a position where there is no risk of fire or explosion from the emergence of oils and vapour and shall not lead into crew spaces, passenger spaces nor into special category spaces, closed ro-ro cargo spaces, machinery spaces or similar spaces.*</i>	*: Air pipes from oil fuel tanks or heated lubricating oil tanks are to be led to a safe position on the open deck. They are not to terminate in any place where a risk of ignition is present.
4.2.2.5.1	Oil fuel pipes and their valves and fittings shall be of <i>steel or other approved material*</i> , except that restricted use of flexible pipes shall be permissible in positions where the Administration is satisfied that they are necessary.* 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 Administration. For valves, fitted to oil fuel tanks and which are 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.	*: Refer to <a href="#">12.1.5, Part D of the Rules for the Survey and Construction of Steel Ships</a> , <a href="#">D12.1.5, Part D of the Guidance for the Survey and Construction of Steel Ships</a> and <a href="#">R4.2.2-11, Part R of the Guidance for the Survey and Construction of Steel Ships</a> .
4.2.2.5.6	<i>Where the Administration may permit*</i> the conveying of oil and combustible liquids through accommodation and service spaces, the pipes conveying oil or combustible liquids shall be of a material approved by the Administration having regard to the fire risk.	*: The wording “where the Administration may permit” means a case where the conveying of oil and combustible liquids through accommodation and service spaces is adapted to the provision of <a href="#">Chapter 12, 13 and Chapter 14, Part D of the Rules for the Survey and Construction of Steel Ships</a> .
4.2.2.6.1	Surfaces with temperatures above 220°C which may be impinged as a result of a fuel system failure shall be <i>properly insulated*</i> .	*: Refer to <a href="#">R4.2.2-17, Part R of the Guidance for the Survey and Construction of Steel Ships</a> .
4.2.2.6.2	<i>Precautions*</i> shall be taken to prevent any oil that may escape under pressure from any pump, filter or heater from coming into contact with heated surfaces.	*: Refer to <a href="#">4.2.2(5)(b) and (c), Part R of the Rules for the Survey and Construction of Steel Ships</a> and <a href="#">R4.2.2-14 and -15, Part R of the Guidance for the Survey and Construction of Steel Ships</a> .
4.2.3.1	The arrangements for the storage, distribution and utilization of oil used in pressure lubrication systems shall be such as to ensure the safety of the ship and persons on board. The arrangements made in machinery spaces of category A, and whenever practicable in other machinery spaces, shall at least comply with the provisions of paragraphs <a href="#">2.2.1</a> , <a href="#">2.2.3.3</a> , <a href="#">2.2.3.4</a> , <a href="#">2.2.3.5</a> , <a href="#">2.2.4*</a> , <a href="#">2.2.5.1</a> , <a href="#">2.2.5.3</a> , and <a href="#">2.2.6</a> except that:  .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; and	*: Air pipes from unheated lubricating oil (including hydraulic oil) tanks may terminate in the machinery space, provided that the open ends are so situated that issuing oil cannot come into contact with electrical equipment or heated surfaces.



	.2 sounding pipes may be authorized in machinery spaces; however, the requirements of paragraphs <b>2.2.3.5.1.1</b> and <b>2.2.3.5.1.3</b> need not be applied on condition that the sounding pipes are fitted with appropriate means of closure.	
4.2.4	The arrangements for the storage, distribution and utilization of other flammable oils employed under pressure in power transmission systems, control and activating systems and heating systems shall be such as to ensure the safety of the ship and persons on board. <b><i>Suitable oil collecting arrangements for leaks shall be fitted below hydraulic valves and cylinders.*</i></b> In locations where means of ignition are present, such arrangements shall at least comply with the provisions of paragraphs <b>2.2.3.3</b> , <b>2.2.3.5</b> , <b>2.2.5.3</b> and <b>2.2.6</b> and with the provisions of paragraphs <b>2.2.4</b> and <b>2.2.5.1</b> in respect of strength and construction.	*: The second sentence of regulation <b>4.2.4</b> is not applicable to hydraulic valves and cylinders located on weather decks, in tanks, cofferdams or void spaces.
4.3	Gaseous fuel systems used for domestic purposes shall be approved by the 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.	A portion of open deck, recessed into a deck structure, machinery casing, deck house, etc., utilized for the exclusive storage of gas bottles is considered acceptable for the purpose of reg. <b>II-2/4.3</b> provided that: (1) such a recess has an unobstructed opening, except for small appurtenant structures, such as opening corner radii, small sills, pillars, etc. The opening may be provided with grating walls and door; (2) the depth of such a recess is not greater than 1m. A portion of open deck meeting the above shall be considered as open deck in applying <b>Tables 9.1</b> to <b>9.8</b> of <b>SOLAS</b> Chapter II-2. For gas welding equipments, refer to <b>4.3.2, Part R of the Rules for the Survey and Construction of Steel Ships</b> .
4.4.1	<b><i>Electric radiators*</i></b> , 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.	*: Where a heater, range and cooking stove is installed, these are fixed and the parts having the fear of the combustion at installed table and floor are to be of non-combustibles. In the case of heater, the non-combustibles are to be 0.3m or more away from the side and the upper end of heater, and the flammables are to be 0.6m or more away from the side of it and 0.9m or more away from the upper end of it. In the case of range and cooking stove, the flammables are to be 0.3m or more from the side of those and 0.9m or more from the upper end of those.
4.4.2	Waste receptacles shall be constructed of non-combustible materials with no openings in the sides or bottom.	This regulation is not intend to preclude the use of containers constructed of combustible materials in galleys, pantries, bars, garbage handling or storage spaces and incinerator rooms provided they are intended purely for the carriage of wet waste, glass bottles and metal cans and are suitably marked.
4.4.3	<b><i>In spaces where penetration of oil products is</i></b>	*1: The wording “spaces where permeation of oil products is

	<i>possible</i> <sup>*1</sup> , <i>the surface of insulation</i> <sup>*2</sup> shall be impervious to oil or oil vapours.	possible” means the spaces located in the vicinity of all types of equipment (purifiers, pumps and tanks) and pipe fittings (valves, flanges, strainers, flowmeters, etc.) handling oils (fuel oil, lubricating oil, hydraulic oil and thermal oil) with possible involvement of oils or oil vapours leaked or splashed during operation or in maintenance work to reach out thermal insulation. However, the requirements of thermal insulation of pipes in machinery spaces do not apply.  *2: The fire insulation in such spaces is to be covered by metal sheets (not perforated) or by vapour proof glass cloth accurately sealed at the joint.
4.4.4	<b>Primary deck coverings</b> *, if applied within accommodation and service spaces and control stations, or if applied on cabin balconies of passenger ships constructed on or after 1 July 2008, shall be of approved material which will not readily ignite, this being determined in accordance with the Fire Test Procedures Code.	*: The wording “primary deck coverings” means the first layer of a floor construction which is applied directly on the top of deck plating and is inclusive of any primary coat, anti-corrosive compound or adhesive which is necessary to provide protection or adhesion to the deck plating. In this case, “the first layer” means the materials forming deck covering excluding “A” class deck (including insulation materials), non-combustible materials and “fire retardant surface flooring.”
5.2.1.1	The <b>main inlets and outlets</b> <sup>*1</sup> of all ventilation systems shall <i>be capable of being closed</i> <sup>*2</sup> from <i>outside the spaces being ventilated</i> <sup>*3</sup> . 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.	*1: The wording “main inlets and outlets” means inlets and outlets to be capable of stop supplying air to each ventilation system in the event of fire.  *2: The damper is considered as being capable of being closed.  Main inlet or outlet is the part shown by solid line in <b>Fig. 7-1-A2</b> .  Fire damper in accommodation room is not considered as opening and closing devices of main inlets and outlets as A/C UNIT in figure is used for Dk 1.  Closing devices are to be provided between the line of Dk2 and line of Dk5 or in inlet or outlet at Dk5.  *3: The wording “outside the spaces being ventilated” means easily accessible spaces. Therefore, closing devices required to be fitted with ventilation systems are provided in weather part or outside main vertical zone or horizontal zone. However, where this is not practicable, closing devices are to be arranged so that the closing devices are accessible easily in the event of fire in spaces ventilated by the ventilation systems. Therefore, the closing devices are not to be provided on the same deck as spaces being ventilated. Control stations of closing devices are to be identified conspicuously and permanently in the position to be accessible easily and are to be provided with indicator.  *3: The closing appliances for the ventilation of battery rooms are to be in accordance with <b>R5.2.1, Part R of the Guidance for the Survey and Construction of Steel Ships</b> .
5.2.1.2	<b>Power ventilation of accommodation spaces, service</b>	*: Exhaust ventilation of accommodation spaces, service

	<p><i>spaces, cargo spaces, control stations and machinery spaces*</i> shall be capable of being stopped from an easily accessible position outside the space being served. This position should not be readily cut off in the event of a fire in the spaces served.</p>	<p>spaces and control stations are, in principle, to be effected through the exhaust ventilation ducts except where ventilation openings are accepted under Regulation <b>9.4.1.1</b> and <b>9.4.1.2</b>. The dampers of the balancing ducts are not accepted.</p> <p>*: The fan in a HVAC temperature control unit, or a circulation fan inside a cabinet/switchboard, is not considered to be a ventilation fan as addressed in Reg.<b>II-2/5.2.1.2</b>, if it is not capable of supplying outside air to the space (e.g., small units intended for re-circulation of air within a cabin). Therefore, such fans need not be capable of being stopped from an easily accessible position outside the space being served when applying Reg.<b>II-2/5.2.1.2</b>.</p>
5.2.1.3	<p>In passenger ships carrying more than 36 passengers, power ventilation, except machinery space and cargo space ventilation and any alternative system which may be required under regulation <b>8.2</b>, shall be fitted with <i>controls</i><sup>*1</sup> so grouped that all <i>fans</i><sup>*2</sup> 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 <i>outside such spaces</i><sup>*3</sup>.</p>	<p>*1: The places in which “controls” are installed are to satisfy the following requirements, and reference is also to be made to the interpretations of regulation <b>II-2/5.2.2</b>;</p> <ul style="list-style-type: none"> <li>(1) two controls which are fixed independently; and</li> <li>(2) safety corridors to there from open deck are to be placed.</li> </ul> <p>*2: The fan in a HVAC temperature control unit, or a circulation fan inside a cabinet/switchboard, is not considered to be a ventilation fan as addressed in Reg.<b>II-2/5.2.1.3</b>, if it is not capable of supplying outside air to the space (e.g., small units intended for re-circulation of air within a cabin). Therefore, such fans need not be capable of being stopped from a safe position outside the space being served when applying Reg.<b>II-2/5.2.1.3</b>.</p> <p>*3: The spaces of “outside such space” or “outside cargo space” are to satisfy the requirements for passenger ships specified in regulation <b>II-2/5.2.2</b>, that is, controls for stopping fans installed in machinery space and cargo space are to be situated at one control position or grouped in as few position as possible to the satisfaction of the Administration together with the other controls required by regulation <b>II-2/8.3.2</b> and <b>9.5.2.3</b>. This control position is to be safely approachable from open decks.</p>
5.2.2.2	<p>Means of control shall be provided for stopping ventilating fans. Controls provided for the power ventilation serving machinery spaces <i>shall be grouped*</i> 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.</p>	<p>*: The wording “shall also be grouped” means that means of controls required in regulation <b>4.2.2.3.4</b>, <b>5.2.2.2</b>, <b>5.2.2.3</b>, <b>8.3.3</b> and <b>9.5.2.3</b> and means of controls of fire extinguishing arrangements are provided in fire control stations or the similar spaces to fire control stations. Means of controls required in <b>5.2.2.2</b> and <b>8.3.3</b> may be controlled from open deck.</p> <p>** : In principle, apply to machinery spaces except machinery spaces of category <i>A</i>.</p>
5.2.2.3	<p><i>Means of control shall be provided for stopping forced and induced draught fans, oil fuel transfer pumps, oil fuel unit pumps, lubricating oil service</i></p>	<p>*: In principle, apply to machinery spaces except machinery spaces of category <i>A</i>.</p>

	<i>pumps, thermal oil circulating pumps and oil separators (purifiers).</i> * However, paragraphs 2.2.4 and 2.2.5 need not apply to oily water separators.	
5.2.2.4	The controls required in paragraph 2.2.1 to 2.2.3 and in regulation 4.2.2.3.4 shall be located outside the space concerned so <i>they will not be cut off in the event of fire in the space they serve.</i> *	*: In machinery spaces of category A, controls to close off ventilation ducts and pipes are to be installed with due regard to the hot gases produced by a fire in the space concerned. **: In principle, apply to machinery spaces except machinery spaces of category A.
5.2.2.5	In passenger ships, the controls required in paragraphs 2.2.1 to 2.2.4 and in regulations 8.3.3 and 9.5.2.3 and the controls for any required fire-extinguishing system shall be <i>situated at one control position</i> * <sup>1</sup> or grouped in as few positions as possible to the satisfaction of the Administration. Such positions shall have <i>a safe access</i> * <sup>2</sup> from the open deck.	*1: The wording “situated at one control position” means that means of controls required in regulation 4.2.2.3.4, 5.2.2.2, 5.2.2.3, 8.3.3 and 9.5.2.3 and means of controls of fire extinguishing arrangements are provided in fire control stations or the similar spaces to fire control stations. Means of controls required in 5.2.2.2 and 8.3.3 may be controlled from open deck. *2: The entrance not directly exposed to open deck is not required for “a safe access”. **: In principle, apply to machinery spaces except machinery spaces of category A.
5.3	<b>Fire Protection Materials*</b>	*: With respect to materials and components used for bulkheads in accommodation spaces, as defined in regulation 3.1, see Fig. 7-1-A3.
5.3.1.1	Insulating materials shall be non-combustible, except in <i>cargo spaces, mail rooms, baggage rooms and refrigerated compartments of service spaces</i> * <sup>1</sup> . Vapour barriers and adhesives used in conjunction with insulation, as well as insulation of pipe fittings for <i>cold service systems</i> * <sup>2</sup> , 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.	*1: Internal divisions of refrigerated compartments and doors for internal division may not be of non-combustible materials. *1: Linings of mail rooms, baggage rooms or refrigerated compartments, internal divisions of grounds, ceilings and refrigerated compartments or doors used as internal division are to be constructed by fire retardant veneers required by <b>R5.3.2-2, Part R of the Guidance for the Survey and Construction of Steel Ships</b> . However, heat insulating doors within refrigerated compartments may also be the doors which are constructed of FRP with heat insulating materials (the materials need not to be non-combustible materials.). *2: “Cold service” is understood to mean refrigeration systems and chilled water piping for air-conditioning systems.
5.3.1.3.1	<b>Partial bulkheads or decks*</b> used to subdivide a space for utility or artistic treatment shall also be of non-combustible materials.	*: With respect to partial bulkheads, reference is made to the interpretations of regulation <b>II-2/9.2.2.3.2</b> . The floor plating of normal passageways in machinery spaces of category A are to be made of steel.

5.3.2.2	Combustible materials used on the surfaces and linings specified in paragraph 3.2.1 <i>shall have a calorific value not exceeding 45MJ/m<sup>2</sup> of the area for the thickness used.</i> * The requirements of this paragraph are not applicable to the surfaces of furniture fixed to linings or bulkheads.	*: The fire retardant veneers specified in <b>R5.3.2-2, Part R of the Guidance for the Survey and Construction of Steel Ships</b> , whose thickness is not more than 1 mm, are considered to be corresponding this regulation.
5.3.2.3	Where combustible materials are used in accordance with paragraph 3.2.1, they shall comply with the following requirements: .1 The total volume of combustible facings, <b>mouldings, decorations</b> <sup>*1</sup> and veneers in accommodation and service space shall not exceed a volume equivalent to 2.5mm 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; and .2 In the case of ships fitted with an automatic sprinkler system complying with the provisions of the Fire Safety Systems Code, the above volume may <b>include some combustible material used for erection of “C” class divisions.</b> <sup>*2</sup>	*1: The wording “mouldings, decorations” means skirtings, rails and other fittings which are directly installed in walls or ceilings. *2: In ships provided with an automatic sprinkler system, the use of combustible materials is admitted when division of category C is erected (see interpretations of regulation <b>II-2/3.10</b> ). In this case, the treatments of combustible materials are to be in accordance with the follows : (1) Combustible materials, which are used for erection of “C” class divisions, are included in “total volume of combustible facings, mouldings, decorations and veneers” of this rule (regulation <b>II-2/5.3.2</b> ). (2) “The above volume” specified in this provision may consider as “a volume equivalent to 2.5mm veneer” of this rule (regulation <b>II-2/5.3.2</b> ), and it does not generally admit that “combustible material used for erection of “C” class divisions” is included in “the above volume”.
5.3.2.4.1	The following surfaces shall have low flame-spread characteristics in accordance with the Fire Test Procedures Code: In passenger ships: .1 exposed <b>surfaces</b> <sup>*1</sup> in corridors and stairway enclosures and of bulkhead and ceiling linings in accommodation and service spaces (except saunas) and control stations; and .2 <b>surfaces</b> <sup>*1</sup> and grounds in <b>concealed or inaccessible spaces</b> <sup>*2</sup> in accommodation and service spaces and control stations.	*1: The wording “surfaces” of the Rules includes grounds, but it needs not to include exposed surface of floors. *2: The wording “concealed or inaccessible spaces” means the spaces in the rear side of ceilings, spaces between lining and shell plating, spaces in double-plated bulkheads and other similar spaces.
5.3.3	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 Procedures Code, and shall not restrict the passenger escape route. The Administration may permit additional seating in the main reception area within a stairway enclosure if it is fixed, non-combustible and does not restrict the passenger escape route. Furniture shall not be permitted in passenger and crew corridors forming escape routes in cabin areas. In addition to the above, lockers of non-combustible	

	material, providing <i>storage for non-hazardous safety equipment</i> * 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. This applies as well to decorative flower or plant arrangements, statues or other objects of art such as paintings and tapestries in corridors and stairways.	*: Safety equipment which may be hazardous (such as rockets) is not to be accepted to be located in stairway enclosures.
6.2.1	Paints, varnishes and <i>other finishes</i> * <sup>1</sup> used on <i>exposed interior surfaces</i> * <sup>2</sup> <i>shall not be capable of producing excessive quantities of smoke and toxic products</i> * <sup>3</sup> , this being determined in accordance with the Fire Test Procedures Code* <sup>4</sup> .	<p>With respect to materials and components used for bulkheads in accommodation spaces, as defined in regulation 3.1, see <b>Fig. 7-1-A3</b>.</p> <p>*1: The wording “other finishes” means those combustible flooring of deck covering and combustible veneers applied on surfaces of bulkheads, linings and ceilings. However, those surface materials used for handrailing, moulding and non-skid strips of stairs or other surface materials used only for equally small areas of application may not be required to satisfy these requirements.</p> <p>*2: The wording “exposed surfaces” specified in this provision are those of bulkheads, decks, floor coverings, wall linings and ceilings as appropriate. The requirements described within these provisions are not meant to apply to plastic pipes, electric cables, and furniture.</p> <p>*3: Materials of “not be capable of producing excessive quantities of smoke and toxic products” means “fire retardant paints”, “fire retardant veneers” or “fire retardant surface flooring” passed the test of “Smoke and toxicity test” and “Test for surface flammability” carried out in accordance with the <b>FTP Code</b>, or non-combustible materials.</p> <p>*3: Mat, e.g. carpet, rug, etc., may not satisfy this regulation (regulation II-2/6.2). (However, in case where the mat is provided with cabins containing furniture of restricted fire risk, the requirements of regulation II-2/3.40.4 are to be noted.) However, glue is not to use except for the purpose of determining a position and stopping a move. In case where mat covers all of floor, the mat is to be of having flame prevention mark required by “Nippon Bohen Kyokai”, or of equivalent. Tatami mat may be used if the grounds/materials under the floor which constructed by the non-combustible materials are as show in <b>Fig. 7-1-A3</b>.</p> <p>*4: This requirement applies to the surfaces exposed to accommodation spaces, services spaces, control stations and machinery spaces in addition to the surfaces of corridors and stairway enclosures exposed to accommodation spaces, services spaces, control stations and machinery spaces (other than the exposed surfaces specified in 5.3.1-1, <b>Part R of the Rules</b> or the exposed surfaces of finishes used in similarly small spaces).</p>

6.3.1	<b>Primary deck coverings*</b> , 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 Fire Test Procedures Code.	*: Refer to interpretations of regulation 4.4.4.
7.4.1	<p>A fixed fire detection and fire alarm system shall be installed in:</p> <p>.1 periodically unattended machinery spaces;</p> <p>.2 machinery spaces where:</p> <p>.2.1 <i>the installation of automatic and remote control systems and equipment has been approved in lieu of continuous manning of the space</i><sup>*1</sup>; and</p> <p>.2.2 <i>the main propulsion and associated machinery, including the main sources of electrical power, are provided with various degrees of automatic or remote control and are under continuous manned supervision from a control room</i><sup>*2</sup>; and</p> <p>.2.3 enclosed spaces containing incinerators.</p>	<p>*1: The spaces not required to always supervise like inert gas system rooms or wheelhouse etc. may not be included in the “machinery spaces” specified in regulation 7.4.1.2.1.</p> <p>*2: Where control stations are provided in the machinery spaces for the control of the main propulsion machinery and related auxiliaries (including the main sources of power supply), such machinery spaces are to be regarded as machinery spaces specified in regulation 7.4.1.2.2.</p> <p>** : In principle, apply to machinery spaces except machinery spaces of category A.</p>
7.5.2	<p>A fixed fire detection and fire alarm system shall be installed and arranged as to provide smoke 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 and galleys. <b>Spaces having little or no fire risk</b><sup>*1</sup> such as voids, public toilets, carbon dioxide rooms and similar spaces need not be fitted with a <b>fixed fire detection and alarm system</b><sup>*2</sup>. Detectors fitted in cabins, when activated, shall also be capable of emitting, or cause to be emitted, an audible alarm within the space where they are located.</p>	<p>*1: The wording “spaces having little or no fire risk” means ventilating fan rooms, air-conditioning rooms, windlass rooms, steering rooms, thruster rooms, stabilizer rooms, switch-board rooms, rooms provided with electric equipment (except for the equipment provided with the oil-immersed transformer having the capacity which is above 10kVA and machinery rooms for lifts), rooms provided with pumps and refrigerating machine (the operation in the rooms and the use of combustible liquid are not necessary for them), trunks (except for the trunk which is used for electric wire), void spaces, cofferdams, public toilets, public shower rooms (except for the spaces having dressing room) and CO<sub>2</sub> bottle storage rooms.</p> <p>Note: Freezer need to be provided with the both of sprinkler and fire detection.</p> <p>*1: The spaces not required the installation of sprinkler mean the sauna (the sauna which the source of heat is electricity or steam, except the spaces having dressing room), public baths (except the spaces having dressing room), trunks used for electric wire and machinery rooms used for lifts.</p> <p>*2: Detectors which are installed in stairways, in principle, are to be installed in the ceilings of upper layer out of two layer which are connected with stairways. Where, however, the stairways continue up and down within the stairway enclosure, detectors are installed in the inside of enclosure every interval not greater than 11m from the ceiling of upper layer.</p>

		*2: Fixed fire-detecting systems (smoke detectors) are to be installed in the cargo spaces which are usually inaccessible.
7.5.3	<p>There shall be installed throughout each separate zone, whether vertical or horizontal, in all accommodation and service spaces and, <b>where it is considered necessary by the Administration</b>*1, in control stations, except <b>spaces which afford no substantial fire risk</b>*2 such as void spaces, sanitary spaces, etc., <b>either</b>*3:</p> <p>.1 a fixed fire detection and fire alarm system so installed and arranged as to detect the presence of fire in such spaces and providing smoke detection in corridors, stairways and escape routes within accommodation spaces. Detectors fitted in cabins, when activated, shall also be capable of emitting, or cause to be emitted, an audible alarm within the space where they are located; or</p> <p>.2 an automatic sprinkler, fire detection and fire alarm system of an approved type complying with the relevant requirements of the Fire Safety Systems Code and so installed and arranged as to protect such spaces and, in addition, a fixed fire detection and fire alarm system and so installed and arranged as to provide smoke detection in corridors, stairways and escape routes within accommodation spaces.</p>	<p>*1: The control stations which the crews are not always stationed (steering room is generally considered as the space which crews are always stationed) and the cargo spaces which are usually inaccessible (the cargo spaces are to be provided with fire detection) are applicable to the case.</p> <p>*2: “Spaces which afford no substantial fire risk” are to include deckhouses and boatswain’s store which are separated from accommodation spaces (the spaces which are separated from accommodation space by cargo space, special category space or machinery space, or the spaces which main vertical zones are installed in the boundary between accommodation space and which have no direct access from the accommodation space at all). And, “sanitary space” means lavatories, baths, showers, small laundry rooms, etc.</p> <p>*2: Storage rooms for gas bottles of gaseous fuel systems and gas welding equipments where complying with the provisions of <b>R4.3.1-3</b> or <b>R4.3.2-4, Part R of the Guidance for the Survey and Construction of Steel Ships</b>, may be regarded as those on open deck and are to be treated as the exclusion from application of regulation <b>II-2/7.5.3</b>.</p> <p>*3: Where “either system” is installed, either one system is to be installed in one horizontal zone (the horizontal zone defined by interpretation of regulation <b>II-2/9.2.2.3.2</b>) without being mixed regulation <b>II-2/7.5.3.1</b> with regulation <b>II-2/7.5.3.2</b> in principle.</p> <p>*3: The effective automatic sprinkler system and smoke detection system are to be installed in the whole area of the atrium.</p>
7.7	<p><b>Manually operated call points complying with the Fire Safety Systems Code shall be installed throughout the accommodation spaces, service spaces and control stations. One manually operated call point shall be located at each exit</b>*. Manually operated call points shall be readily accessible in the corridors of each deck such that no part of the corridor is more than 20m from a manually operated call point.</p>	<p>*: Refer to <b>R7.5.2, Part R of the Guidance for the Survey and Construction of Steel Ships</b>.</p> <p>*: The “exit” of accommodation spaces, service spaces and control stations is exit to outside on the each deck and exit on stairway enclosure. Manually operated call point are generally to be located in the corridors not inside the spaces.</p>



7.8.2	<p>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 <i>to detect</i><sup>*1</sup> any smoke originating in <i>concealed and inaccessible places</i><sup>*2</sup>, except <i>where in the opinion of the Administration there is no risk of fire originating in such places</i>.<sup>*3</sup></p>	<p>*1: The wording “to detect” means, for example, cover for inspection installed in appropriate interval (the cover is to install at least one in every subdivision surrounded by draft stop). These covers are to be able to open and close easily as long as the effectiveness of fire protection does not spoil.</p> <p>*2: The wording “concealed and inaccessible spaces” means the spaces in the rear side of ceilings, spaces between lining and shell plating, spaces in double-plated bulkheads and other similar spaces.</p> <p>*3: The wording “where in the opinion of the Administration there is no risk of fire originating in such places” means the spaces where there is no risk of leakage of electricity (the space where cable is not generally laid between ceiling, lining and bulkhead) and where there is no joint and valve of combustible liquid pipes, provided that the space is to be where people need not to enter.</p>
7.8.3	<p>Each member of the fire patrol shall be provided with a <i>two-way portable radiotelephone apparatus</i>*.</p>	<p>*: On ships provided with special category spaces, ro-ro cargo spaces or cargo spaces for the carriage of dangerous goods the two-way portable telephone apparatus are to be of certified safe type (IIA T3) for use in zone 1 areas as defined in <b>IEC Publication 79</b> - Electrical Apparatus for Explosive Gas Atmospheres.</p> <p>Two-way portable telephone apparatus is to be audible from most parts of the ship. As a minimum, they are to be audible where the fire patrol makes their rounds such as key box locations and the routes specified on fire patrol check list. If necessary, extra antennas are to be fitted to obtain effective communication.</p>
7.9.1	<p>Passenger ships shall at all times when at sea, or in port (except when out of service), be so manned or <i>equipped</i>* as to ensure that any initial fire alarm is immediately received by a responsible member of the crew.</p>	<p>*: The indicators of fixed fire detect and alarm system, auto-sprinkler system, ventilation system, open/closed of fire doors and watertight doors and so on are to be equipped in the main control room.</p>

7.9.3	<p>Passenger ships carrying more than 36 passengers shall have the fire detection alarms for the systems required by paragraph 5.2 centralized in a continuously manned central control station. In addition, controls for remote closing of the fire doors and shutting down the <i>ventilation fans</i>* shall be centralized in the same location. The <i>ventilation fans</i>* 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 and closed or off status of the detectors,</p> <p>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 regulation II-1/42 unless other arrangements are permitted by the regulations, as applicable.</p>	<p>*: The fan in a HVAC temperature control unit, or a circulation fan inside a cabinet/switchboard, is not considered to be a ventilation fan as addressed in Reg.II-2/7.9.3, if it is not capable of supplying outside air to the space (e.g., small units intended for re-circulation of air within a cabin). Therefore, such fans need not be capable of being controlled from a continuously manned central control station for passenger ships carrying more than 36 passengers when applying Reg.II-2/7.9.3.</p>
8.2	<p><b>Practicable measures</b>*<sup>1</sup> 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 <b>means of air supply</b>*<sup>2</sup> 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 Administration, such requirements need not apply to <b>control stations situated on, and opening on to, an open deck</b>*<sup>3</sup>, or <b>where local closing arrangements would be equally effective</b>*<sup>4</sup>. The ventilation system serving safety centres may be derived from the ventilation system serving the navigation bridge, unless located in an adjacent main vertical zone.</p>	<p>*1: As “practicable measures”, mechanical ventilation is preferable, but natural ventilation may also be accepted.</p> <p>*2: “Means of air supply” are to be of the positive pressure type mechanical ventilation.</p> <p>*3: “Control stations situated on, and opening on to, an open deck” means, for example, radio room or wheel house adjacent to boundary of a deckhouses or superstructure, to ensure ventilation clearing of smoke by opening window.</p> <p>*4: The “where local closing arrangements would be equally effective” means that fire dampers or smoke dampers which are easily closed within the control stations are provided in the effective supply and exhaust ventilation system so that smoke would not be drawn into such a control station in case of fire, and further, any openings, where provided, can be easily and securely closed.</p>
8.3.2	<p><b>Suitable arrangements</b>* 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 9.5.2.1. The normal ventilation systems may be acceptable for this purpose.</p>	<p>*: The “suitable arrangement” is to comply with <b>R8.3.1-1, Part R of the Guidance for the Survey and Construction of Steel Ships</b>.</p> <p>** : In principle, apply to machinery spaces except machinery spaces of category <i>A</i>.</p>
8.3.3	<p>Means of control shall be provided for permitting the release of smoke and such controls shall be located outside the space concerned so that, <b>in the event of fire, they will not be cut off from the space they serve</b>*.</p>	<p>*: In machinery spaces of category <i>A</i>, controls to close off ventilation ducts and pipes are to be installed with due regard to the hot gases produced by a fire in the space concerned.</p> <p>** : In principle, apply to machinery spaces except machinery spaces of category <i>A</i>.</p>
8.3.4	<p>In passenger ships, the controls required by paragraph</p>	<p>*1: The wording “situated at one control position” means</p>

	<p><b>3.3</b> shall be <i>situated at one control position</i><sup>*1</sup> or grouped in as few positions as possible to the satisfaction of the Administration. Such positions shall have <i>a safe access</i><sup>*2</sup> from the open deck.</p>	<p>that means of controls required in regulation <b>4.2.2.3.4</b>, <b>5.2.2.2</b>, <b>5.2.2.3</b>, <b>8.3.3</b> and <b>9.5.2.3</b> and means of controls of fire extinguishing arrangements are provided in fire control stations or the similar spaces of fire control stations. Means of controls required in <b>5.2.2.2</b> and <b>8.3.3</b> are controlled from open deck.</p> <p>*2: The entrance not directly exposed to open deck is not required for “a safe access”.</p> <p>** : In principle, apply to machinery spaces except machinery spaces of category <i>A</i>.</p>
8.4	<p>Air spaces enclosed behind ceilings, panelling or linings shall be divided by <i>close-fitting</i><sup>*1</sup> <i>draught stops</i><sup>*2</sup> spaced not more than <i>14m apart</i><sup>*3</sup> In the vertical direction, such enclosed air spaces, including those behind linings of stairways, trunks, etc., shall be closed at each deck.</p>	<p>*1: “Close-” means that the tightness of extent, which light does not filter, is secured. Therefore, the 2.5mm apart, which is admitted in the penetration of “B” class divisions, is not to be applied to draught stops.</p> <p>*2: Any of the following methods of construction may be used to construct “draught stops”:</p> <ol style="list-style-type: none"> <li>1 the extension of the “B” class bulkhead, ceiling or lining;</li> <li>2 the extension of the “C” class bulkhead, ceiling or lining;</li> <li>3 1mm thick minimum steel sheet, stiffened where necessary, intermittently welded to the ship’s structure and the top profile of the bulkhead, or fastened mechanically to the ceilings or linings;</li> <li>4 non-combustible board type material fastened mechanically to the ship’s structure, bulkheads, ceilings or linings; or</li> <li>5 “A” class mineral wool insulation, not less than 20mm in thickness, faced on each side with expanded metal mesh may be fitted on one side and non-combustible cloth (glass-cloth) on the other side of mineral wool insulation.</li> </ol> <p>*2: Arrangement of “draught stops” is to be in accordance with the follows :</p> <ol style="list-style-type: none"> <li>1 the draught stops are to coincide with the bulkheads where continuous ceilings are used; and</li> <li>2 Draught stops are not required in public spaces with open ceilings (perforated ceilings) with openings of 40 % or more and arranged in such a way that a fire behind the ceiling can be seen and extinguished.</li> </ol> <p>*3: “Apart” is to measure the distance in a straight line from bulkhead or deck (of steel) which is part of the hull structure. (see <b>Fig. 7-1-A4</b>)</p>
8.5	<p>Atriums <i>shall be equipped with a smoke extraction system</i>.<sup>*1</sup> <i>The smoke extraction system shall be activated by the required smoke detection system and be capable of manual control</i>.<sup>*2</sup> The fans shall be sized such that <i>the entire volume within space</i><sup>*3</sup> can</p>	<p>*1: The application of this regulation does not imply the arrangement of additional exhaust fans other than those normally dedicated to the space considered, if these latter fans are of sufficient size to meet the required capacity.</p> <p>*2: The functioning of indicators for cleaning of smoke</p>

	be exhausted in 10 <i>min</i> or less.	apparatus and the start/stop device are to be fixed within central control station. In ventilation systems which need to remote controlled the damper in order to make it for atrium only, the control device is to be installed in central control station. In this case, the damper is also to operate by smoke detecting device. *3: The volume within public room is to be calculated by the distance from steel wall surface to another one.
9.2.2.1.1.1	In ships carrying more than 36 passengers, the hull, superstructure and deckhouses shall be subdivided into main vertical zones by “A-60” class divisions. <b>Steps and recesses shall be kept to a minimum*</b> but where they are necessary they shall also be “A-60” class divisions. Where a category (5), (9) or (10) space defined in paragraph 2.2.3.2.2 is on one side or where fuel oil tanks are on both sides of the division the standard may be reduced to “A-0”.	*: Where main vertical zones are made into steps and recesses, they give a bad influence such as the follows : a) increase of the face which is exposed to fire; b) complication of external escape routes; and c) difficulty of extinguishing activity, etc. Accordingly, the number is to be as small as possible and their length is also to be as short as possible.
9.2.2.1.2	As far as practicable, the bulkheads forming the boundaries of the main vertical zones above the bulkhead deck shall be <b>in line with watertight subdivision bulkheads</b> <sup>*1</sup> situated immediately below the bulkhead deck. The length and width of main vertical zones may be extended to a maximum of 48m in order to bring the ends of main vertical zones to coincide with watertight subdivision bulkheads or in order to accommodate a large public 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 1600m <sup>2</sup> on any deck. The length or width of a main vertical zone is <b>the maximum distance between the furthestmost points</b> <sup>*2</sup> of the bulkheads bounding it.	*1: In the case of considering the length of steps and recesses of the bulkheads forming the boundaries of main vertical zones above the bulkhead deck, the standard bulkhead is to be a watertight bulkhead situated immediately below the bulkhead deck. Where, however, main vertical zones are divided into halfway by installation of horizontal zones, escape routes are to be considered and the bulkhead of main vertical zones over horizontal zones need not be installed on the same line of the standard watertight bulkhead. *2: If a stairway for the escape sets in the adjacent main vertical zone, but not served for the escape from the adjacent main vertical zone, the maximum length of the considered vertical zone is to be measured so as to include such stairway. If a stairway serves two main vertical zones, the maximum length of one main vertical zone is to be measured in accordance with <b>Fig. 7-1-A5</b> . In this case, all boundaries of the stairway enclosure are to be insulated as main vertical zones. For the calculation of the size of the main vertical zones, the stairways are to be included in one main vertical zone according to the length of the main vertical zones mentioned above. However, the stairway needs not to be included in calculating the size of the main vertical zone if it is treated as its own main vertical zone.
9.2.2.1.4	Where a main vertical zone is subdivided by horizontal “A” class divisions into horizontal zones for the purpose of providing an appropriate <b>barrier between a zone with sprinklers*</b> and a zone without sprinklers, the divisions shall extend between adjacent main vertical zone bulkheads and to the shell or exterior boundaries of the ship and shall be insulated in	*: “Barrier between a zone with sprinklers” means the zones which is one tween deck and between a main vertical zone is considered as minimum unit where automatic sprinkler system is installed in all place which is required by regulation <b>II-2/10.6</b> . And, where this one tween deck has a space where other fixed fire-extinguishing system are installed even if the automatic sprinkler system is not

	accordance with the fire insulation and integrity values given in <b>Table 9.4</b> .	installed in this one tween deck, e.g. machinery space, the space is considered as sprinklered zone, provided that other spaces in this zone are protected by automatic sprinkler system in accordance with the requirements of regulation <b>II-2/10.6</b> .
9.2.2.2.2	<p>For ships carrying not more than 36 passengers, bulkheads within accommodation and service spaces which are not required to be “A” class divisions shall be at least “B” class or “C” class divisions as prescribed in the tables in paragraph <b>2.2.4</b>. In addition, corridor bulkheads, where not required to be “A” class, shall be “B” class divisions which shall extend from deck to deck except:</p> <p>.1 when continuous “B” class ceilings or linings are fitted on both sides of the bulkhead, <i>the portion of the bulkhead behind the continuous ceiling or lining shall be of material which, in thickness and composition, is acceptable in the construction of “B” class divisions</i><sup>*1</sup> but <i>which shall be required to meet “B” class integrity standards only in so far as is reasonable and practicable in the opinion of the Administration</i><sup>*2</sup>; and</p> <p>.2 in the case of a ship protected by an automatic sprinkler system complying with the provisions of the Fire Safety Systems Code, <i>the corridor bulkheads may terminate at a ceiling in the corridor provided such bulkheads and ceilings are of “B” class standard in compliance with paragraph 2.2.4.</i><sup>*3</sup> All doors and frames in such bulkheads shall be of non-combustible materials and shall have the same fire integrity as the bulkhead in which they are fitted.</p>	<p>*1: In non-sprinklered zones, the divisions of materials, which are admitted to be “B” class divisions for thickness and construction, are certainly to be installed in the following position of corridor bulkheads.</p> <p>(1) between continuous “B” class ceilings and decks (see <b>Fig. 7-1-A6(1)</b>)</p> <p>(2) between continuous “B” class linings and side shell platings (see <b>Fig. 7-1-A6(2)</b>)</p> <p>*2: The extension of the bulkhead is to be made of non-combustible material and the construction of the extension is to correspond to the fire class of extended bulkhead. If the extended bulkhead is of “B-0” class standard, then the extension may be made of thin steel plates of 1.6mm thickness and tightened (e.g. with mineral wool). Alternatively, “B-0” class extensions may be constructed of a suitably supported mineral wool (density at least 100kg/m<sup>3</sup>, thickness at least 50mm).</p> <p>*3: The example of corridor bulkheads in a zone protected by automatic sprinkler system is shown in <b>Fig. 7-1-A7</b>.</p>
9.2.2.2.3	<p>Bulkheads required to be “B” class divisions, except corridor bulkheads as prescribed in paragraph <b>2.2.2.2</b>, shall extend from deck to deck and to the shell or other boundaries. However, where a <i>continuous “B” class ceilings 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.</i><sup>*1</sup></p>	<p>*1: Where, for example, bulkheads and ceilings are of “B-15” and “B-0” respectively, the construction is not to be continuous ceilings, and the bulkhead is to be reached from deck to deck (see <b>Fig. 7-1-A8(1)</b>). Adversely, if linings and ceilings of bulkheads including exposed side walls are of “B-15”, then continuous ceilings/linings which the bulkheads have only to reach the ceilings may be constructed in the part of cabin including corridors (see <b>Fig. 7-1-A8(2)</b>). And, if bath room and toilet within each cabin are constructed as a unit and the entrance door is “B-15” class fire door, the unit may be constructed by “C” class materials. Furthermore, the coamings of windows, which construct the sills installed in ship’s sides, are to correspond to heat insulation value of panels which the coamings are installed in it.</p>

		<p>*1: The distance from side wall to lining of side wall is to be less than the distance from lining of ceiling to deck.</p> <p>*1: Where the openings not less than <math>0.02m^2</math> are opened at the linings of ceiling or side wall, on the purpose of installation of lightings, units of air conditioner and other equipments, the measures which the whole of unit is at least protected by approved insulated materials and so on are to be taken.</p>
9.2.2.3.2	<p>The following requirements shall govern application of the tables:</p> <p>.1 <b>Table 9.1</b> shall apply to <i>bulkheads</i><sup>*1</sup> not bounding either main vertical zones or <i>horizontal zones</i><sup>*2</sup>. <b>Table 9.2</b> shall apply to decks not forming steps in main vertical zones nor bounding horizontal zones.</p> <p>.2 For determining the appropriate fire integrity standards to be applied to boundaries between adjacent spaces, such spaces are <i>classified according to their fire risk as shown in categories (1) to (14)</i><sup>*3</sup> 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, <i>it shall be treated as a space within the relevant category having the most stringent boundary requirements</i><sup>*4</sup>. 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 <b>Table 9.1</b> and <b>9.2</b>. 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.</p>	<p>*1: “Bulkheads bounding main vertical zones” means, for example, fore and aft ends bulkheads of special category zones.</p> <p>*2: “Horizontal zone” means the zones which are divided by “A” class horizontal divisions reached from main vertical zone bulkheads, shell platings and other surrounded walls to the others.</p> <p>*3: A separation made by wire mesh between two portions of a space is not considered a division in applying this regulation.</p> <p>*4: In case a space has the special characters of two or more space categories of regulation <b>II-2/9.2.2.3.2.2</b>, the insulation value of the divisions of such a space are to be the highest for the space categories concerned.</p>
9.2.2.3.2.2 (1)	<p>(1) Control stations</p> <p>Spaces containing emergency sources of power and lighting.</p> <p><i>Wheelhouse</i><sup>*5</sup> and chartroom.</p> <p>Spaces containing the ship’s radio equipment.</p> <p>Fire control stations</p> <p>Control room for propulsion machinery when located outside the propulsion machinery space.</p> <p>Spaces containing centralized <i>fire alarm equipment</i><sup>*6</sup>.</p> <p><i>Spaces containing centralized emergency public address system stations and equipment</i><sup>*7</sup>.</p>	<p>*5: “Wheelhouse” includes the installation places of navigation equipment. And, motor generator rooms which are used for navigation equipment and radio equipment, or inverter rooms are also treated as control stations.</p> <p>*6: “Fire alarm equipment” means alarm system of automatic sprinkler system and fixed fire detection and fire alarm system in accordance with regulation <b>II-2/7</b>.</p> <p>*7: “Centralized emergency public address system stations and equipment” means whistle, siren and loudspeaker for giving the information to passenger and crew, and the alarm system for calling crew, in case of emergency.</p>
9.2.2.3.2.2 (2)	<p>(2) <i>Stairways</i><sup>*8</sup></p> <p>Interior stairways, <i>lifts</i><sup>*9</sup>, totally enclosed emergency escape trunks, and escalators (other than those wholly contained within the machinery spaces) for</p>	<p>*8: “Stairways” also contain the dumbwaiter.</p> <p>(Regulation <b>II-2/9.2.2.4</b> and <b>9.2.2.5</b> are also to be treated the same as this.)</p> <p>*9: Machinery rooms for lift, which are located right above</p>

	<p>passengers and crew and enclosures thereto.</p> <p>In this connection <b>a stairway which is enclosed at only one level</b><sup>*10</sup> shall be regarded as part of the space from which it is not separated by a fire door.</p>	<p>lift boundary and built in lift boundary, are treated as a portion of lift boundary. Machinery rooms for lift, which are next to above lift boundary, are also to be treated as spaces of category (2) in case of determining those fire insulation value.</p> <p>*10: Stairways, which are only enclosed in one between deck, are to see regulation <b>II-2/9.2.2.5.1</b>.</p>
9.2.2.3.2.2 (4)	<p>(4) Evacuation stations and external escape routes <b>Survival craft</b><sup>*11</sup> <b>stowage area</b><sup>*12</sup>.</p> <p>Open deck spaces and enclosed promenades forming lifeboat and liferaft embarkation and lowering stations. Assembly stations, internal and external.</p> <p>External stairs and open decks used for escape routes.</p> <p>The ship's side to the waterline in the lightest seagoing condition, superstructure and deckhouse sides <b>situated below and adjacent to</b><sup>*13</sup> <b>the liferaft and evacuation slide embarkation areas</b>.<sup>*14</sup></p>	<p>*11: Survival craft are excluded.</p> <p>*12: In case where the position which is reflected from the top of boat or raft to ships side is in tween deck, stowage area is to be the range from there until right above deck.</p> <p>*13: "Situated below and adjacent to the liferaft and evacuation slide embarkation areas" refer to <b>Fig. 7-1-A10</b> in interpretations of regulation <b>II-2/9.4.1.3.3</b>.</p> <p>*14: These are to include not only lifeboat but also boat for survival.</p>
9.2.2.3.2.2 (7)	<p>(7) Accommodation spaces of moderate fire risk</p> <p>Spaces as in category (6) above but containing furniture and furnishings of other than restricted fire risk.</p> <p>Public spaces containing furniture and furnishings of restricted fire risk and having a deck area of 50m<sup>2</sup> or more.</p> <p>Isolated lockers and small store-rooms in accommodation spaces having areas less than 4m<sup>2</sup> (in which flammable liquids are not stowed).</p> <p>Motion picture projection and film stowage rooms.</p> <p><b>Diet kitchens (containing no open flame)</b><sup>*15</sup>.</p> <p>Cleaning gear lockers (in which flammable liquids are not stowed).</p> <p>Laboratories (in which flammable liquids are not stowed).</p> <p>Pharmacies.</p> <p>Small drying rooms (having a deck area of 4m<sup>2</sup> or less).</p> <p>Specie rooms.</p> <p>Operating rooms.</p>	<p>Distribution boards may be located behind panels/linings within accommodation spaces including stairway enclosures, without the need to categorize the space, provided no provision is made for storage. If distribution boards are located in an identifiable space having a deck area of less than 4m<sup>2</sup>, this space may be categorized in (7) according to regulation <b>9.2.2.3.2.2</b>.</p> <p>*15: Diet kitchens (containing no open flame) are to be in compliance with the interpretations for pantries as stated under regulation <b>II-2/3.1</b>.</p>
9.2.2.3.2.2 (9)	<p>(9) Sanitary and similar spaces</p> <p>Communal sanitary facilities, showers, baths, water closets, etc.</p> <p>Small laundry rooms.</p> <p>Indoor swimming pool area.</p> <p><b>Isolated pantries containing no cooking appliances in accommodation spaces</b>.<sup>*16</sup></p> <p>Private sanitary facilities shall be considered a portion</p>	<p>*16: For isolated pantries containing no cooking appliances, see interpretations to regulation <b>II-2/3.1</b>.</p> <p>*16: "Isolated pantries containing no cooking appliances in accommodation spaces" are pantries enclosed in an accommodation space and are only accessible from accommodation spaces and/or open deck. For the purpose of this categorization, "accommodation space" is as defined in regulation <b>II-2/3.1</b>. These pantries are not to have</p>

	of the space in which they are located.	communicating openings to spaces other than accommodation spaces, such as a category (12) “main galley”. These pantries do not contain cooking appliances, except as allowed in accordance with interpretation to regulation II-2/3.1.
9.2.2.3.2.2 (10)	<p>(10) Tanks, voids and auxiliary machinery spaces having little or no fire risk</p> <p>Water tanks forming part of the ship's structure.</p> <p>Voids and <b>cofferdams</b>*17.</p> <p>Auxiliary machinery spaces which do not contain machinery having a pressure lubrication system and where storage of combustibles is prohibited, such as:</p> <ul style="list-style-type: none"> <li>ventilation and air-conditioning rooms;</li> <li>windlass room;</li> <li>steering gear room;</li> <li>stabilizer equipment room;</li> <li>electrical propulsion motor room;</li> <li>rooms containing <b>section switchboards</b>*18 and purely electrical equipment other than oil-filled electrical transformers (above 10kVA);</li> <li>shaft alleys and pipe tunnels;</li> <li>spaces for pumps and refrigeration machinery (not handling or using flammable liquids).</li> </ul> <p>Closed trunks serving the spaces listed above.</p> <p>Other closed trunks such as pipe and cable trunks.</p>	<p>Spaces where urea or sodium hydroxide solution tanks for selective catalytic reduction systems, exhaust gas recirculation systems or exhaust gas cleaning systems are installed are to be considered as “Tanks, voids and auxiliary machinery spaces having little or no fire risk”. (Except in the cases where such tanks are installed in machinery spaces of category A.)</p> <p>*17: If a cofferdam is open to some other space, it is considered to be part of that other space.</p> <p>*18: Section switchboards may be located behind panels/linings within accommodation spaces including stairway enclosures, without the need to categorize the space, provided no provision is made for storage. Such location also need not to be categorized in (10) according to regulation 9.2.2.3.2.2. If section switchboards are located in an identifiable space having a deck area of less than 4m<sup>2</sup>, this space may be categorized in (7) according to regulation 9.2.2.3.2.2.</p>
9.2.2.3.2.2 (11)	<p>(11) Auxiliary machinery spaces, cargo spaces, cargo and other oil tanks and other similar spaces of moderate fire risk</p> <p>Cargo oil tanks.</p> <p>Cargo holds, trunkways and hatchways.</p> <p>Refrigerated chambers.</p> <p><b>Oil fuel tanks</b>*19 (where installed in a separate space with no machinery).</p> <p>Shaft alleys and pipe tunnels allowing storage of combustibles.</p> <p>Auxiliary machinery spaces as in category (10) which contain machinery having a pressure lubrication system or where storage of combustibles is permitted.</p> <p>Oil fuel filling stations.</p> <p>Spaces containing oil-filled electrical transformers (above 10kVA).</p> <p>Spaces containing turbine and reciprocating steam engine driven auxiliary generators and small internal combustion engines of power output up to 110kW driving generators, sprinkler, drencher or fire pumps, bilge pumps, etc.</p> <p>Closed trunks serving the spaces listed above.</p>	<p>*19: “Oil fuel tank”, which is mentioned here, means storage tank.</p>



<p>9.2.2.3.2.2 (13)</p>	<p>(13) Store-rooms, workshops, pantries, etc. Main pantries not annexed to galleys. <b>Main laundry.</b><sup>*20</sup> Large drying rooms (having a deck area of more than 4m<sup>2</sup>) Miscellaneous stores. Mail and baggage rooms. Garbage rooms. Workshops (not part of machinery spaces, galleys, etc.). Lockers and store-rooms having areas greater than 4m<sup>2</sup>, other than those spaces that have provisions for the storage of flammable liquids.</p>	<p>*20: "Main laundry" means the laundry in which washing machine for business and large-sized press machine are installed.</p>
<p>9.2.2.3.2 Note</p>	<p>Note: To be applied to <b>Table 9.1 to 9.2</b>, as appropriate.</p> <p>a Where adjacent spaces are in the same numerical category and superscript "a" appears, a bulkhead or deck between such spaces <b>need not be fitted</b><sup>*21</sup> if deemed unnecessary by the Administration. For example, in category (12) a bulkhead not be required between a galley and its annexed pantries provided the pantry bulkhead and decks maintain the integrity of the galley boundaries. A bulkhead is, however, required between a galley and machinery space even though both spaces are in category (12).</p> <p>b The ship's side, to the waterline in the lightest seagoing condition, superstructure and deckhouse sides situated below and adjacent to <b>liferafts</b><sup>*22</sup> and evacuation sides may be reduced to "A-30".</p> <p>c Where public toilets are installed completely within the stairway enclosure, the public toilet bulkhead within the stairway enclosure can be of "B" class integrity.</p> <p>d <b>Where spaces of category (6), (7), (8) and (9) are located completely within the outer perimeter of the assembly station</b><sup>*23</sup>, the bulkheads of these spaces are allowed to be of "B-0" class integrity. Control positions for audio, video and light installations may be considered as part of the assembly station.</p>	<p>*21: If bulkheads or decks are installed in these spaces, these are to be of "C" class boundaries.</p> <p>*22: These are to include not only liferafts but also lifeboats.</p> <p>*23: If the perimeter is arranged at the inside (this arrangement is not permitted to Ro-Ro passenger ships), fire insulation value of boundaries of this perimeter may be lighter than the value of outside perimeter.</p>
<p>9.2.2.3.2</p>	<p>.3 Where a single value is shown for the fire integrity of a boundary between two spaces, that value shall apply in all cases.</p> <p>.4 <b>Notwithstanding the provisions of paragraph 2.2.2</b><sup>*24</sup>, there are no special requirements for material or integrity of boundaries where only a dash appears in the tables.</p> <p>.5 The Administration shall determine in respect of category (5) spaces whether the insulation values in</p>	<p>*24: Regulation <b>II-2/5.3</b> is to be applied.</p>

	<p><b>Table 9.1</b> shall apply to ends of deckhouses and superstructures, and whether the insulation values in <b>Table 9.2</b> shall apply to weather decks. In no case shall the requirements of category (5) of <b>Table 9.1</b> or <b>9.2</b> necessitate enclosure of spaces which in the opinion of the Administration need not be enclosed.</p>	
9.2.2.3.3	Continuous “B” class ceilings or linings, in association with the relevant decks or bulkheads, may be accepted as <i>contributing wholly or in part*</i> , to the required insulation and integrity of a division.	*: Continuous “B” class ceilings and linings may be accepted as contributing to the required insulation of a division (combination of steel deck or bulkhead and ceiling or lining) provided that they are fire tested in accordance with the <b>FTP Code</b> .
9.2.2.4.2	<p><b>The following requirements govern application of the tables*<sup>1</sup>:</b></p> <p>.1 <b>Tables 9.3</b> and <b>9.4</b> shall apply respectively to the bulkheads and decks separating adjacent spaces.</p> <p>.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 <b>Tables 9.3</b> and <b>9.4</b>. 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.</p>	*1: See the interpretation of regulation <b>II-2/9.2.2.3.2</b> .
9.2.2.4.2.2 (4)	<p>(4) Stairways</p> <p>Interior stairways, lifts and totally <b>enclosed emergency escape trunks</b>*<sup>2</sup>, and escalators (other than those wholly contained within the machinery spaces) and enclosures thereto.</p> <p>In this connection, a stairway which is enclosed only at one level shall be regarded as part of the space from which it is not separated by a fire door.</p>	*2: Enclosed emergency escape trunks are to be treated as stairways in case of determining fire insulation value. Escape trunks are necessarily to reach corridors and stairways.
9.2.2.4.2.2 (5)	<p>(5) Service spaces (low risk)</p> <p>Lockers and store-rooms not having provisions for the storage of flammable liquids and having areas less than 4m<sup>2</sup> and drying rooms and laundries.</p>	Distribution boards may be located behind panels/linings within accommodation spaces including stairway enclosures, without the need to categorize the space, provided no provision is made for storage. If distribution boards are located in an identifiable space having a deck area of less than 4m <sup>2</sup> , this space may be categorized in (5) according to

		regulation <b>9.2.2.4.2.2</b> .
9.2.2.4.2.2 (7)	<p>(7) Other machinery spaces</p> <p>Electrical equipment rooms (auto-telephone, exchange, air-conditioning duct spaces).</p> <p>Spaces as defined in regulation <b>3.30</b> excluding machinery spaces of category <i>A</i>.</p>	<p>Distribution boards may be located behind panels/linings within accommodation spaces including stairway enclosures, without the need to categorize the space, provided no provision is made for storage. Such location also need not to be categorized in (7) according to regulation <b>9.2.2.4.2.2</b>. If distribution boards are located in an identifiable space having a deck area of less than <math>4m^2</math>, this space may be categorized in (5) according to regulation <b>9.2.2.4.2.2</b>.</p>
9.2.2.4.2 Note	<p>Notes: To be applied to both <b>Tables 9.3</b> and <b>9.4</b>, as appropriate.</p> <p>a For clarification as to which applies, see paragraph <b>2.2.2</b> and <b>2.2.5</b>.</p> <p>b Where spaces are of the same numerical category and superscript <i>b</i> appears, <b><i>a bulkhead or deck of the ratings shown in the table is only required when the adjacent spaces are for a different purpose</i></b><sup>*3</sup>, (e.g. in category (9)). A galley next to a galley does not require a bulkhead, but a galley next to a paint room requires an “A-0” bulkhead.</p> <p>c <b><i>Bulkheads separating the wheelhouse and chartroom from each other may have a “B-0” rating.</i></b><sup>*4</sup> No fire rating is required for those partitions separating the navigation bridge and the safety centre when the latter is within the navigation bridge.</p> <p>d See paragraphs <b>2.2.4.2.3</b> and <b>2.2.4.2.4</b>.</p> <p>e For the application of Regulation <b>2.2.1.1.2</b>, “B-0” and “C”, where appearing in <b>Table 9.3</b>, shall be read as “A-0”.</p> <p>f Fire insulation need not be fitted <b><i>if the machinery space of category (7), in the opinion of the Administration, has little or no fire risk.</i></b><sup>*5</sup></p> <p>g Ships constructed before 1 July 2014 shall comply, as a minimum, with the previous requirements applicable at the time the ship was constructed, as specified in regulation <b>1.2</b>.</p> <p>* 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 in a category (10) space, is penetrated for the passage of electric cables, pipes and vent ducts, such penetrations should be made</p>	<p>*3: If bulkheads and decks are installed in spite of being not required, these are to be of “C” class boundaries.</p> <p>*4: A navigation locker that can only be accessed from the wheelhouse is to be considered as a control station, and Note c may be applied.</p> <p>*5: See the definitions of (10) of regulation <b>II-2/9.2.2.3.2</b>.</p>

	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-extinguishing system is fitted. For the application of paragraph 2.2.1.1.2, an asterisk, where appearing in <b>Table 9.4</b> , except for categories (8) and (10), shall be read as “A-0”.	
9.2.2.4.2	<p>.3 In determining the applicable fire integrity standard of a boundary between two spaces within a main vertical zone or horizontal zone which is not <b><i>protected by an automatic sprinkler system</i></b>*<sup>6</sup> complying with the provisions of the Fire Safety System Code or between such zones neither of which is so protected, the higher of the two values given in the tables shall apply; and</p> <p>.4 In determining the applicable fire integrity standard of a boundary between two spaces within a main vertical zone or horizontal zone which is protected by an automatic sprinkler system complying with the provisions of the Fire Safety System Code or between such zones both of which are so protected, the lesser of the two values given in the tables shall apply. Where a zone with sprinklers and a zone without sprinklers meet within accommodation and service spaces, the higher of the two values given in the tables shall apply to the division between the zones.</p>	<p>*6: The treatment of sprinklered and non-sprinklered zones are to be in accordance with the follows;</p> <ol style="list-style-type: none"> <li>(1) Minimum unit of sprinklered and non-sprinklered zones, which are provided by regulation <b>II-2/9.2.2.1.4</b>, is in one tween deck zone within one main vertical zone.</li> <li>(2) Fire integrity standard, which is applied to the boundaries of zone, is to apply the higher one only if two sprinklered zones are next to each other.</li> <li>(3) Even if the spaces in which sprinklers are installed are within a non-sprinklered zone, boundaries of zones are to apply the higher one of fire integrity standard.</li> </ol>
9.2.2.4.3	Continuous “B” class ceilings or linings, in association with the relevant decks or bulkheads, may be accepted as <b><i>contributing, wholly or in part, to the required insulation and integrity of a division.</i></b> *	*: See interpretations of regulation <b>II-2/9.2.2.3.3</b> .
9.2.2.4.4	External boundaries which are required in regulation <b>11.2</b> to be of steel or other equivalent material may be pierced for the fitting of windows and sidescuttles provided that there is no requirement for such boundaries of passenger ships to have “A” class integrity. Similarly, in such boundaries which are not required to have “A” class integrity, <b><i>doors may be constructed of materials which are to the satisfaction of the Administration.</i></b> *	*: Doors which is next to stowage, launching and embarkation areas of lifeboat and liferaft are to be of steel or other equivalent materials, but the other areas are to be of non-combustible materials.
9.2.2.4.5	Sauna shall comply with paragraph 2.2.3.4.	With respect to the provisions of regulation <b>9.2.2.3.4.1</b> , the wording “categories (5), (9) and (10)” are to read as “category (5), (7) and (10)”.
9.2.2.5.1. 1	.1 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	*: Though the protection of stairway enclosures of a stairway connecting only two decks is specified in this rule so as to use the fire retardant value which is required for the decks in order that the value of decks is generally higher. Sometimes

	one 'tween-deck space, the stairway enclosure shall be <i>protected in accordance with the tables for decks in paragraphs 2.2.3 or 2.2.4;</i> * and	the fire retardant value of bulkheads get higher than the value of decks in case where the surrounding walls construct a part of the main vertical zone bulkheads. In this case, the higher one is to be adopted.  The enclosures of stairways which is enclosed by the both position of up and down are to be in accordance with the requirements of the table on bulkhead provided in regulation <b>II-2/9.2.2.3 or 9.2.2.4.</b>
9.3.1	Where “A” class divisions are penetrated, such penetrations shall be tested in accordance with the Fire Test Procedures Code, subject to the provisions of paragraph 4.1.1.5. In the case of ventilation ducts, paragraphs 7.1.2 and 7.3.1 apply. <i>However, where a pipe penetration is made of steel or equivalent material having a thickness of 3mm or greater and a length of not less than 900mm (preferably 450mm on each side of the division), and there are no openings, testing is not required. Such penetrations shall be suitably insulated by extension of the insulation at the same level of the division.*</i>	*: For the construction of penetrations, reference is made to the requirements in “Guidance for the details of penetrations” of <b>Annex R9.3.1, Part R of the Guidance for the Survey and Construction of Steel Ships.</b>
9.3.2	Where “B” class divisions are penetrated for the passage of electric cables, pipes, trunks, ducts, etc., or for the fitting of <i>ventilation terminals</i> * <sup>1</sup> , lighting fixtures and similar devices, arrangements shall be made <i>to ensure that the fire resistance is not impaired</i> * <sup>2</sup> , subject to the provisions of paragraph 7.3.2. Pipes other than steel or copper that penetrate “B” class divisions shall be protected by either: .1 a fire-tested penetration device suitable for the fire resistance of the division pierced and the type of pipe used; or .2 a steel sleeve, having a thickness of not less than 1.8mm and a length of not less than 900mm for pipe diameters of 150mm or more and not less than 600mm for pipe diameters of less than 150mm (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 2.5mm; or any clearance between pipe and sleeve shall be made tight by means of non-combustible or other suitable material.	*1: “Ventilation terminals” means a diffuser and a punkah louvre which are installed in the tip of duct.  *2: For the construction of penetrations, reference is made to the requirements in “Guidance for the details of penetrations” of <b>Annex R9.3.1, Part R of the Guidance for the Survey and Construction of Steel Ships.</b>
9.3.4	In approving structural <i>fire protection details</i> *, the 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 450mm in the case of steel and aluminium structures.	*: Fire protection details are to be in accordance with the requirements of <b>R9.3.4, Part R of the Guidance for the Survey and Construction of Steel Ships.</b>

	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 450mm.	
9.4.1.1.1	Except for hatches between cargo, special category, store, and baggage spaces, and between such spaces and the weather decks, openings shall be provided with <b><i>permanently attached means of closing</i></b> <sup>*1</sup> which shall be at least <b><i>as effective for resisting fires as the divisions</i></b> <sup>*2</sup> in which they are fitted.	<p>*1: “Permanently attached means of closing” means, for example, in case where bolted plates are installed in the openings for carrying in machinery or cargoes. (However, service hatches, which are arranged between galley and dining room, are to be treated as fire doors which are required by the regulation <b>II-2/9.4.1.1.2</b>.)</p> <p>*2: “Effective for resisting fires” means those of being adapted to the following requirements.</p> <ol style="list-style-type: none"> <li>(1) it is to be of a steel or equivalent materials, and is to be of the thickness of not less than 4.5mm, and is to be appropriately stiffened;</li> <li>(2) packing is generally to be of non-combustible materials, and have means of tightening for effective fix; and</li> <li>(3) it is to be constructed to the same effective heat insulation as the divisions in which it is fitted.</li> </ol>
9.4.1.1.2	The construction of doors and door frames in “A” class divisions, with the means of securing them when closed, shall provide resistance to fire as well as to the passage of smoke and flame <b><i>equivalent to that of the bulkheads</i></b> <sup>*</sup> in which the doors are situated, this being determined in accordance with the Fire Test Procedures Code. Such doors and door frames shall be constructed of steel or other equivalent material. Doors approved without the sill being part of the frame, which are installed on or after 1 July 2010, shall be installed such that the gap under the door does not exceed 12mm. A non-combustible sill shall be installed under the door such that floor coverings do not extend beneath the closed door.	<p>*: In principle, doors which pass the fire testing in accordance with the <b>FTP Code</b> are to be used, except for watertight doors.</p> <p>*: Where required divisions are replaced by divisions of a higher standard, the door need only conform to the required division.</p> <p>*: Watertight doors constructed in accordance with <i>SOLAS</i> Regulation <b>II-1/15</b> and fitted below the bulkhead deck that are required to be watertight need not be tested to the <b>FTP Code</b> provided that the doors meet the requirements for water tightness in <i>SOLAS</i> Regulation <b>II-1/16</b>. However, doors fitted above the bulkhead deck, which are required to meet both the fire protection and watertight requirements, are to be tested to the <b>FTP Code</b> in accordance with the fire rating of the division they are fitted in.</p>
9.4.1.1.5	Fire doors in main vertical zone bulkheads, galley boundaries and stairway enclosures other than <b><i>power-operated watertight doors</i></b> <sup>*1</sup> and those which are normally locked, shall satisfy the following requirements: .1 the doors shall be self-closing and be capable of closing with an angle of inclination of up to 3.5° opposing closure; .2 the approximate time of closure for hinged fire	<p>*1: “Power-operated watertight doors” and “approved power-operated watertight doors” mean the power-operated sliding doors which satisfy the requirements of regulation <b>II-1/13</b>.</p>

doors shall be no more than 40s and no less than 10s from the beginning of their movement with the ship in upright position. The approximate uniform rate of closure for sliding doors shall be of no more than 0.2m/s and no less than 0.1m/s with the ship in upright position;

.3 *the doors*<sup>\*2</sup>, except those for emergency escape trunks, shall be capable of remote release from the continuously manned central control station, either simultaneously or in groups, and shall be capable of release also 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;

.4 hold-back hooks not subject to central control station release are prohibited;

.5 a door closed remotely from the central control station shall be capable of being *re-opened*<sup>\*3</sup> from both sides of the door by local control. *After such local opening, the door shall automatically close again*; <sup>\*4</sup>

.6 indication shall be provided at *the fire door indicator panel in the continuously manned central control station*<sup>\*5</sup> whether each door is closed;

.7 the release mechanism shall be so designed that the door will automatically close in the event of disruption of the control system or central power supply;

.8 local power accumulators for power-operated doors shall be provided in the immediate vicinity of the doors to enable the doors to be operated ten times (fully opened and closed) after disruption of the control system or central power supply at least using the local controls;

.9 disruption of the control system or central power supply at one door shall not impair the safe functioning of the other doors;

.10 remote-released sliding or power-operated doors shall be equipped with an alarm that sounds at least 5s but no more than 10s after the door being released from the central control station and before the door begins to move and continues sounding until the door is completely closed;

.11 a door designed to re-open upon contacting an object in its path shall re-open not more than 1m from the point of contact;

.12 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;

\*2: Remote-controlled closing systems are to be installed in fire doors in spite of whether normally to be opened or closed.

\*3: Hinged fire doors may also be re-opened by hand-operation.

\*4: Re-closed of hinged fire doors with self-closing systems may satisfy the requirement.

\*5: Fire doors of lifts are also to have indicator panel in which the following indications and operation are displayed.

- (1) Indication which shows that “close” of “A” class lift doors, when the fire doors are closed.
- (2) Indication which shows that all lift doors are closed, in case several lifts are on the same stairways and have the access to the same landings.
- (3) When the fire doors are operated to be closed, the lifts are to stop at particular decks and the doors can be opened from inside by the same order. In this case, fire doors are not to be capable of being open from outside.

	<p>.13 doors 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 required in paragraphs <b>4.1.1.4.3</b> and <b>4.1.1.4.10</b>;</p> <p>.14 the components of the local control system shall be accessible for maintenance and adjusting;</p> <p>.15 power-operated doors shall be provided with a control system of an approved type which shall be able to operate in case of fire and <b><i>be in accordance with the Fire Test Procedures Code</i></b>.<sup>*6</sup> This system shall satisfy the following requirements:</p> <ul style="list-style-type: none"> <li>.1 the control system shall be able to operate the door at the temperature of at least 200°C for at least 60min, served by the power supply;</li> <li>.2 the power supply for all other doors not subject to fire shall not be impaired; and</li> <li>.3 at temperatures exceeding 200°C, the control system shall be isolated from the power supply and shall be automatically capable of keeping the door closed up to at least 945°C.</li> </ul>	<p><sup>*6</sup>: It means that of having efficiency which can pass the test of “Test for fire door control systems” carried out in accordance with the <b>FTP Code</b>.</p>
9.4.1.1.6	<p>In ships carrying not more than 36 passengers, where a space is protected by an automatic sprinkler fire detection and fire alarm system complying with the provisions of the Fire Safety Systems Code or fitted with a continuous “B” class ceiling, openings in decks not forming steps in main vertical zones nor bounding horizontal zones <b><i>shall be closed reasonably tight and such decks shall meet the “A” class integrity requirements in so far as is reasonable and practicable in the opinion of the Administration</i></b>.<sup>*</sup></p>	<p><sup>*</sup>: Decks are to satisfy “A” class integrity required by <b>Table 9.4</b> in general, and the openings are also to satisfy the requirements of regulation <b>II-2/9.4.1.1.1</b>. However, special consideration may be given if necessary.</p>
9.4.1.1.7	<p>The requirements for “A” class integrity of the outer boundaries of a ship shall not apply to glass partitions, windows and sidescuttles, provided that there is no requirement for such boundaries to have “A” class integrity in paragraph <b>4.1.3.3</b>. The requirements for “A” class integrity of the outer boundaries of the ship shall not apply to exterior doors, except for those in superstructures and deckhouses facing life-saving appliances, embarkation and external assembly station areas, external stairs and open decks used for escape routes. <b><i>Stairway enclosure doors need not meet this requirement</i></b>.<sup>*</sup></p>	<p><sup>*</sup>: Doors which open to exposed areas from stairways need not apply the criteria of “A” class integrity, and the requirements of regulation <b>II-2/9.4.1.1.5</b> need not apply. (For doors which open to outside stairways and open decks which are used for life saving appliances, evacuation stations, outside muster stations and escape routes, the doors are to be constructed of steel or other equivalent materials.) However, windows installed in the doors are to be constructed of “A-60” or “A-0” + sprinkler head for windows.</p>
9.4.1.1.8	<p>Except for watertight doors, weathertight doors (semi-watertight doors), doors leading to the open deck and doors which need to be reasonably gastight, all “A”</p>	



	class doors located in <i>stairways</i> *, 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 150mm 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.	*: As stairways are basically used for escape, self-closing hose port is also installed in all doors of stairway enclosures even though the doors are not designated as main or second route of escape.
9.4.1.1.9	Where it is necessary that a ventilation duct passes through a main vertical zone division, <b><i>a fail-safe automatic closing fire damper shall be fitted adjacent to the division</i></b> *1. The damper shall also <b><i>be capable of being manually closed from each side of the division</i></b> *2. 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 3.1. 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.	*1: The relations between these regulation and the other regulation (Regulation 9.7.1.1, 9.7.2.1 and 9.7.2.2) are given in <b>Fig. 7-1-A9</b> . *2: Manual closing may be achieved by mechanical means of release or by remote operation of the fire damper by means of a fail-safe electrical switch or pneumatic release (spring-loaded, etc.) on both sides of division.
9.4.1.2.1	Doors and door 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, this being determined in accordance with the Fire Test Procedures Code except that ventilation openings <b><i>may be permitted in the lower portion of such doors</i></b> *. Where such opening is in or under a door the total net area of any such opening or openings shall not exceed 0.05m <sup>2</sup> . Alternatively, a non-combustible air balance duct routed between the cabin and the corridor, and located below the sanitary unit is permitted where the cross-sectional area of the duct does not exceed 0.05m <sup>2</sup> . All ventilation openings shall be fitted with a grill made of non-combustible material. Doors shall be non-combustible. Doors approved without the sill being part of the frame, which are installed on or after 1 July 2010, shall be installed such that the gap under the door does not exceed 25 mm.	*: Balancing openings or ducts between two enclosed spaces are prohibited except for openings as permitted by this regulation. Where ventilation openings are installed in the lower part of fire door, the fire door is to be of “B” class fire door with louvres of approved type and the ventilation openings (louvres) are to be capable of being closed from the corridor side. Other openings, except the gap which is not greater than 3mm in the lower portion and which need to open and close the doors, are not to be installed.
9.4.1.2.2	<b><i>Cabin doors in “B” class divisions</i></b> * shall be of a self-closing type. Hold-backs hooks are not permitted.	*: Door of cabin for disabled person is to satisfy the following requirements in case where automatic door is provided in place of self-closing fire door : (1) The doors are to have “B-15” class fire integrity; (2) The system in itself of automatic open and close needs not to carry out the fire test.

		<p>(3) The power is to be provided from main and emergency source of power.</p> <p>(4) In case where control system has malfunctioned, doors are to keep the closing condition. However, the doors are to have the system capable of opening them by pushing even they are locked.</p> <p>(5) The door is to have automatic closing system after some duration of opening in order to prevent to leave opened.</p>
9.4.1.2.3	The requirements for “B” class integrity of the outer boundaries of a ship shall not apply to glass partitions, windows and sidescuttles. Similarly, the requirements for “B” class integrity shall not apply to <i>exterior doors in superstructures and deckhouses</i> *. For ships carrying not more than 36 passengers, the Administration may permit the use of combustible materials in doors separating cabins from the individual interior sanitary spaces such as showers.	*: The materials of doors which are located near the place used for the stowage, launching and boarding of lifeboats or liferafts (except the doors which open on the spaces having a low risk of fire, such as corridors, stairways, sanitary spaces, void spaces, etc.) are to be of steel or equivalent.
9.4.1.2.4	<p>In ships carrying not more than 36 passengers, where an automatic sprinkler system complying with the provisions of the Fire Safety Systems Code is fitted:</p> <p>.1 openings in decks not forming steps in main vertical zones nor bounding horizontal zones shall be closed reasonably tight and such decks shall <i>meet the “B” class integrity requirements</i>* in so far as is reasonable and practicable in the opinion of the Administration; and</p> <p>.2 openings in corridor bulkheads of “B” class materials shall be protected in accordance with the provisions of paragraph 2.2.2.</p>	*: In general, decks which are required “B” class division do not exist.
9.4.1.3.2	Notwithstanding the requirements of Tables 9.1 to 9.4, <i>windows and sidescuttles</i> * in bulkheads separating accommodation and service spaces and control stations from weather shall be constructed with frames of steel or other suitable material. The glass shall be retained by a metal glazing bead or angle.	*: Windows and side scuttles, which satisfy the requirement of <a href="#">Part L of the Rules for the Survey and Construction for Steel Ships</a> or satisfy the standard of JIS/ISO, may be considered as to satisfy this Rule.
9.4.1.3.3	<p><i>Windows facing</i>*<sup>1</sup> life-saving appliances, embarkation and assembly stations, external, external stairs and open decks used for escape routes, and <i>windows situated below</i>*<sup>1</sup> <i>liferaft</i>*<sup>2</sup> and escape slide embarkation areas shall have fire integrity as required in Table 9.1. Where automatic 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:</p> <p>.1 dedicated heads located above the windows, and installed in addition to the conventional ceiling sprinklers; or</p>	<p>*1: The wordings “windows facing” and “windows situated below” mean the windows which are netted in Fig. 7-1-A10(A) and which are marked by arrow in Fig. 7-1-A10(B) respectively.</p> <p>*2: “Life rafts” are also to include life boats</p>

	<p>.2 conventional ceiling sprinkler heads arranged such that the windows is protected by an average application rate of at least <i>5l/min</i> per square metre and the additional window area is included in the calculation of the area of coverage; or</p> <p>.3 water-mist nozzles that have been tested and approved in accordance with the guidelines approved by Organization.</p> <p>Windows located in the ship's side below the lifeboat embarkation areas shall have fire integrity <b><i>at least equal to "A-0" class</i></b>.<sup>*3</sup></p>	<p>*3: Windows equivalent to "A-30" or "A-0" + sprinkler head are to be provided.</p>
9.5.2.2	<p><b><i>Skylights</i></b>* shall be of steel and shall not contain glass panels.</p>	<p>*: The skylights are to be of steel cover operable easily from the position outside of the machinery space.</p> <p>** : In principle, apply to machinery spaces except machinery spaces of category <i>A</i>.</p>
9.5.2.3	<p>Means of control shall be provided for closing power-operated doors or actuating release mechanisms on doors other than power-operated watertight doors. The control shall be located outside the space concerned, <b><i>where they will not be cut off in the event of fire in the space it serves</i></b>*.</p>	<p>*: In machinery spaces of category <i>A</i>, controls to close off ventilation ducts and pipes are to be installed with due regard to the hot gases produced by a fire in the space concerned.</p>
9.5.2.4	<p>In passenger ships, the means of control required in paragraph 5.2.3 shall be <b><i>situated at one control position</i></b>*<sup>1</sup> or grouped in as few positions as possible to the satisfaction of the Administration.</p> <p>Such positions shall have <b><i>safe access</i></b>*<sup>2</sup> from the open deck.</p>	<p>*1: The wording "situated at one control position" means that means of controls required in regulation 4.2.2.3.4, 5.2.2.2, 5.2.2.3, 8.3.3 and 9.5.2.3 and means of controls of fire extinguishing arrangements are provided in fire control stations or the similar spaces to fire control stations. Means of controls required in 5.2.2.2 and 8.3.3 may be controlled from open deck.</p> <p>*2: The entrance not directly exposed to open deck is not required "a safe access".</p> <p>** : In principle, apply to machinery spaces except machinery spaces of category <i>A</i>.</p>
9.5.2.5	<p>In passenger ships, doors, other than <b><i>power-operated watertight doors</i></b>* 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 capable of closing against an inclination of 3.5° opposing closure and having a fail-safe hold-back arrangement, provided with a remotely operated release device. Doors for emergency escape trunks need not be fitted with a fail-safe hold-back facility and a remotely operated release device.</p>	<p>*: The power-operated watertight doors are to be power operated sliding door to comply with SOLAS II-1, Regulation 13.</p>
9.6.2	<p>In passenger ships, <b><i>indicators</i></b>* shall be provided on the navigation bridge which shall indicate when any fire door leading to or from the special category spaces is closed.</p>	<p>*: Indicators of fire doors are not to only show the closing condition but also the open/close condition.</p>

9.7.1.1	<p>Ventilation ducts, including single and double wall ducts, shall be of <b>steel or equivalent*</b> material except flexible bellows of short length not exceeding 600 mm used for connecting fans to the ducting in air-conditioning rooms. Unless expressly provided otherwise in paragraph 7.1.6, any other material used in the construction of ducts, including insulation, shall also be non-combustible. However, short ducts, not generally exceeding 2m in length and with a free cross-sectional area not exceeding 0.02m<sup>2</sup>, need not be of steel or equivalent material subject to the following conditions:</p> <ul style="list-style-type: none"> <li>.1 the ducts shall be made of 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<sup>2</sup> of their surface area for the thickness used;</li> <li>.2 the ducts are only used at the end of the ventilation device; and</li> <li>.3 the ducts are not situated less than 600mm, measured along the duct, from an opening in an "A" or "B" class division including continuous "B" class ceiling.</li> </ul>	<p>*: Gaskets in duct connections are to be of non-combustible material. However, where the use of elastic gasket are deemed necessary for the prevention of the leakage of air, combustible gaskets may be permitted provided that such gasket material is at least to have low flame-spread characteristics and appropriate considerations are made to the construction of such connection. In any case, combustible gaskets in flanged ventilation duct connections are not permitted in:</p> <ul style="list-style-type: none"> <li>(1) ducts within 600mm of an A class or B class division;</li> <li>(2) ducts required to be of A class construction; and</li> <li>(3) exhaust ducts from galley ranges.</li> </ul> <p>Unless otherwise specified, a ventilation duct made of material other than steel may be considered equivalent to a ventilation duct made of steel, provided the material is non-combustible and has passed a standard fire test in accordance with Part 3 of Annex 1 to the <b>FTP Code</b> as non-load bearing structure for 30 minutes following the requirements for testing "B" class divisions.</p>
9.7.1.2	<p>The following arrangements shall <b>be tested in accordance with the Fire Test Procedures Code</b><sup>*1</sup>:</p> <ul style="list-style-type: none"> <li>.1 <b>fire dampers</b><sup>*2</sup>, including their relevant means of operation, however, the testing is not required for dampers located at the lower end of the duct in exhaust ducts for galley ranges, which must be of steel and capable of stopping the draught in the duct; and</li> <li>.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 connections or by welding.</li> </ul>	<p>*1: The arrangement are to comply with test for fire dampers, pipe penetrations and cable transits in "Test for "A", "B" and "F" class divisions" carried out in accordance with the <b>FTP code</b>.</p> <p>*2: For dampers required by regulation <b>II-2/9.7</b>, reference is made to <b>Table 7-1-A11</b>.</p>
9.7.3.1	<p>Ducts passing through "A" class divisions shall meet the following requirements:</p> <ul style="list-style-type: none"> <li>.1 where a thin plated duct with a free cross-sectional area equal to, or less than, 0.02m<sup>2</sup> pass through "A" class divisions, the opening shall be fitted with a steel sheet sleeve having a thickness of at least 3mm and a length of at least 200mm, divided preferably into 100mm on each side of a bulkhead or, in the case of a deck, wholly laid on the lower side of the decks penetrated.</li> <li>.2 where ventilation ducts with a free cross-sectional area exceeding 0.02m<sup>2</sup>, but not more</li> </ul>	<p>Ducts with free sectional area of 0.075 m<sup>2</sup> or less need to be fitted with fire damper at their passage through Class "A" divisions in those cases indicated in requirements 9.7.2.2 and 9.7.2.3. The fire damper can be omitted if the duct is arranged in compliance with the requirements of 9.7.2.4.2.1 and 9.7.2.4.2.2.</p>

	<p>than <math>0.075m^2</math>, pass through “A” class divisions, the openings shall be lined with a steel sheet sleeves. The ducts and sleeves shall have a thickness of at least <math>3mm</math> and a length of at least <math>900mm</math>. When passing through bulkheads, this length shall be divided preferably into <math>450mm</math> 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 division through which the duct passes; and</p> <p>.3 <b>automatic fire dampers*</b> shall be fitted in all ducts with a free cross-sectional area exceeding <math>0.075m^2</math> that pass through “A” class divisions. Each damper shall be fitted close to the division penetrated and the duct between the damper and the division penetrated shall be constructed of steel in accordance with paragraphs <b>7.2.4.2.1</b> and <b>7.2.4.2.2</b>. The fire damper shall operate automatically, but shall also be capable of being closed manually from both sides of the division. The damper shall be fitted with a visible indicator which shows the operating position of the damper. 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 penetrate. A duct of cross-sectional area exceeding <math>0.075 m^2</math> shall not be divided into smaller ducts at the penetration of an “A” class division and then recombined into the original duct once through the division to avoid installing the damper required by this provision.</p>	<p>*: “Fire dampers” are to be in accordance with following requirements:</p> <ol style="list-style-type: none"> <li>(1) Manual closing may be achieved by mechanical means of release or by remote operation of the fire damper by means of a fail-safe electrical switch or pneumatic release (spring-loaded, etc.) on both sides of the division.</li> <li>(2) Fire dampers mean those complied with the standards defined in “<b>GUIDANCE FOR THE APPROVAL AND TYPE APPROVAL OF MATERIALS AND EQUIPMENT FOR MARINE USE</b>”.</li> <li>(3) Automatic closing devices are to comply with Notification No. 1097-3-2 (1 June 1981) “Construction of automatic fire damper with thermal fuse” of Ministry of Construction of Japanese Government or equivalent thereto.</li> </ol> <p>Ventilation inlets and outlets located outside boundaries are to be fitted with closing appliances as required by regulation <b>5.2.1.1</b> and need not comply with regulation <b>9.7.3</b>.</p>
9.7.4.2	<p>In general, the ventilation fans <b><i>shall be so disposed that the ducts reaching the various spaces remain within the main vertical zone.*</i></b></p>	<p>*: Arrangement of ventilation fan is to satisfy the following requirements :</p> <ol style="list-style-type: none"> <li>(1) In principle, the ventilation fan, which is used for a main vertical zone, is to be installed in the inside of the vertical zone so as to show <b>Fig. 7-1-A12</b>;</li> <li>(2) In case where there is an unavoidable reason, e.g. adjacent main vertical zone is so small that the installation of ventilation fan for both main vertical zone is unreasonable and impractical or the ventilation serves only for a part of the similar compartment belonging to the adjacent main vertical zone, etc., the ventilation to the adjacent main vertical zone may be carried out by using of the same</li> </ol>

		<p>ventilation fan. However, fail-safe self-closing type damper required in regulation <b>9.4.1.1.9</b> is to be installed in the vicinity of the division. (see <b>Fig. 7-1-A13</b>)</p> <p>(3) In case of (2), duct of the adjacent main vertical zone is not to be branched off halfway of the duct for the main vertical zone so as to be shown in <b>Fig 7-1-A15</b>.</p>
9.7.4.3	Stairway enclosures shall be served by <b><i>an independent ventilation fan and duct system (exhaust and supply)</i></b> * which shall not serve any other spaces in the ventilation systems.	*: Though there are not the requirements for ventilation system and emergency source of power, the adoption of pressurized system is desirable from the point of view of extracting smoke.
9.7.5.1.1	<p>In addition to the requirements in sections <b>7.1</b>, <b>7.2</b> and <b>7.3</b>, exhaust ducts from galley ranges shall be constructed in accordance with paragraphs <b>7.2.4.2.1</b> and <b>7.2.4.2.2</b> and insulated to “A-60” class standard throughout accommodation spaces, service spaces, or control stations they pass through. They shall also be fitted with:</p> <ol style="list-style-type: none"> <li>.1 a grease trap readily removable for cleaning unless an alternative approved grease removal system is fitted;</li> <li>.2 <b><i>a fire damper located in the lower end of the duct</i></b>*<sup>1</sup> at the junction between the duct and the galley range hood which is automatically and remotely operated and, in addition, a remotely operated fire damper located in the upper end of the duct close to the outlet of the duct;</li> <li>.3 a fixed means for extinguishing a fire within the duct;</li> <li>.4 remote-control arrangements for shutting off the exhaust fans and supply fans, for operating the fire dampers mentioned in paragraph <b>7.5.1.1.2</b> and for operating the fire-extinguishing system, which shall be placed in a position outside the galley close to the entrance to the galley. Where a multi-branch system is installed, a remote <b><i>means located with the above controls shall be provided to close all branches</i></b>*<sup>2</sup> exhausting through the same main duct before an extinguishing medium is released into the system; and</li> <li>.5 suitably located <b><i>hatches</i></b>*<sup>3</sup> for inspection and cleaning, including one provided close to the exhaust fan and one fitted in the lower end where grease accumulates.</li> </ol>	<p>*1: Fire dampers are to be installed in the space between ducts and range food. Such fire dampers do not need to pass “Test for “A”, “B” and “F” class divisions” carried out in accordance with the <b>FTP code</b>, but are to be of steel and capable of stopping the draught.</p> <p>*2: The means for closing the end of multi-branch system are to be remote controlled from a position close to the remote controls listed in paragraph <b>4</b>.</p> <p>*3: “Hatches” are to be provided close to the exhaust fan and fire dampers in the galley exhaust ducts, and the other places where the grease is most likely to accumulate, taking account of the arrangement of ventilation damper and the figure of duct, and are to have some extent of interval.</p>

9.7.5.2	<p>Where passing through accommodation spaces or <i>spaces containing combustible materials</i><sup>*2</sup>, <i>the exhaust ducts from galley ranges</i><sup>*1</sup> shall be constructed in accordance with paragraphs <b>7.2.4.1.1</b> and <b>7.2.4.1.2</b>. Each exhaust duct shall be fitted with:</p> <ul style="list-style-type: none"> <li>.1 a grease trap readily removable for cleaning;</li> <li>.2 an automatically and remotely operated fire damper located in the lower end of the duct at the junction between the duct and the galley range hood and, in addition, a remotely operated fire damper in the upper end of the duct close to the outlet of the duct;</li> <li>.3 arrangements, operable from within the galley, for shutting off the exhaust and supply fans; and</li> <li>.4 <i>fixed means for extinguishing a fire within the duct</i><sup>*3</sup>.</li> </ul>	<p>When a part of an exhaust duct for galley range is contiguous to accommodation spaces or other spaces containing combustible materials, at outside the galley, such ducts are to be in accordance with regulation <b>9.7.2.5</b>.</p> <p><sup>*1</sup>: The “exhaust ducts from galley ranges” are to comply with requirements in <b>R9.7.4, Part R of the Guidance for the Survey and Construction of Steel Ships</b>.</p> <p><sup>*2</sup>: “Spaces containing combustible materials” will normally apply to all spaces in accommodation.</p> <p><sup>*3</sup>: With respect to fixed means for extinguishing a fire within the duct, reference is made to <i>ISO 15371 : 2009 “Ships and marine technology – Fire-extinguishing systems for protection of galley cooking equipment”</i>. For Japanese flag ship special requirements apply.</p>
10.2.1.1	<p>Materials readily rendered ineffective by heat shall not be used for fire mains and hydrants unless adequately protected. The pipes and hydrants shall be so placed that the fire hoses may be easily coupled to them. The <i>arrangement</i><sup>*</sup> 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.</p>	<p><sup>*</sup>: The arrangement to prevent pipes and hydrants from freezing is as follows:</p> <ul style="list-style-type: none"> <li>(1) Pipes and fire hydrants at exposed part are to be provided with suitable insulation.</li> <li>(2) Scupper valves, etc. are to be provided for draining water for the pipes at exposed parts, which are laid in such a way that no water accumulate in the pipes as far as practicable.</li> </ul>
10.2.1.2	<p>The arrangements for the ready availability of water supply shall be:</p> <ul style="list-style-type: none"> <li>.1 In passenger ships: <ul style="list-style-type: none"> <li>.1.1 of 1,000 <i>gross tonnage</i> and upwards such that at least one effective jet of water is <i>immediately available</i><sup>*1</sup> from any hydrant in an interior location and so as to ensure the communication of the output of water by the <i>automatic starting</i><sup>*2</sup> of one required fire pump;</li> <li>.1.2 of less than 1,000 <i>gross tonnage</i> by automatic start of at least one fire pump or by remote starting from the navigation bridge of at least one fire pump. If pump starts automatically or if the bottom valve cannot be opened from where the pump is remotely started, the bottom valve shall always be kept open; and</li> <li>.1.3 if fitted with periodically unattended machinery spaces in accordance with</li> </ul> </li> </ul>	<p><sup>*1</sup>: The word “immediately available” means condition that pressure specified in regulation <b>10.2.1.6</b> is kept at the hydrants.</p> <p><sup>*1&amp;*2</sup>: The way to connect fire main shown in <b>Fig. 7-1-A16</b> with a pressure tank provided with pressure switch for automatic starting of fire pumps is the way to comply with <b>11</b> and <b>12</b>. However, the consideration is to be given for over pressure prevention including safety valve specified in regulation <b>10.2.1.4.3</b>.</p>

	<p>regulation II-1/54, the Administration shall determine provisions for fixed water fire-extinguishing arrangement for such spaces equivalent to those required for normally attended machinery spaces;</p> <p>.2 in cargo ships:</p> <p>.2.1 <i>to the satisfaction of the Administration</i><sup>*3</sup>; and</p> <p>.2.2 with a periodically unattended machinery space or when only one person is required on watch, there shall be immediate water delivery from the fire main system at a suitable pressure, either by remote starting of one of the main fire pumps with remote starting from the navigation bridge and fire control station, if any, or permanent pressurization of the fire main system by one of the main fire pumps, except that the Administration may waive this requirement for cargo ships of less than 1,600 gross tonnage if the fire pump starting arrangement in the machinery space is in an easily accessible position.</p>	<p>*3: Immediate availability of water supply can be achieved either by automatic start of at least one fire pump or by remote starting from the navigation bridge of at least one fire pump. If the pump starts automatically or if the bottom valve cannot be opened from where the pump is remotely started, the bottom valve are to always be kept open.</p>
10.2.1.4.1	<p><b>Isolating valves*</b> 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. <i>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.</i>**</p> <p>The pipes shall have substantial wall thickness, but in no case less than 11mm, and shall be welded except for the flanged connection to the sea inlet valve.</p>	<p>*: The 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 are to comply with <b>R10.2.1-3, Part R of the Guidance for the Survey and Construction of Steel Ships</b>.</p> <p>** : For the application, to be in accordance with <b>R10.2.1-4</b> through <b>-6, Part R of the Guidance for the Survey and Construction of Steel Ships</b>.</p>
10.2.1.5	<p>Number and position of hydrants</p> <p>.1 The number and position of hydrants shall be such that at least <i>two jets of water</i><sup>*1</sup> not emanating from the same hydrant, one of which shall be from a single</p>	<p>*1: Separate jets of water emanating from two parallel fire hoses in the same hydrant are not considered as "two jets of</p>



	<p>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 such space, each from a single length of hose. Furthermore, <b><i>such hydrants</i></b><sup>*2</sup> shall be positioned near the accesses to the protected spaces.</p> <p>.2 In addition to the requirements in paragraph <b>2.1.5.1</b>, passenger ships shall comply with the following:</p> <p>.1 in the accommodation, service and <b><i>machinery spaces</i></b><sup>*3</sup> the number and position of hydrants shall be such that the requirements of paragraph <b>2.1.5.1</b> may be complied with when all watertight doors and all doors in main vertical zone bulkheads are closed; and</p> <p>.2 where access is provided to a machinery space of category <i>A</i> at a <b><i>low level</i></b><sup>*4</sup> 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 <b><i>other spaces</i></b><sup>*5</sup>, in one of those spaces two hydrants shall be provided near the entrance to the machinery space of category <i>A</i>. Such provision need not be made where the tunnel or adjacent spaces are not part of the escape route.</p>	<p>water”.</p> <p>*2: The “such hydrants” means hydrants installed in cargo spaces, ro-ro cargo spaces and special category spaces. (The hydrant need not be provided near the entrance of any part of the ship (for example, passenger spaces) normally accessible to the passengers or crew at sea.)</p> <p>*3: At least one hydrant with hose, nozzle and coupling wrench are to be provided in machinery space of category <i>A</i>.</p> <p>*4: The “low level” means the case where the lower end in entrance is provided within 2.5m from the bottom in the machinery space of category <i>A</i>.</p> <p>*5: The “other spaces” means the spaces adjacent to machinery spaces of category <i>A</i>, similar to the shaft tunnel.</p>
10.2.2.3.1	<p>The arrangement of sea connections, fire pumps and their sources of power shall be as to ensure that:</p> <p>.1 in passenger ships of 1,000 <i>gross tonnage</i> and upwards, <b><i>in the event of a fire in any one compartment all the fire pumps will not be put out of action</i></b><sup>*1</sup>; and</p> <p>.2 in passenger ships of less than 1,000 <i>gross tonnage</i> and in cargo ships, if a fire in any one compartment could put all the pumps out of action there shall be <b><i>an alternative means consisting of an emergency fire pump</i></b><sup>*2</sup> complying with the provisions of the Fire Safety Systems Code with its source of power and sea connection located outside the space where the main fire pumps or their sources of power are located.</p>	<p>*1: In case where fire pumps are motor driven, for fire in spaces containing the main source of electrical power, the fire pumps may be driven by emergency source of electrical power required in Regulation <b>42.2.4, chapter II-1</b>.</p> <p>*2: An emergency fire pump need not to be fitted where:</p> <p>(1) the two main fire pumps, their sea suction and the fuel supply or source of power for each pump are situated within compartments separated at least by <i>A-0</i> divisions, so that a fire in any one compartment will not render both fire pumps inoperable; or</p> <p>(2) an arrangement in which one main fire pump is not located in a compartment having more than one bulkhead or deck adjacent to the compartment containing the other main fire pump.</p>
10.2.2.3.2.1	<p>The space containing the fire pump shall not be contiguous to the boundaries of machinery spaces of category <i>A</i> or those spaces containing main fire pumps. Where this is not practicable, the common bulkhead</p>	<p>When a single access to the emergency fire pump room is through another space adjoining a machinery space of category <i>A</i> or the spaces containing the main fire pumps, <i>A-60</i> boundary is required between that other space and the</p>

	between the two spaces shall be insulated to a standard of structural fire protection equivalent to that required for a control station in regulation <b>9.2.3.3</b> .	machinery space of category <i>A</i> or the spaces containing the main fire pumps.
10.2.2.3.2.2	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 Administration may accept an arrangement where the access is by means of an airlock with the door of the machinery space being of <i>A-60</i> 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.	The electrical cables to the emergency fire pump are not to pass through the machinery spaces containing the main fire pumps and their source(s) of power and prime mover(s). They are to be of a fire resistant type, in accordance with IACS Unified Requirement E15 Electrical Services Required to be Operable Under Fire Conditions and Fire Resistant Cables, paragraph <b>1</b> , where they pass through other high fire risk areas.
10.2.2.3.3	In addition, in cargo ships 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 <b>2.1.6.2</b> and <b>2.2.4.2</b> , is capable of providing water to the fire main.	This paragraph does not force designers to choose pumps with capacity and pressure characteristics other than that being optional for the service intended, just to make their connection to the fire main possible, provided the required number and capacity of fire pumps are already fitted.
10.2.2.4.1	<p>Total capacity of required fire pumps</p> <p>The required fire pumps shall be capable of delivering for fire-fighting purposes a quantity of water, at the pressure specified in paragraph <b>2.1.6</b>, as follows:</p> <ol style="list-style-type: none"> <li>.1 pumps in passenger ships, the quantity of water is not less than <i>two thirds of the quantity*</i> required to be dealt with by the bilge pumps when employed for bilge pumping; and</li> <li>.2 pumps in cargo ships, other than any emergency pump, the quantity of water is not less than four thirds of the quantity required under regulation <b>II-1/35-1</b> to be dealt with by each of the independent bilge pumps in a passenger ship of the same dimension when employed in bilge pumping, provided that in no cargo ship, other than those included in paragraph <b>7.3.2</b>, need the total required capacity of the fire pumps exceed <math>180 \text{ m}^3/\text{h}</math>.</li> </ol>	<p>*: The required total capacity of fire pumps are equal to <math>2/3 \times (\text{minimum numbers of bilge pumps required in II-1/21.2.2}) \times (\text{capacity of bilge pumps required in Regulation II-1/21.2.6})</math>.</p>
10.2.2.4.2	Each of the required fire pumps (other than any emergency pump required in paragraph <b>2.2.3.1.2</b> for cargo ships) shall have a capacity not less than 80% of the total required capacity divided by the minimum	

	number of required fire pumps but in any case not less than $25m^3/h$ and each such pump shall in any event be capable of delivering at least <b><i>the two required jets of water*</i></b> . These fire pumps shall be capable of supplying the fire main system under the required conditions. Where more pumps than the minimum of required pumps are installed such additional pumps shall have a capacity of at least $25m^3/h$ and shall be capable of delivering at least two jets of water required in paragraph 2.1.5.1.	*: The word “required jets of water” means 12m jet throw.
10.2.3.2.1	Ships shall be provided with fire hoses <b><i>the number and diameter of which shall be to the satisfaction of the Administration*</i></b> .	*: The number and diameter are obtained from the regulation 10.2.3.2.2.
10.2.3.3.1	For the purposes of this chapter, <b><i>standard nozzle sizes*</i></b> shall be 12mm, 16mm and 19mm or as near thereto as possible. Larger diameter nozzles may be permitted at the discretion of the Administration.	*: The maximum inside diameter of nozzles is not to be more than 22mm. However, the inside diameter of nozzle using as jet of water for machinery spaces or exposed spaces is not to exceed diameters required in Table 7-1-A17.
10.3.2.1	Accommodation spaces, service spaces and control stations shall be provided with portable fire extinguishers of appropriate types and in <b><i>sufficient number*</i></b> to the satisfaction of the Administration. Ships of 1,000 <i>gross tonnage</i> and upwards shall carry at least five portable fire extinguishers*.	*: To be in accordance with Table 7-1-A18: (including ships of less than 1,000 <i>gross tonnage</i> )
10.3.2.2	One of the portable fire extinguishers intended for use in any space shall be stowed <b><i>near the entrance*</i></b> to that space.	*: For spaces having plural entrances, the “entrance” means the one used most frequently.
10.4	Fixed fire-extinguishing systems	<p>When a system consisting of fire-extinguishing systems, pump systems, etc. as required in 10.5.1.1, 10.5.2.1, 10.5.6 and 10.6 comply with the following (1) to (5), a pump system may be commonly served for fixed water-based fire-extinguishing systems for the protection of different areas.</p> <p>(1) Each fire-extinguishing system is to comply with the performance standards required for each system when the system operates independently.</p> <p>(2) Failure of any one component in the power and control system is not to result in a reduction of the total pump capacity below that required by any of the areas the system is required to protect, e.g. pump units arranged as 2x100%, 3x50%, etc. with a dedicated starter cabinet or equivalent arrangements will be accepted. Back-up arrangements are not required for the remote release controls.</p> <p>(3) Alarms for typical faults in the power and control system are to be provided in a continuously manned control station. Means are to be provided to ensure that the system can be operated manually from positions outside the protected area(s) in case of such faults.</p>

		<p>(4) The system is to be arranged to avoid a single failure (including pipe rupture) in one protected area resulting in the system being inoperable in another protected area.</p> <p>(5) Redundant arrangements for power and water supply are to be located in different compartments separated by <i>A</i> class divisions.</p>
10.4.3	<p>When the fire-extinguishing medium is stored outside a protected space, it shall be stored in a room which is located behind the forward collision bulkhead, and <b><i>is used for no other purposes</i></b>.<sup>*</sup> Any entrance to such a storage room shall preferably be from the open deck and shall be independent of the protected space. <b><i>If the storage space is located below deck, it shall be located no more than one deck below the open deck and shall be directly accessible by a stairway or ladder from the open deck.</i></b><sup>*</sup> <b><i>Spaces which are located below deck or spaces where access from the open deck is not provided, shall be fitted with a mechanical ventilation system designed to take exhaust air from the bottom of the space and shall be sized to provide at least 6 air changes per hour.</i></b><sup>*</sup> <b><i>Access doors shall open outwards, and bulkheads and decks including doors and other means of closing any opening therein, which form the boundaries between such rooms and adjacent enclosed spaces shall be gastight.</i></b><sup>*</sup> For the purpose of the application of <b>Tables 9.1 to 9.8</b>, such storage rooms shall be treated as fire control stations.</p>	<p><sup>*</sup>: The following requirements in the regulation are applicable only to the storage rooms for fire-extinguishing media of fixed gas fire-extinguishing systems:</p> <ol style="list-style-type: none"> <li>.1 the storage room should be used for no other purposes (aft part of first sentence);</li> <li>.2 if the storage space is located below deck, it should be located no more than one deck below the open deck and should be directly accessible by a stairway or ladder from the open deck (3rd sentence);</li> <li>.3 spaces which are located below deck or spaces where access from the open deck is not provided, should be fitted with a mechanical ventilation system designed to take exhaust air from the bottom of the space and should be sized to provide at least 6 <i>air changes per hour</i> (4th sentence); and</li> <li>.4 access doors should open outwards, and bulkheads and decks including doors and other means of closing any opening therein, which form the boundaries between such rooms and adjacent enclosed spaces should be gas tight (5th sentence).</li> </ol>
10.5	Fire extinguishing arrangements in machinery spaces	<p>With respect to the number of systems, appliance and extinguisher required by regulation <b>10.5</b>, reference is made to <b>Table R10.5.1-1</b> and <b>R10.5.1-2, Part R of the Guidance for the Survey and Construction of Steel Ships</b>.</p>
10.5.1.2.2	<p>There shall be at least two portable foam extinguishers or <b><i>equivalent</i></b><sup>*1</sup> in each firing space in each boiler room and in <b><i>each space in which a part of the oil fuel installation is situated</i></b><sup>*2</sup>. There shall be not less than one approved foam-type extinguisher of at least 135/ capacity or <b><i>equivalent</i></b><sup>*1</sup> 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 175kW, or boilers protected by fixed water-based local application fire-extinguishing systems, an approved foam-type extinguisher of at least 135/ capacity is not required.</p>	<p><sup>*1</sup>: The “equivalent” are to comply with the following: A carbon dioxide gas fire extinguisher with a mass of 45kg may be deemed equivalent to a foam fire extinguisher with a capacity of 135/ in fire extinguishing efficiency. A carbon dioxide fire extinguisher with a mass of 16kg or a powder fire extinguisher with a mass of 23kg may be deemed equivalent to a foam fire extinguisher with a capacity of 45/ in fire extinguishing efficiency.</p> <p>In case where the carbon dioxide gas fire extinguishers provided in ships which are capable of discharging the carbon dioxide gas to all areas within the spaces of boiler rooms, etc. and the quantity of the carbon dioxide gas used exclusively for such purpose is not less than 16kg, such fire-extinguishing arrangement may be deemed equivalent to a foam fire extinguisher with a capacity of 45/ in fire-extinguishing efficiency.</p>

		<p>*2: “Each space in which a part of the oil fuel installation is situated” means the space in which fuel oil transfer pumps or oil purifiers are provided or the space where an aggregate of valves of the fuel oil transfer line are provided among the spaces provided with the oil fuel installations.</p>
10.5.2.2.2	<p>There shall be in each such space approved foam-type fire extinguishers, each of at least 45l capacity or equivalent, sufficient in number to enable foam or its equivalent to be directed on to any part of <b>the fuel and lubricating oil pressure systems, gearing</b><sup>*1</sup> 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 <b>no point in the space is more than 10m walking distance from an extinguisher</b><sup>*2</sup> and that there are at least two such extinguishers in <b>each such space</b><sup>*3</sup>. For smaller spaces of cargo ships the Administration may consider relaxing this requirement.</p>	<p>*1: The “fuel and lubricating oil pressure systems” means, for example, valves, strainers, etc. of the internal combustion engines, fuel oil transfer pumps, oil burning pumps, lubricating oil coolers, oil purifiers, reversing gears, reduction gears and hydraulic piping.</p> <p>*2: The wording “no point in the space is more than 10m walking distance from an extinguisher” means that no point in the space is more than 10m from an extinguisher along the passages and stairways.</p> <p>*3: For “each such space”, spaces to which persons normally have no access may be exempted.</p>
10.5.3.1	<p>In spaces containing steam turbines or enclosed steam engines used for main propulsion or other purposes having in the <b>aggregate a total power output*</b> of not less than 375kW, one of the fire-extinguishing systems specified in paragraph 4.1 shall be provided if such spaces are periodically unattended.</p>	<p>*: The “total power output” means the total aggregate of the maximum continuous power output of each engine.</p>
10.5.4	<p><b>Other machinery spaces</b><sup>*1</sup></p> <p>Where, in the opinion of the Administration, a fire hazard exists in any machinery space for which no specific provisions for fire-extinguishing appliances are prescribed in paragraphs 5.1, 5.2 and 5.3, there shall be provided in, or adjacent to, that space such <b>a number of approved portable fire extinguishers or other means of fire extinction as the Administration may deem sufficient</b><sup>*2</sup>.</p>	<p>*1: A portable fire extinguisher is to be provided at or near entrance and exits in the following spaces in machinery spaces excluding the machinery spaces specified in regulation 10.5.1 to 10.5.3. And, the type of portable fire extinguisher has to correspond to the Class B or C ones specified in <b>note (2) of Table 7-1-A18</b>. If a space is locked when unmanned, portable fire extinguishers required for that space may be kept inside or outside the space.</p> <p>(1) Spaces containing internal combustion machinery and machinery having forced lubricating system or hydraulic machinery*, oil filling stations and spaces having oil fire risk. (except for the spaces specified in the following (2))</p> <p>(2) Spaces containing refrigerating, ventilating (excluding those of small capacity fitted with one duct) or air conditioning machinery and spaces having electric fire risk.</p> <p>*1: For portable fire extinguishers in spaces containing hydraulic machinery, one or more extinguisher are to be provided in each spaces containing hydraulic pumps, hydraulic cylinders or hydraulic motors of more than 3kW or hydraulic fluid tanks (excluding exposed areas). However, portable fire extinguishers required in this regulation are not needed for a hydraulic pumps in hydraulic circuit such as the</p>

		<p>following;</p> <p>(a) A hydraulic circuit whose total quantity of hydraulic oil is not more than 100l</p> <p>(b) A hydraulic circuit whose flash point of the oil is not less than 200°C</p> <p>*2: With respect to the number of systems, appliance and extinguisher required by regulation <b>10.5</b>, reference is made to <b>R10.5.1-1, Part R of the Guidance for the Survey and Construction of Steel Ships</b>.</p>
10.5.6	Fixed local application fire-fighting systems	With respect to the detail of the fixed local application fire-fighting systems, reference is made to <b>R10.5.5, Part R of the Guidance for the Survey and Construction of Steel Ships</b> .
10.6.1.1	<p>Passenger ships carrying more than 36 passengers shall be equipped with an automatic sprinkler, fire detection and fire alarm system of an approved type and complying with the requirements of the Fire Safety Systems Code 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. <i>Spaces having little or no fire risk*</i> such as voids, public toilets, carbon dioxide rooms and similar spaces need not be fitted with an automatic sprinkler system.</p>	<p>*: The spaces not required the installation of sprinkler mean the sauna (the sauna whose source of heat is electricity or steam, except the spaces having dressing room), public baths (except the spaces having dressing room), trunks used for electric wire and machinery rooms used for lifts.</p>
10.7.1.1	Except as provided for in paragraph <b>7.2</b> , the cargo spaces of passenger ships of 1,000 <i>gross tonnage</i> and upwards shall be protected by a fixed carbon dioxide or inert gas fire-extinguishing system complying with the provisions of the Fire Safety Systems Code or by a <i>fixed high-expansion foam fire-extinguishing system*</i> which gives equivalent protection.	<p>*: In cases where systems complying with the <b>FSS Code 6.3.5</b> are provided, where the area of the space to be protected is greater than the value of the square breath of the ship multiplied by 3, fixed fire-extinguishing arrangements is to be capable of discharging a quantity of foam sufficient to fill the space within 10 <i>minutes</i>.</p>
10.7.2	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 Fire Safety Systems Code or with a fire-extinguishing system which, in the opinion of the Administration, gives <i>equivalent protection*</i> for the cargoes carried.	<p>*: Reference is made to <b>R10.7.2, Part R of the Guidance for the Survey and Construction of Steel Ships</b>.</p>
10.7.3.2	<p>Ships designed to carry five or more tiers of containers on or above the weather deck shall carry, in addition to the requirements of paragraph <b>7.3.1</b>, <i>mobile water monitors*</i> as follows:</p> <p>.1 ships with breadth less than 30 <i>m</i>: at least two mobile water monitors; or</p>	<p>*: Refer to <b>R10.7.3, Part R of the Guidance for the Survey and Construction of Steel Ships</b>.</p>

	.2 ships with breadth of 30 <i>m</i> or more: at least four mobile water monitors.	
10.9	Protection of cargo pump rooms in tankers	Each cargo pump room is to be provided with at least two portable foam extinguishers or equivalent, one at the position the pumps are installed and one at the pump room entrance. The type has to correspond to the Class <i>B</i> ones specified in <b>note (2) of Table 7-1-A18</b> .
10.10.2.2	<p>In addition, in passenger ships there shall be provided:</p> <p>.1 for every 80<i>m</i>, or part thereof, of the aggregate of the lengths of all <i>passenger spaces</i>* 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 comprising the items stipulated in the Fire Safety Systems Code. In passenger ships carrying more than 36 passengers, 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), (8) or (12) defined in regulation <b>9.2.2.3</b>, no additional fire-fighter's outfits are required ; and</p> <p>.2 ships carrying more than 36 passengers, for each pair of breathing apparatus there shall be provided one water fog applicator which shall be stored adjacent to such apparatus.</p>	*: The “passenger spaces” means the space for living and use of passenger except for baggage compartments, store rooms, food stores and mail rooms.
10.10.2.4	The Administration may require <i>additional sets of personal equipment</i> * and breathing apparatus, having due regard to the size and type of the ship.	*: Where the number of fireman’s outfits calculated as one for each main vertical zone exceed the number obtained from Regulation <b>10.10.2.2.1</b> , the number of difference is to be provided as additional fireman’s outfit.
11.3	<p>Unless otherwise specified in paragraph 2, in case where any part of the structure is of aluminium alloy, the following shall apply:</p> <p>.1 the insulation of aluminium alloy components of “<i>A</i>” or “<i>B</i>” class divisions, except structure which, in the opinion of the Administration, is non-<b>load-bearing</b>*<sup>1</sup>, shall be such that the temperature of the structural core <b>does not rise more than 200 °C above the ambient temperature</b>*<sup>2</sup> at any time during the applicable fire exposure to the standard fire test; and</p> <p>.2 special attention shall be given to the insulation of aluminium alloy components of columns, stanchions and other structural members required to support lifeboat and liferaft stowage, launching and embarkation areas, and “<i>A</i>” and “<i>B</i>” class divisions to ensure:</p>	<p>*1: Load-bearing division is a deck or bulkhead including stiffeners, pillars, stanchions and other structural members which, if eliminated, would adversely affect the designated structural strength of the ship. When, however, spaces of category (1) to (5) and (10) in regulation <b>II-2/9</b> are located on top of aluminum decks, the deck does not need to be insulated from the upper side, provided the deck is protected by a not readily ignitable deck covering.</p> <p>*2: The average temperature of the structural core is not to rise more than 200°C above the initial temperature during</p>

	<p>.2.1 that for such members supporting lifeboat and liferaft areas and “A” class divisions, the temperature rise limitation specified in paragraph 3.1 shall apply at the end of one <i>hour</i>; and</p> <p>.2.2 that for such members required to support “B” class divisions, the temperature rise limitation specified in paragraph 3.1 shall apply at the end of half an <i>hour</i>.</p>	the test for 1 <i>hour</i> .
11.4.1	Crowns and casings of machinery spaces of category A* <sup>1</sup> shall be of steel construction and shall be <b>insulated</b> <sup>*2</sup> as required by Table 9.5 and 9.7, as appropriate.	<p>*1: Refer to <b>R11.4.1-2, Part R of the Guidance for the Survey and Construction of Steel Ships</b> for the interpretations of crowns and casings of machinery spaces of category A.</p> <p>*2: “insulated” means that crowns and casings of machinery spaces of category A is to be insulated in compliance with the regulation II-2/9. Accordingly, crowns and casings exposed to air need not be insulated, except for at least 450mm range from not exposed part and for the part which is required by the regulation II-2/9 (mainly, adjacent parts of category (4) “Evacuation stations and external escape routes”).</p>
11.5	Materials readily rendered ineffective by heat shall not be used for <b>overboard scuppers</b> *, sanitary discharges, and other outlets which are close to the waterline and where the failure of the material in the event of fire would give rise to danger of flooding.	*: The parts where the use of materials readily rendered ineffective by heat (PVC, FRP, aluminum alloys, lead, copper and copper alloys) is prohibited for overboard scuppers and sanitary discharges are to be in accordance with the requirements in <b>R11.5.1, Part R of the Guidance for the Survey and Construction of Steel Ships</b> .
13.1	<p>The purpose of this regulation is to provide means of escape so that persons on board can safely and swiftly escape to the lifeboat and liferaft embarkation deck. For this purpose, the following functional requirements shall be met:</p> <p>.1 safe escape routes shall be provided;</p> <p>.2 escape routes shall be maintained in a safe condition, clear of obstacles; and</p> <p>.3 additional aids for escape shall be provided as necessary to ensure accessibility, clear marking, and adequate design for emergency situations.</p>	In cases where overhead hatches are used as escape routes, they are to be in accordance with <b>R13.1.1-2, Part R of the Guidance for the Survey and Construction of Steel Ships</b> .
13.3.1.1	Stairways and ladders shall be so arranged as to provide <b>ready means of escape</b> * to the lifeboat and liferaft embarkation deck from passenger and crew accommodation spaces and from spaces in which the crew is normally employed, other than machinery spaces.	<p>*: Means of escape is to satisfy the following requirements.</p> <p>(1) Means of escape is to be corridors, stairways and these combinations. As the routes through the public spaces (e.g. hall, restaurant, atrium, etc.) are not permitted as means of escape, the routes through the public space such as promenade from accommodation and public spaces can not be arranged as routes of escape.</p> <p>(2) Means of escape is to be widely separated from each other.</p> <p>(3) Public spaces and the other spaces** of passenger ships</p>



are to have two entrances at least. And, these entrances are to satisfy the following requirements :

- i) The two entrances are to separate as far as possible.
- ii) All entrances are not to be arranged at same side of exposed part (the entrances are to be arranged both sides or center. If the entrances are arranged in center, then these are to directly access to the ship's both sides by corridors).
- iii) Width of entrances is to be suitable size and is not to be less than 60cm at least.

\*\* : "The other spaces" means the spaces which are used for some extent times by many passengers (e.g. public spaces, barber shops, beauty parlors, baths, athletic rooms, children's rooms, movie theaters, saunas, etc.). However, the spaces which are temporary used (e.g. water closets, washrooms, etc.) are excluded from the above spaces.

(4) Notwithstanding the requirement (3), for the ships of the following a, b and c, one entrance may be permitted subject to complying with the requirements i) and ii).

- a. Passenger ships engaged on international voyages
- b. Ro-Ro passenger ships not less than 79m ships of length (these are to satisfy with the requirements of 2 spaces flooding probability, and fire prevention measures are to be provided for inside of public spaces and other similar spaces\*\* and the entrance.)
- c. Other ships which comply with flooding probability and fire prevention measures equivalent to a or b
  - i) Deck area of public spaces and other similar spaces\*\*  $\leq 25m^2$
  - ii) The capacity of persons onboard is not more than 12, provided that the planned capacity is determined by the arrangement of seats and so on.

(5) The requirements of emergency entrance installed in public spaces and other similar spaces\* (deck area is not more than  $25m^2$  or the planned capacity is not more than 49 persons) are to be in accordance with the follows :

- i) Breadth of emergency entrance is not less than 60cm;
- ii) Doors are to be operable from both sides; and
- iii) The mark is to be indicated clearly

(6) Doors on the escape routes are to be of the construction precluding to be locked.

(7) Storm rails are to be installed in corridors, stairways and other passage on the escape routes.

(8) In case where embarkation decks are not less than two layers, enough numbers of slope stairways which connect both decks are to be installed.

(9) Opening direction of doors along escape routes

The doors along escape routes are not to open against the

		<p>escape flow. The following exceptions are to be noted:</p> <ol style="list-style-type: none"> <li>1. The cabin doors may be opened into the cabins in order to avoid damage to persons in a corridor when the door is opened; and</li> <li>2. The doors in vertical emergency escape trunks are to open out of the trunk in order to be used both for escape and for access.</li> </ol> <p>(10) Enclosed escape trunks are to reach the corridors and stairways.</p>
13.3.1.2	<p>Unless expressly provided otherwise in this regulation, a corridor, lobby, or part of a corridor from which <i>there is only one route of escape*</i> shall be prohibited. Dead-end corridors used in service areas which are necessary for the practical utility of the ship, such as fuel oil stations and athwartship supply corridors, shall be permitted, provided such dead-end corridors are separated from crew accommodation areas and are inaccessible from passenger accommodation areas. Also, a part of a corridor that has a depth not exceeding its width is considered a recess or local extension and is permitted.</p>	<p>*: A corridor, lobby or part of a corridor is necessarily to have means of escape of two directions. In the example of arrangement of <b>Fig. 7-1-A19</b>, the corridors with an arrow need to change the arrangement as the corridors have only one route of escape.</p>
13.3.1.4	<p>If a radiotelegraph station has no direct access to the open deck, <i>two means of escape</i><sup>*1</sup> from or access to, the station shall be provided, one of which may be a porthole or window of <i>sufficient size</i><sup>*2</sup> or other means to the satisfaction of the Administration.</p>	<p>*1: The wording “two means of escape” means that two escape openings from the radiotelegraph station a part far away from each other and not have a common route.</p> <p>*2: The wording “sufficient size” means that the clear opening, in general, is not less than 600mm×400mm.</p>
13.3.2.1.1	<p>Below the bulkhead deck two means of escape, at least one of which shall be independent of watertight doors, shall be provided from each <i>watertight compartment*</i> or similarly restricted space or group of spaces. Exceptionally, the Administration may dispense with one of the means of escape for crew spaces that are entered only occasionally, if the required escape route is independent of watertight doors.</p>	<p>*: The wording “watertight compartment” means the compartment which is enclosed by watertight longitudinal bulkheads between transverse bulkheads which are installed in order to satisfy the provision of <b>Chapter II-1</b>.</p>
13.3.2.2	<p>Above the bulkhead deck there shall be at least two means of escape from each main vertical zone or similarly restricted space or group of spaces <i>at least one of which shall give access to a stairway forming a vertical escape.*</i></p>	<p>*: One of the means of escape from each space in main vertical zone (from each layer in atrium) is to be so arranged that one route can escape in the vertical direction by stairways without passing through the other main vertical zones.</p>
13.3.2.3	<p>Stairway enclosures in accommodation and service spaces shall have direct access from the corridors and be of a sufficient area to prevent congestion, having in view the number of persons likely to use them in an emergency. Within the perimeter of such stairway enclosures, only public toilets, <i>lockers of non-combustible material providing storage for non-hazardous safety equipment</i><sup>*1</sup> and open information</p>	<p>*1: Safety equipment which may be hazardous (such as rockets) is not to be accepted to be located in stairway enclosures.</p> <p>*2: Barber shops and beauty parlors can not have direct</p>

	counters are permitted. Only <b>public spaces</b> <sup>*2</sup> , corridors, lifts, public toilets, special category spaces and open ro-ro spaces to which any passengers carried can have access, other escape stairways required by paragraph 3.2.4.1 and external areas are permitted to have direct access to these <b>stairway enclosures</b> <sup>*3</sup> . Public spaces may also have direct access to stairway enclosures except for the backstage of a theatre. Small corridors or “lobbies” used to separate an enclosed stairway from galleys or main laundries may have direct access to the stairway provided they have a minimum deck area of 4.5m <sup>2</sup> , a width of no less than 900mm and contain a fire hose station.	access to the stairways, because the spaces are not included in public spaces. And, even if the compartment which constructs a part of public spaces, e.g. control room within hall, theatre backstage areas, etc. can not have direct access to the stairway room because it does not have the necessity to escape many passengers in a short time.  *3: The regulation 13.3.2.3 need not apply to the lifts. However, the regulation 9.2.2.5.2 is to apply to the lift which is constructed by individual trunk not included within stairway enclosures.
13.3.2.4.1	<i>At least one of the means of escape required by paragraphs 3.2.1.1 and 3.2.2 shall consist of a readily accessible enclosed stairway</i> <sup>*1</sup> , <i>which shall provide continuous fire shelter from the level of its origin to the appropriate lifeboat and liferaft embarkation decks, or to the uppermost weather deck if the embarkation deck does not extend to the main vertical zone being considered.</i> <sup>*2</sup> In the latter case, direct access to the embarkation deck by way of external open stairways and passageways shall be provided and shall have emergency lighting in accordance with regulation III/11.5 and slip-free surfaces underfoot. Boundaries facing external open stairways and passageways forming part of an escape route and boundaries in such a position that their failure during a fire would impede escape to the embarkation deck shall have fire integrity, including insulation values, in accordance with Tables 9.1 to 9.4, as appropriate.	*1: One of means of escape from uppermost deckhouse above embarkation deck is to be a enclosed stairway in principle. The arrangement of deckhouse, which can only approach by lifts and outside opened corridors and stairways, is to avoid if possible.  Means of escape are to be arranged so as to reach the master station directly without passing enclosed places again after once getting to the outside open place.  *1: Enclosed stairways are not to be divided into pieces by installation of partitions on the route of escape.  *2: In watertight compartments under bulkhead decks which are in the middle of one main vertical zone, an enclosed stairway which is installed as a route of escape other than a watertight door is enough to reach at least bulkhead deck if escape to embarkation deck is available via this watertight door and through an enclosed stairway installed in an adjacent watertight compartment within the same main vertical zone. (see Fig. 7-1-A20)
13.3.2.4.2	Protection of access from the stairway enclosures to the lifeboat and liferaft <b>embarkation areas</b> <sup>*1</sup> shall be provided either directly or <b>through protected internal routes</b> <sup>*2</sup> which have fire integrity and insulation values for stairway enclosures as determined by Tables 9.1 to 9.4, as appropriate.	*1: In ships provided with liferafts or lifeboats, the embarkation stations and master stations of 0.35m <sup>2</sup> or more in area per person are to be provided.  *2: The route from the stairway enclosures to the lifeboat and liferaft embarkation stations is to be of either a direct route or an internal route which has fire integrity and insulation values for stairway enclosures as determined by the regulation II-2/9 (see Fig. 7-1-A21). In short, the stairways are to be extended from side to side of the ship for exit.
13.3.2.4.4	Each level within an atrium shall have two means of escape, one of which shall give direct access to <b>an enclosed vertical means of escape</b> <sup>*</sup> meeting the requirements of paragraph 3.2.4.1.	*: The description of means of escape is to be in accordance with the regulation 13, the Fire Safety Systems Code (including IMO Res. A757(18) (see Annex 7-2)). Such enclosed means of escape are to be sized taking into account the total number of persons at each level of the public space considered.

13.3.2.4.5	The widths, number and <b>continuity</b> * of escapes shall be in accordance with the requirements in the Fire Safety Systems Code.	*: One of route of escape from passenger accommodation space is not to go through watertight bulkhead or main vertical zone bulkhead.
13.3.2.5.1	In addition to the emergency lighting required by regulations <b>II-1/42</b> and <b>III/11.5</b> , the means of escape, including stairways and exits, shall be marked by lighting or photoluminescent strip indicators placed not more than 300mm above the deck at all points of the escape route including angles and intersections. <b>The marking</b> * must enable passengers to identify the routes of escape and readily identify the escape exits. If electric illumination is used, it shall be supplied by the emergency source of power and it shall be so arranged that the failure of any single light or cut in a lighting strip will not result in the marking being ineffective. Additionally, escape route signs and fire equipment location markings shall be of photoluminescent material or marked by lighting. The Administration shall ensure that such lighting or photoluminescent equipment has been evaluated, tested and applied in accordance with the Fire Safety Systems Code.	*: The specific way of indication is to be at the Society's discretion.
13.3.4	.1 Emergency escape breathing devices shall comply with the Fire Safety Systems Code. Spare emergency escape breathing devices shall be kept onboard. .2 All ships shall carry <b>at least two emergency escape breathing devices within accommodation spaces</b> *. .3 In passenger ships, <b>at least two emergency escape breathing devices shall be carried in each main vertical zone</b> *. .4 In passenger ships carrying more than 36 passengers, <b>two emergency escape breathing devices, in addition to those required in paragraph 3.4.3 above, shall be carried in each main vertical zone</b> *. .5 However, paragraphs 3.4.3 and 3.4.4 do not apply to 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), (8) or (12) defined in regulation <b>9.2.2.3</b> .	*: The number of EEBD(s) to be kept within accommodation spaces should, as a minimum, be: (1) For passenger ships carrying not more than 36 passengers: 2 sets for each main vertical zone except those defined in the regulation <b>13.3.4.5</b> , and a total of 2 sets of spare; (2) For passenger ships carrying more than 36 passengers: 4 sets for each main vertical zone except those defined in the regulation <b>13.3.4.5</b> , and a total of 2 sets of spare.
13.4.1	Means of escape from each machinery space in passenger ships shall comply with the following provisions.	Inclined ladders and stairways in machinery spaces being part of, or providing access to, escape routes but not located within a protected enclosure are not to have an inclination greater than 60° and are not to be less than 600 mm in clear width. Such requirement need not be applied to ladders and stairways not forming part of an escape route, only provided for access to equipment or components, or similar

		areas, from one of the main platforms or deck levels within such spaces.
13.4.1.1	<p>Where the space is below the bulkhead deck the two means of escape shall consist of either:</p> <ol style="list-style-type: none"> <li>.1 two sets of <b>steel ladders</b><sup>*1</sup> as widely separated as possible, leading to doors in the upper part of the space similarly separated and from which access is provided to the appropriate lifeboat and liferaft embarkation decks. One of these ladders shall be located within a protected enclosure that satisfies regulation <b>9.2.2.3</b>, category (2) or regulation <b>9.2.2.4</b>, category (4), as appropriate, from the lower part of the space it serves to a <b>safe position</b><sup>*2</sup> outside the space. 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 <b>protected enclosure</b><sup>*3, *4</sup> shall have minimum internal dimensions of at least 800 mm x 800 mm, and shall have emergency lighting provisions; or</li> <li>.2 one steel ladder leading to a door in the upper part of the space from which access is provided to the embarkation deck and additionally, in the <b>lower part of the space</b><sup>*5</sup> and in a position well separated from the ladder referred to, a steel door capable of being operated from each side and which provides access to a safe escape route from the lower part of the space to the embarkation deck.</li> </ol>	<p>*1: Ladders having strings of flexible steel wire ropes are not acceptable in such escape routes.</p> <p>*2: A “safe position” can be any space, such as steering gear spaces where hydraulic oils for the steering gear equipment are stowed, and special category spaces and ro-ro spaces, from which access is provided and maintained clear of obstacles to the embarkation decks. This excludes lockers, storerooms, cargo spaces and spaces where flammable liquids are stowed.</p> <p>*3: Refer to <b>R13.4.1-10, Part R of the Guidance for the Survey and Construction of Steel Ships</b>.</p> <p>*4: Internal dimensions are to be interpreted as clear width, so that a passage having diameter of 800 mm is available throughout the vertical enclosure, as shown in the <b>Fig. R13.4.1-2</b>, clear of ship's structure, with insulation and equipment, if any. The ladder within the enclosure can be included in the internal dimensions of the enclosure. When protected enclosures include horizontal portions their clear width is not to be less than 600 mm.</p> <p>*5: Machinery spaces may include working platforms and passageways, or intermediate decks at more than one deck level. In such case, the lower part of the space is to be regarded as the lowest deck level, platform or passageway within the space. At deck levels, other than the lowest one, where only one means of escape other than the protected enclosure is provided, self-closing fire doors are to be fitted in the protected enclosure at that deck level. Smaller working platforms in-between deck levels, or only for access to equipment or components, need not be provided with two means of escape.</p>
13.4.1.3	<p>In a ship of less than 1,000 gross tonnage, the Administration may dispense with one of the means of escape, due regard being paid to the width and disposition of the upper part of the space. <b><i>In a ship of 1,000 gross tonnage and above, the Administration may dispense with one means of escape from any such space, including a normally unattended auxiliary machinery space, so long as either a door or a steel ladder provides a safe escape route to the embarkation deck, due regard being paid to the nature and location of the space and whether persons are normally employed in that space.</i></b><sup>*</sup> In the</p>	<p>*: This requirement applies only to auxiliary machinery spaces where persons are not normally employed.</p>

	steering gear space, a second means of escape shall be provided when the emergency steering position is located in that space unless there is direct access to the open deck.	
13.4.1.4	Two means of escape shall be provided from <i>a machinery control room</i> <sup>*1</sup> located within a machinery space, at least one of which will provide <i>continuous fire shelter</i> <sup>*2</sup> to a <i>safe position</i> <sup>*3</sup> outside the machinery space.	<p>*1: Refer to <b>R13.4.5-1, Part R of the Guidance for the Survey and Construction of Steel Ships</b>.</p> <p>*2: Refer to <b>R13.4.5-2 to R13.4.5-4, Part R of the Guidance for the Survey and Construction of Steel Ships</b>.</p> <p>*3: A “safe position” can be any space, such as steering gear spaces where hydraulic oils for the steering gear equipment are stowed, and special category spaces and ro-ro spaces, from which access is provided and maintained clear of obstacles to the embarkation decks. This excludes lockers, storerooms, cargo spaces and spaces where flammable liquids are stowed.</p>
13.4.1.6	Two means of escape shall be provided from <i>the main workshop</i> <sup>*1</sup> within a machinery space. At least one of these escape routes shall provide a <i>continuous fire shelter</i> <sup>*2</sup> to a safe position outside the machinery space.	<p>*1: Refer to <b>R13.4.6-1, Part R of the Guidance for the Survey and Construction of Steel Ships</b>.</p> <p>*2: Refer to <b>R13.4.6-2 to R13.4.6-4, Part R of the Guidance for the Survey and Construction of Steel Ships</b>.</p>

13.4.3.1	On all ships, within machinery spaces, emergency escape breathing devices shall be situated ready for use at easily visible places, which can be reached quickly and easily at any time in the event of fire. <b><i>The location of emergency escape breathing devices shall take into account the layout of the machinery space and the number of persons normally working in the spaces*</i></b> .	<p>*: The location of EEBDs is to comply with the following requirements;</p> <p>(1) In machinery spaces of category <i>A</i> containing internal combustion machinery used for main propulsion</p> <ul style="list-style-type: none"> <li>(a) One EEBD in the engine control room, if located within the machinery space.</li> <li>(b) One EEBD in the workshop areas. If any there is, however, a direct access to an escape way from the workshop, an EEBD is not required.</li> <li>(c) One EEBD on each deck or platform level near the escape ladder constituting the second means of escape from the machinery space (the other means being an enclosed escape trunk or watertight door at the lower level of the space).</li> <li>(d) Notwithstanding the provisions of (a) to (c) above, different number or location may be determined by the Administration taking into consideration the layout and dimensions or the normal manning of the space.</li> </ul> <p>(2) In machinery spaces of category <i>A</i> other than those of (1) One EEBD, as a minimum, on each deck or platform level near the escape ladder constituting the second means of escape from the space (the other means being an enclosed escape trunk or watertight door at the lower level of the space).</p> <p>(3) For machinery spaces other than those of (1) and (2), the number and location of EEBDs are to be determined by the Administration.</p>
13.5.1	In special category and open ro-ro spaces to which any passengers carried can have access, <b><i>the number and location of the means of escape</i></b> <sup>*1</sup> both below and above the bulkhead deck shall be to the satisfaction of the Administration and, in general, the safety of access to the embarkation deck shall be at least <b><i>equivalent to that provided for under paragraphs 3.2.1.1, 3.2.2, 3.2.4.1 and 3.2.4.2</i></b> . <sup>*2</sup> Such spaces shall be provided with designated walkways to the means of escape with a breadth of at least 600mm. The parking arrangements for the vehicles shall maintain the walkways clear at all times.	<p>*1: One of the route of escape which provides with a vertical escape (one of the routes from machinery space not passing special category spaces) is to be of steel stairways within a steel enclosures having insulation value of at least <i>A-30</i>. And, evacuation station and master station are to be arranged on open deck.</p> <p>*2: In application of regulation II-2/13.3.2.1.1, 13.3.2.2, 13.3.2.4.1 and 13.3.2.4.1, means of escape is to be arranged at fore and aft parts of these special category spaces as far as possible, and is to be arranged at a distance of not greater than 40m apart from each other.</p>
13.6	At least two means of escape shall be provided in ro-ro spaces where the crew are normally employed. The escape routes shall provide a <b><i>safe escape</i></b> <sup>*</sup> to the lifeboat and liferaft embarkation deck and shall be located at the fore and aft ends of the space.	*: The escape routes are to be so arranged to ensure safe escape also during loading and unloading such as indication of escape lane on deck with minimum clearance of 600mm in width.
13.7.1.2	The escape route from cabins to stairway enclosures shall be as direct as possible, with a minimum number of changes in direction. It shall not be necessary to	

	cross from one side of the ship to the other to reach an escape route. <b><i>It shall not be necessary to climb more than two decks*</i></b> up or down in order to reach an assembly station or open deck from any passenger space.	*: Routes of escape from passenger space to master station or open deck is not to up or down for three decks or more.
13.7.3.1	Handrails or other handholds shall be provided in corridors along the entire escape route so that a firm handhold is available at every step of the way, where possible, to the assembly stations and embarkation stations. Such handrails shall be provided on both sides of longitudinal corridors more than 1.8m in width and transverse corridors more than 1m in width. Particular attention shall be paid to the need to be able to cross lobbies, atriums* and other large open spaces along escape routes. Handrails and other handholds shall be of such strength as to withstand a distributed horizontal load of 750N/m applied in the direction of the centre of the corridor or space, and a distributed vertical load of 750N/m applied in the downward direction. The two loads need not be applied simultaneously.	*: A route of escape from other compartments to corridors or stairways through the atrium (treated as a public space) is not permitted. However, when the route through atrium is satisfied with the requirements for means of escape and the adjacent compartments of the route are satisfied with the regulation <b>II-2/9.2.2</b> , this route of escape is permitted.
13.7.4	<b><i>Escape routes shall be evaluated by an evacuation analysis early in the design process.*</i></b> The analysis shall be used to identify and eliminate, as far as practicable, congestion which may develop during an abandonment, due to normal movement of passengers and crew along escape routes, including the possibility that crew may need to move along these routes in a direction opposite to the movement of passengers. In addition, the analysis shall be used to demonstrate that escape arrangements are sufficiently flexible to provide for the possibility that certain escape routes, assembly stations, embarkation stations or survival craft may not be available as a result of a casualty.	*: A reasonable selection of routes of escape is expected to take place after the simulation is carried out by the computer program in which the examples of past fire accidents are used as the logical grounds.
14.2.2.1	<b><i>Maintenance, testing and inspections*</i></b> shall be carried out based on the guidelines developed by the Organisation* and in a manner having due regard to ensuring the reliability of fire-fighting systems and appliances.	*: Examination of fire extinguishers are to comply with the requirements of the flag government of ship. However, the extinguishers are to be hydraulically tested every 10 years.
15.2.2.6	An onboard means of recharging breathing apparatus cylinders used during drills shall be provided or <b><i>a suitable number of spare cylinders*</i></b> shall be carried on board to replace those used.	*: “A suitable number of spare cylinders” is to be at least one “set of cylinders” for each mandatory breathing apparatus required by regulations <b>II-2/10.10.2</b> and <b>18.5.1.7</b> . If additional spare cylinders are required by the shipboard safety management system (SMS), the number of spare cylinders carried on board is to be in accordance with the SMS. “Set of cylinders” means the number of cylinders which are required to operate the breathing apparatus. No



		additional cylinders are required for fire drills for breathing apparatus sets required by regulation <b>II-2/19</b> .
15.2.4.1	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 Administration, the aforementioned details may be set out in a booklet, a copy of which shall be supplied to each officer, and <b>one copy shall at all times be available on board in an accessible position</b> *. 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 Administration. If the language is neither English nor French, a translation into one of those languages shall be included.	*: A duplicate set of fire control plans or a booklet containing such plans is to be stored in the both ship's sides at the outside of deck house in order to be easily noticed by the fire fighting personnel in case where they have been on board from either ship's side.
15.3.2	In ships carrying more than 36 passengers, plans and booklets required by this regulation shall provide <b>information regarding fire protection, fire detection and fire extinction based on the guidelines issued by the Organization</b> .*	*: The followings are to be added in addition to regulation <b>15.2.4.1</b> . And, the symbols used are to be in accordance with <i>IMO</i> resolution <i>A.952(23)</i> and Table 3 of <i>IMO</i> resolution <i>A.1116(30)</i> ; (1) The date which undertook the construction and the version of applicable <i>SOLAS</i> convention (including amendments); (2) Details of measures in case where there are additional fire safety measures. (3) Details and the date of remodeling where fire protection and fire fighting facility are changed, and the version of applicable convention for the remodeled parts (including amendments).
Reg.18	<b>Regulation 18 Helicopter facilities*</b>	*: In regulation <b>III/28.1</b> , the installation of winching area for helicopter is required for all Ro-Ro passenger ships, and the installation of helicopter landing area is required for Ro-Ro passenger ships not less than 130 m in length constructed after 1 July, 1999. The requirements of helicopter landing area are to be in accordance with " <i>MSC/Circ.895</i> (as amended, including the amendments by <i>MSC.1/Circ.1524</i> )".
Reg.19	Carriage of dangerous goods	For the application, reference is made to the provisions of <b>R19 of the Guidance for the Survey and Construction of</b>

		<b>Steel Ships</b> with the modification that special category space(s) is treated as “roll on-roll off space(s)”.
20.2.2	<p>.1 The basic principle underlying the provisions of this regulation is that the main vertical zoning required by regulation <b>9.2</b> may not be practicable in vehicle spaces of passenger ships and, therefore, equivalent protection must be obtained in such spaces on the basis of a <b>horizontal zone</b><sup>*1</sup> 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 <b>the total overall clear height for vehicles</b><sup>*2</sup> does not exceed 10m.</p> <p>.2 The basic principle underlying the provisions of paragraph <b>2.2.1</b> is also applicable to ro-ro spaces.</p> <p>.3 The requirements of <b>ventilation systems</b><sup>*3</sup>, <b>openings in “A” class divisions</b><sup>*4</sup> 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.</p>	<p>*1: “Horizontal zone” specified in this rule is equivalent to the main vertical zone.</p> <p>*2: “The total overall clear height for vehicles” need not include the depth of deck girders as shown in <b>Fig. 7-1-A22</b>.</p> <p>*3: An example of application of regulation <b>II-2/9.7</b> is shown in <b>Fig. 7-1-A23</b>.</p> <p>*4: For the application of regulation <b>II-2/9.4.1.1</b>, shipboard lampway covers and lampway cover doors (see <b>Fig. 7-1-A24</b>, respectively) are to be treated as the hatch specified in regulation <b>II-2/9.4.1.1.1</b> where “A-0” class materials are required for them, but the structure and closing equipment are to be examined case by case considering the practices in vehicles carrier, Ro-Ro, etc.</p>
20.3.1.1	<p>There shall be provided <b>an effective power ventilation system</b><sup>*</sup> sufficient to give at least the following air changes:</p> <p>.1 Passenger ships:</p> <p>Special category spaces      10 <i>air changes per hour</i></p> <p>Closed ro-ro and vehicle spaces other than special category spaces for ships carrying more than 36 passengers      10 <i>air changes per hour</i></p> <p>Closed ro-ro and vehicle spaces other than special category spaces for ships carrying not more than 36 passengers      6 <i>air changes per hour</i></p> <p>.2 Cargo ships:      6 <i>air changes per hour</i></p> <p>The Administration may require an increased number of air changes when vehicles are being loaded and unloaded.</p>	<p>*: “Effective power ventilation systems” are to be of the exhaust type. However, the ventilation may be of the suction type subject to the following conditions:</p> <ol style="list-style-type: none"> <li>(1) these are no openings except those to exposed spaces ;</li> <li>(2) air-locked spaces having self-closing fire doors are provided in the access to the machinery spaces of category “A” or the accommodation spaces; and</li> <li>(3) self-closing fire doors are provided in the access to the other spaces.</li> </ol>
20.3.1.2.1	<p>In passenger ships, the power ventilation system shall be separate from other ventilation systems. The power ventilation system shall be operated to give at least the number of air changes required in paragraph <b>3.1.1</b> at all times when vehicles are in such spaces, except where <b>an air quality control system</b><sup>*</sup> in accordance with paragraph <b>3.1.2.4</b> is provided. Ventilation ducts serving such cargo spaces capable of being effectively sealed shall be separated for each such space. The system shall be capable of being</p>	<p>*: Reference is made to <i>Appendix 1</i> of “<i>Revised Design Guidelines and Operational Recommendations for Ventilation Systems in Ro-Ro Cargo Spaces</i>” (MSC.1/Circ.1515).</p>

	controlled from a position outside such spaces.	
20.3.1.3	<i>Means shall be provided on the navigation bridge to indicate any loss of the required ventilating capacity.*</i>	*: The requirement to indicate any loss of ventilating capacity may be complied with by an alarm on the bridge initiated by loss of power at the starter relay of fan motor.
20.3.1.4.1	Arrangements shall be provided to permit <i>a rapid shutdown*1 and effective closure of the ventilation system*2</i> from outside of the space in case of fire, <i>taking into account the weather and sea conditions*1</i> .	*1: Refer to <b>R20.3.1-5, Part R of the Guidance for the Survey and Construction of Steel Ships</b> . *2: Shutdown operations of ventilation systems are to be possible without entering into the special category space.
20.3.2.1	Except as provided in paragraph <b>3.2.2</b> , electrical equipment and wiring shall be of <i>a type suitable for use in an explosive petrol and air mixtures*</i> .	*: For the degree of protection of electrical equipment, reference is made to <b>Chapter 3, Part 6 of the Rules</b> .
20.3.2.2	In case of other than special category spaces below the bulkhead deck, notwithstanding the provisions in paragraph <b>3.2.1</b> , above a height of 450mm from the deck and from each platform for vehicles, if fitted, expect platforms with <i>openings of sufficient size permitting penetration of petrol gases downwards*1</i> , <i>electrical equipment of a type so enclosed and protected as to prevent the escape of sparks*2</i> shall be permitted as an alternative on condition that the ventilation system is so designed and operated as to provide continuous ventilation of the cargo spaces at the rate of at least ten <i>air changes per hour</i> whenever vehicles are on board.	*1: For “openings of sufficient size permitting penetration of petrol gases downwards”, reference is made to <b>Chapter 3, Part 6 of the Rules</b> . *2: For the degree of protection of electrical equipment, reference is made to <b>Chapter 3, Part 6 of the Rules</b> .
20.3.3	Electrical equipment and wiring, if installed in an exhaust ventilation duct, shall be of <i>a type approved for use*1</i> in explosive petrol and air mixtures and the outlet from any exhaust duct shall be sited in a <i>safe position*2</i> , having regard to <i>other possible sources of ignition*3</i> .	*1: For the degree of protection of electrical equipment in exhaust ventilation ducts and of exhaust fans, reference is made to <b>Chapter 3, Part 6 of the Rules</b> . *2: “A safe position” means the places which is arranged at a distance of at least 3m apart from ignition sources. *3: The windlass and opening for chain lockers are to be regarded as “possible sources of ignition”.
20.3.5	<i>Scuppers*</i> shall not be led to machinery or other spaces where sources of ignition may be present.	*: Scupper pipes are not to be led in machinery spaces or other spaces where sources of ignition may exist even if non-return valve and drain cock are installed in them. However, in case where scupper pipes are led to bilge tank directly or are arranged so as not to open to the machinery space like a bilge pipe which is directly led in bilge tank or which is absorbed by bilge pump, the above-mentioned arrangement may be permitted.
20.4.1	Except as provided in paragraph <b>4.3.1</b> , there shall be provided a <i>fixed fire detection and fire alarm system*</i> complying with the requirements of the Fire Safety Systems Code. 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 Administration, taking into account the effects of ventilation and other relevant	*: The requirement for fire detection and fire alarm systems needs not apply to weather deck used for the carriage of vehicle. *: The detector sections in vehicle and ro-ro spaces may be provided with an arrangement, (e.g. a timer) for disconnecting detector sections during loading and unloading of vehicles to avoid “false” alarms. The time of

	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 Administration.	disconnection is to be adapted to the time of loading/unloading. The central unit is to indicate whether the detector sections are disconnected or not. However, manual call points are not to be capable of being disconnected by the arrangements referred to above.
20.4.3.1	An efficient fire patrol system shall be maintained in special category spaces. However, if an efficient fire patrol system is <i><b>maintained by a continuous fire watch at all times</b></i> <sup>*1</sup> during the voyage, <i><b>a fixed fire detection and fire alarm system</b></i> <sup>*2</sup> is not required.	<p>*1: "Maintained by a continuous fire watch at all times" means either of the following <b>(1)</b> or <b>(2)</b>:</p> <p>(1) A room permanently and appropriately installed from where designated personnel can effectively and continuously monitor the space effectively; or</p> <p>(2) Means (e.g. video monitors) are provided in the engine control room or at the bridge for monitoring the space. (In Regulation <b>II-1/23.1</b>, passenger ships having special category spaces or ro-ro cargo spaces are required to be continuously patrolled or monitored by effective means such as television surveillance, so that any movement of vehicles in adverse weather condition and unauthorised access by passengers can be detected.)</p> <p>*2: See also the interpretations of Regulation <b>20.4.1</b>.</p>
20.6.1	Fixed fire-extinguishing systems	The requirement for fixed fire-extinguishing systems needs not apply to weather deck used for the carriage of vehicle.
20.6.1.4	<p>The requirement of this paragraph shall apply to ships constructed on or after 1 January 2010. Ships constructed on or after 1 July 2002 and before 1 January 2010 shall comply with the previously applicable requirements of <b>6.1.4</b>, as amended by resolution <i>MSC.99(73)</i>. When <i><b>fixed pressure water-spraying fire-extinguishing systems</b></i><sup>*1</sup> are fitted, 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 fixed pressure water-spraying system, the following arrangements shall be provided.</p> <p>.1 in passenger ships:</p> <p>.1.1 in the spaces above the bulkhead deck, <i><b>scuppers</b></i><sup>*2</sup> shall be fitted so as to ensure that such water is <i><b>rapidly discharged directly overboard</b></i><sup>*3</sup>, taking into account the guidelines developed by the Organization;</p> <p>.1.2.1 in ro-ro passenger ships, discharge valves for scuppers, fitted with positive means of closing operable from a position above the bulkhead deck in accordance with the requirements of the International Convention on Load Lines in force, shall be kept open while the ships are at sea;</p> <p>.1.2.2 any operation of valves referred to in paragraph <b>6.1.4.1.2.1</b> shall be recorded in the log-</p>	<p>*1: An example of fixed pressure water-spraying fire-extinguishing systems is shown in <b>Fig. 7-1-A25</b>.</p> <p>*2: For deciding the capacity of scuppers and drainage pumps, the capacity of the water spraying system pumps and the water discharge from the required number of fire hose nozzles specified in regulation <b>II-2/410.2.1.5.1</b> and <b>19</b>, as applicable, are to be taken into account.</p> <p>*3: Scupper pipes are not to be led in machinery spaces or other spaces where sources of ignition may exist even if a non-return valve and a drain cock are installed in them. However, in case where scupper pipes are led to bilge tank directly or are arranged so as not to open to the machinery space like a bilge pipe which is directly led in bilge tank or</p>

	<p>book;</p> <p>.1.3 in the spaces below the bulkhead deck, the Administration may require pumping and drainage facilities to be provided additional to the requirements of regulation <b>II-1/35-1</b>. In such case, the drainage systems 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, taking into account the guidelines developed by the Organization. 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 40m in each watertight compartment;</p> <p>.2 in cargo ships, 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, taking into account the guidelines developed by the Organization. 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 40m 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 Administration in its approval of the stability information.* Such information shall be included in the stability information supplied to the master as required by regulation <b>II-1/5-1</b>.</p>	<p>which is absorbed by bilge pump, the above-mentioned arrangement may be permitted.</p>
20.6.2.1	<p><b>Portable fire extinguishers</b>* shall be provided at each deck level in each hold or compartment where vehicles are carried, spaced not more than 20m apart on both sides of the space. At least one portable fire extinguisher shall be located at each access to such a cargo space.</p>	<p>*: The requirement for portable fire extinguishers needs not apply to weather deck used for the carriage of vehicle, but portable fire extinguishers are required for the access to such spaces. Cargo holds, loaded with vehicles with fuel in their tanks and stowed in open or closed containers also need not to be provided with the portable fire extinguishers.</p> <p>*: "Portable fire extinguisher" is to correspond to the Class <i>B</i> ones specified in <b>note (2) of Table 7-1-A18</b> and to have a capacity of 12kg dry powder or equivalent.</p>
20.6.2.2	<p>In addition to the provision of paragraph <b>6.2.1</b>, the following fire-extinguishing appliances shall be</p>	<p>*1: For the structure of water fog applicators, reference is made to FSS code chapter 7.</p>

	<p>provided in vehicle, ro-ro and special category spaces intended for the carriage of motor vehicles with fuel in their tanks for their own propulsion:</p> <ol style="list-style-type: none"> <li>.1 at least three <i>water-fog applicators</i><sup>*1</sup>; and</li> <li>.2 one <i>portable foam applicator unit</i><sup>*2</sup> complying with the provisions of the Fire Safety Systems Code, provided that <i>at least two such units</i><sup>*3</sup> are available in the ship for use in such spaces.</li> </ol>	<p>*1&amp;2: Cargo holds, loaded with vehicles with fuel in their tanks and stowed in open or closed containers also need not to be provided with the water-fog applicators and foam applicator unit.</p> <p>*2: The requirement for portable foam applicator unit needs not apply to weather deck used for the carriage of vehicle.</p> <p>*3: In “at least two portable foam applicator units”, the portable foam applicator units provided under other requirements may be included. However, they are to be provided at each enclosed space and are to be provided at least two in whole.</p>
21.4	<i>Safe return to port</i> *	<p>*: In accordance with <i>MSC.1/Circ.1437</i> in addition to <i>MSC.1/Circ.1369</i> (includes amendments made by <i>MSC.1/Circ.1369/Add.1</i>).</p>
21.4.13	<i>flooding detection systems</i> *; and	<p>*: For passenger ships carrying 36 or more persons and subject to <b>II-1/8-1</b>, the Safe Return To Port (SRTP) requirements of <b>II-2/21.4</b> apply to both:</p> <ol style="list-style-type: none"> <li>.1 the flooding detection systems in the spaces as defined in paragraph 6 of <i>MSC.1/Circ.1291</i>; and</li> <li>.2 the liquid level monitoring systems, which are used as, or replace, the flooding detection systems, as specified in paragraph 7 of <i>MSC.1/Circ.1291</i>.</li> </ol> <p>Therefore, for systems noted in sub-paragraph .2 above, the phrase "excluded from these requirements" in paragraph 7 of <i>MSC.1/Circ.1291</i> is not an exclusion from the general provision in <b>II-2/21.4.13</b> (remain operational in the event of fire). This exclusion pertains only to the detailed provisions in <i>MSC.1/Circ.1291</i>.</p>

1.2 Figures and Tables Referred to in Interpretation of *SOLAS* Chapter II-2

Fig. 7-1-A1 Length of MVZ (Regulation II-2/3.32)

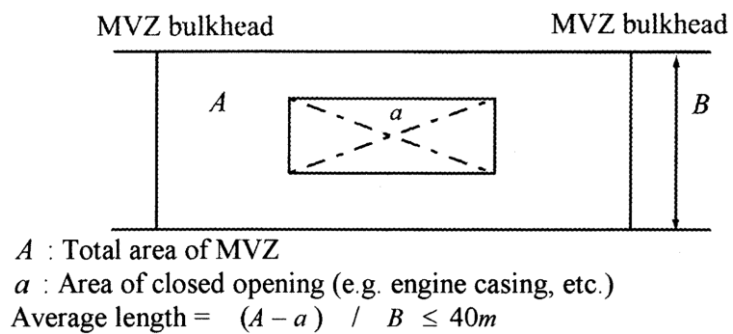


Fig. 7-1-A2 Closing Arrangements of Main Air Inlets and Outlets (Regulation II-2/5.2.1.1)

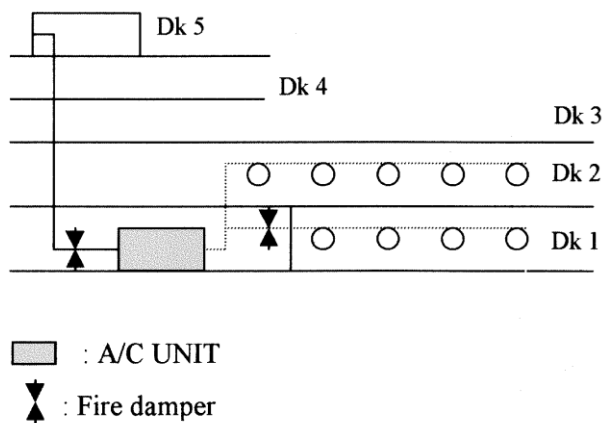
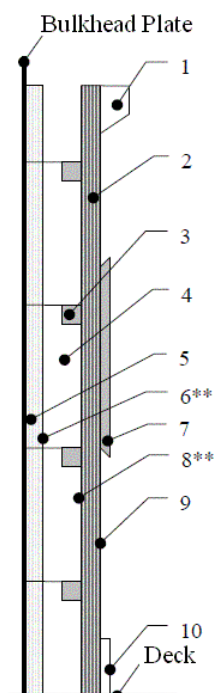


Fig. 7-1-A3 Construction of Fire Protection Divisions (Regulation II-2/5.3 &amp; 6.2)



Materials used for bulkheads of accommodation spaces as defined in regulation II-2/3.1					
Bulkhead components	Requirements in SOLAS chapter II-2 for components				
	Non-combustible material (Reg.5.3.1.1) (Reg.5.3.1.2.1)	Calorific value (Reg.5.3.2.2)	Equivalent volume (Reg.5.3.2.3)	Low flame spread (Reg.5.3.2.4)*	Smoke production, toxic products (Reg.6.2)
	(A)	(B)	(C)	(D)	(E)
1 Moulding			X		
2 Wall panel (lining)	X				
3 Grounds and supports	X				
4 Draft stops	X				
5 Insulation	X				
6 Insulation surface**				X (5.3.2.4.1.2)	
7 Decoration			X		
8 Painted surface** or Fabric or veneer**		---		X (5.3.2.4.1.2) X (5.3.2.4.1.2)	
9 Painted surface or Fabric or veneer		---	X	X (5.3.2.4.1.1) X (5.3.2.4.1.1)	X X
10 Skirting board			X		

## Notes

\*: Exposed surfaces of corridors and stairway enclosures referred to in regulation II-2/5.3.2.4.1.1 includes floor coverings.

\*\* : Where the wall panel is an integral part of the fire insulation in accordance with regulation II-2/9.2.2.3.3, these components are to be of non-combustible material.

In case of "Tatami"

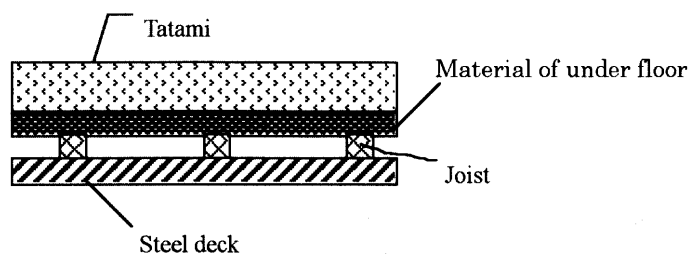




Fig. 7-1-A4 Arrangement of Draught Stops (Regulation II-2/8.4)

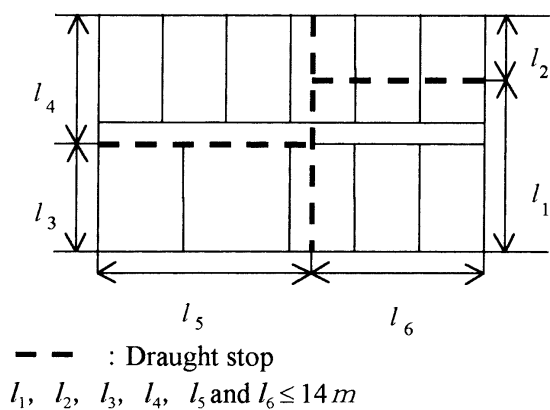


Fig. 7-1-A5 Enclosed Stairways and Main Vertical Zone (Regulation II-2/9.2.2.1.2)

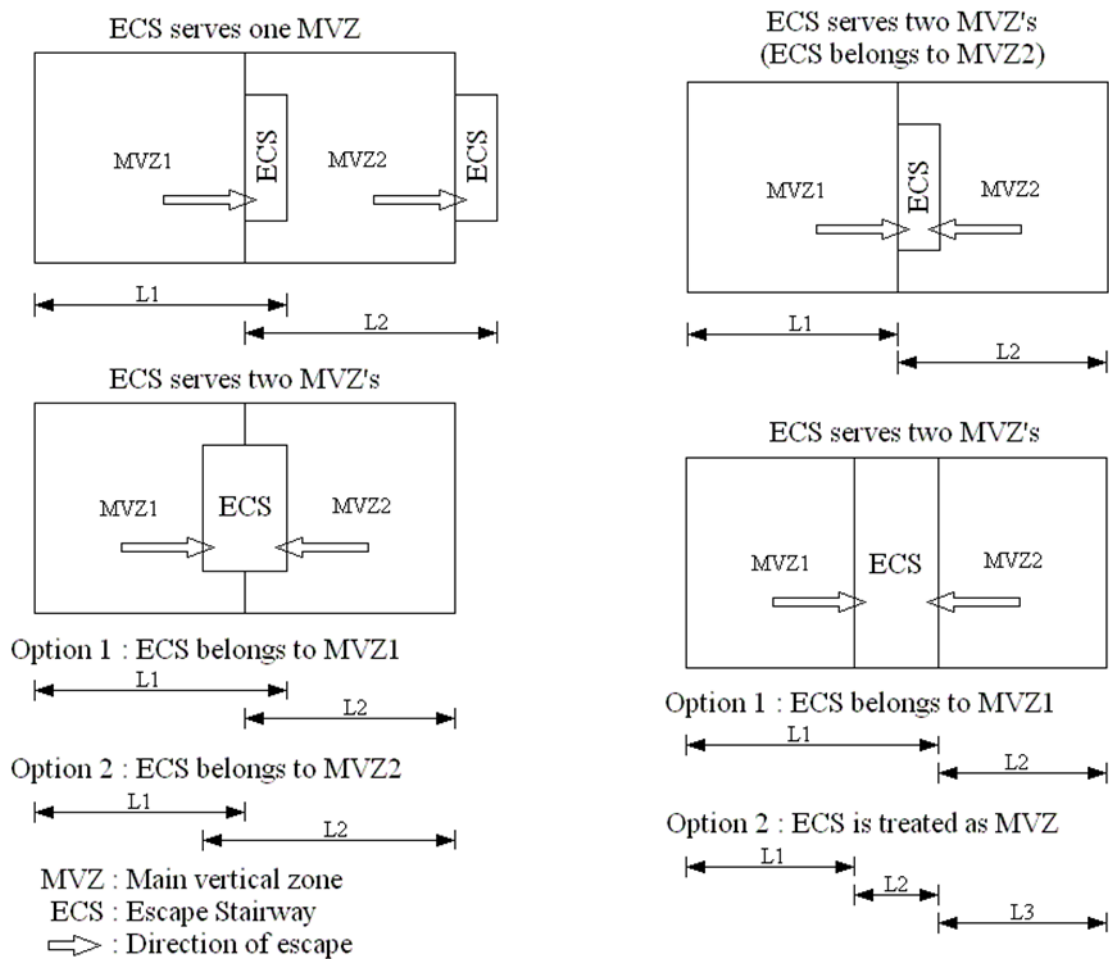
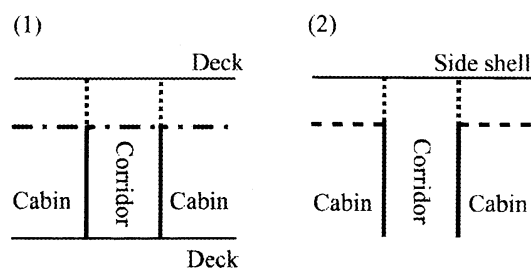
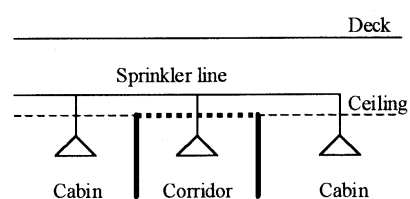


Fig. 7-1-A6 Corridor Bulkhead in the Non-sprinklered Zones (Regulation II-2/9.2.2.2.2)



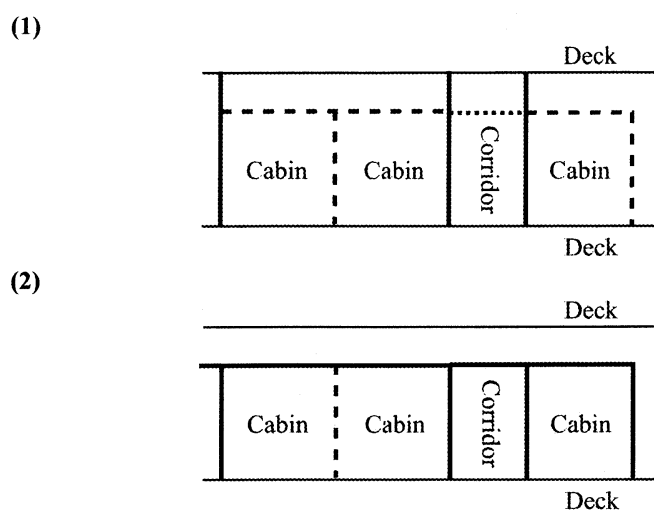
- Note
- : “B” class corridor bulkhead
  - . : Continuous “B” class ceiling
  - - : Continuous “B” class lining
  - ..... : Materials whose thickness and construction are approved as “B” class division

Fig. 7-1-A7 Corridor Bulkhead in the Sprinklered Zones (Regulations II-2/9.2.2.2.2)



- Notes :
- : “B” class corridor bulkhead
  - ..... : Materials whose thickness and construction are approved as “B” class division
  - - - : Non-combustible material ceiling
  - Δ : Automatic sprinkler system

Fig. 7-1-A8 Continuous “B” Class Ceiling(Regulation II-2/9.2.2.2.3)



- Notes
- : “B-15” class bulkhead/ceiling/lining
  - - - : “B-0” class bulkhead/ceiling/lining

Fig. 7-1-A9 Duct Penetration of MVZ (Regulations II-2/9.4.1.1.9)

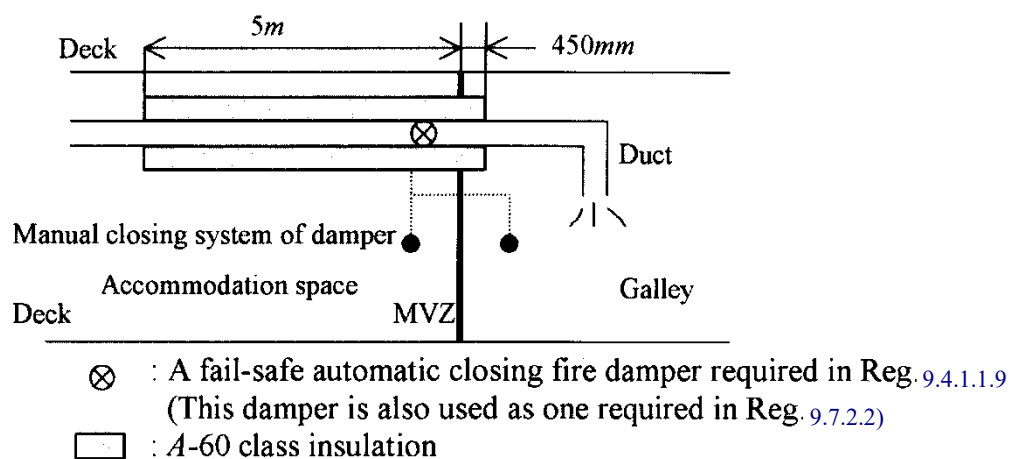


Fig. 7-1-A10 Window Facing or Situated below Life-saving Appliances (Regulation II-2/9.4.1.3.3)

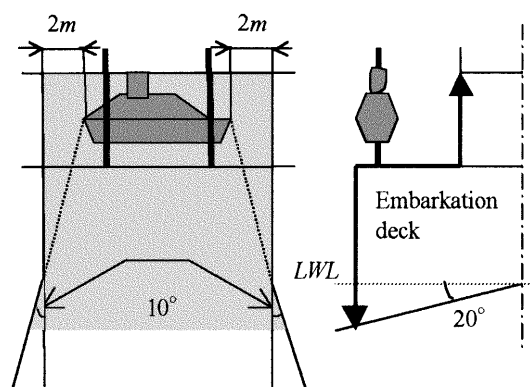


Table 7-1-A11 Requirements for Damper (Regulation II-2/8.5, 9.4.1 and 9.7)

Location	Regulation Number	Self-closing	Remote control	Hand-powered operation from each side	Indicator of open/closed	FTP Code
Exhaust duct from atrium	8.5		X			
Penetrating part in MVZ	9.4.1.1.9	X		X*	X	X
Portion passing through other categories	9.7.2	X				X
Penetrating part in “A” class division (Area > 0.075m <sup>2</sup> )	9.7.3.1.3	X		X	X	X
Junction of duct (smoke damper)	9.7.4.4	X				
The lower end of exhaust duct from galley range (passenger ships carrying more than 36 passengers)	9.7.5.1	X	X			
The upper end of exhaust duct from galley range (passenger ships carrying more than 36 passengers)	9.7.5.1		X			X
The lower end of exhaust duct from galley range (passenger ships carrying not more than 36 passengers)	9.7.5.2	X	X			
The upper end of exhaust duct from galley range (passenger ships carrying not more than 36 passengers)	9.7.5.2		X			X

## Notes

1. Where a mark “X” appears in the table, these requirements are to be complied with.
2. Where an asterisk appears in the table, the location for operating is to be showed with red reflector.
3. In all cases, a local hand-powered operation is to be requested.

Fig. 7-1-A12 Arrangement of Ventilation Fans (1) (Regulation II-2/9.7.4.2)

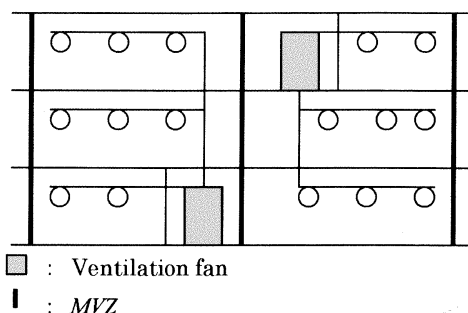


Fig. 7-1-A13 Arrangement of Ventilation Fans (2) (Regulation II-2/9.7.4.2)

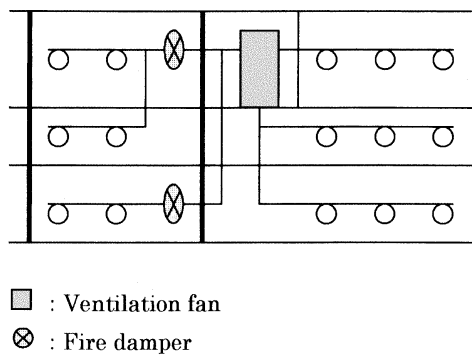


Fig. 7-1-A14 Arrangement of Ventilation Fans (3) (Regulation II-2/9.7.4.2)

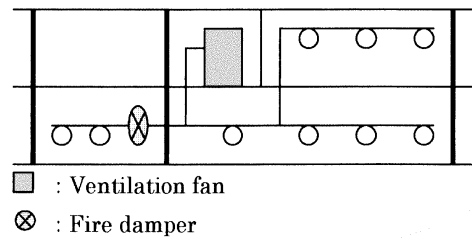


Fig. 7-1-A15 (Deleted)

Fig. 7-1-A16 Arrangement of Fire Pumps (Regulation II-2/10.2.1.2)

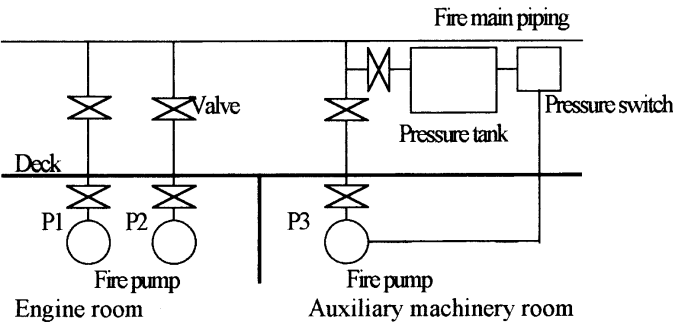


Table 7-1-A17 Inside Diameter of Nozzle Tips (Regulation II-2/10.2.3.3.1)

Value of $K\sqrt{Q}$	Inside dia. of nozzle (mm)	Specified pressure at fire hydrant (MPa)	K
Under 16	12	0.31	2.74
16 and over to 19 exclusive	16	0.27	2.85
19 and over to 22 exclusive	19	0.25	2.90
22 and over	19 or 22	0.235	2.97

$Q$  : Capacity of the smallest pump ( $m^3/h$ )

Table 7-1-A18 Minimum Numbers and Distribution of Portable Fire Extinguishers in the Various Types of Spaces Onboard Ships  
(Regulation II-2/10.3.2.1)

Type of space <sup>(1)</sup>		Minimum number of extinguishers	Class(es) of extinguisher(s) <sup>(2)</sup>
Accommodation spaces	Public spaces <sup>(3)</sup>	1 per 250m <sup>2</sup> of deck area or fraction thereof	<i>A</i>
	Corridors	Travel distance to extinguishers should not exceed 25m within each deck and main vertical zone	<i>A</i>
	Stairway	0	
	Lavatories, cabins, offices, pantries, containing no cooking appliances	0	
	Hospital	1	<i>A</i>
Service spaces	Laundry drying rooms, pantries containing cooking appliances	1 <sup>(4)</sup>	<i>A</i> or <i>B</i>
	Lockers and store rooms (having a deck area of 4m <sup>2</sup> or more), mail and baggage rooms, specie brooms, workshops <sup>(3)</sup> (not part of machinery spaces, galleys)	1 <sup>(4)</sup>	<i>B</i>
	Galleys	1 class <i>B</i> and 1 additional class <i>F</i> or <i>K</i> for galleys with deep fat fryers	<i>B</i> , <i>F</i> or <i>K</i>
	Lockers and store rooms(deck area is less than 4m <sup>2</sup> )	0	
	Other spaces in which flammable liquids are stowed	In accordance with <b>10.6.2, Part R of the Rules</b>	
Control stations	Control stations (other than wheelhouse)	1 <sup>(5)</sup>	<i>A</i> or <i>C</i>
	Wheelhouse	2, if the wheelhouse is less than 50m <sup>2</sup> only 1 extinguisher is required	<i>A</i> or <i>C</i>

Notes:

- (1) Unless otherwise specified, one of portable fire extinguishers required is to be located at or near entrance and exits in the space. If a space is locked when unmanned, portable fire extinguishers required for that space may be kept inside or outside the space.
- (2) The types of portable fire extinguishers are classified below. However, with respect to the application of the requirements specified in **R24.1.2, Part R of the Guidance for the Survey and Construction of Steel Ships**, such classifications need not apply to extinguishers which have been deemed appropriate for use at certain locations in accordance with standards approved by the relevant Administration or organizations deemed appropriate by the Society.

Fire classifications

International Organization for Standardization (ISO standard 3941)	National Fire Protection Association (NFPA 10)
Class <i>A</i> : Fire involving solid materials, usually of an organic nature, in which combustion normally takes places with the formation of glowing embers.	Class <i>A</i> : Fires in ordinary combustible materials such as wood, cloth, paper, rubber and many plastics.
Class <i>B</i> : Fires involving liquids or liquefiable solids	Class <i>B</i> : Fires in flammable liquids, oils, greases, tars, oil base paints, lacquers and flammable gases.
Class <i>C</i> : Fires involving gases.	Class <i>C</i> : Fires, which involve energized electrical equipment where the electrical non-conductivity of the extinguishing medium is of importance. (When electrical equipment is de-energized, extinguishers for class <i>A</i> or <i>B</i> fires may be used safely.)
Class <i>D</i> : Fires involving materials.	Class <i>D</i> : Fires in combustible metals such as magnesium, titanium, zirconium, sodium, lithium and potassium.
Class <i>F</i> : Fires involving cooking oils.	Class <i>K</i> : Fires involving cooking grease, fats and oils.

- (3) It is recommended that the portable fire extinguishers except **(1)** above in public spaces and workshop be located at or near the main entrances and exits.
- (4) A portable fire extinguisher required for that small space placed outside or near the entrance to that space may also be considered as part of the requirement for the space in which it is located.
- (5) If the wheelhouse is adjacent with the chartroom and has a door giving direct access to chartroom, no additional fire extinguisher is required in the chart room. The same applies to safety centers if they are within the boundaries of the wheelhouse.

Fig. 7-1-A19 Example of Corridors having only one escape route (Regulation II-2/13.3.1.2)

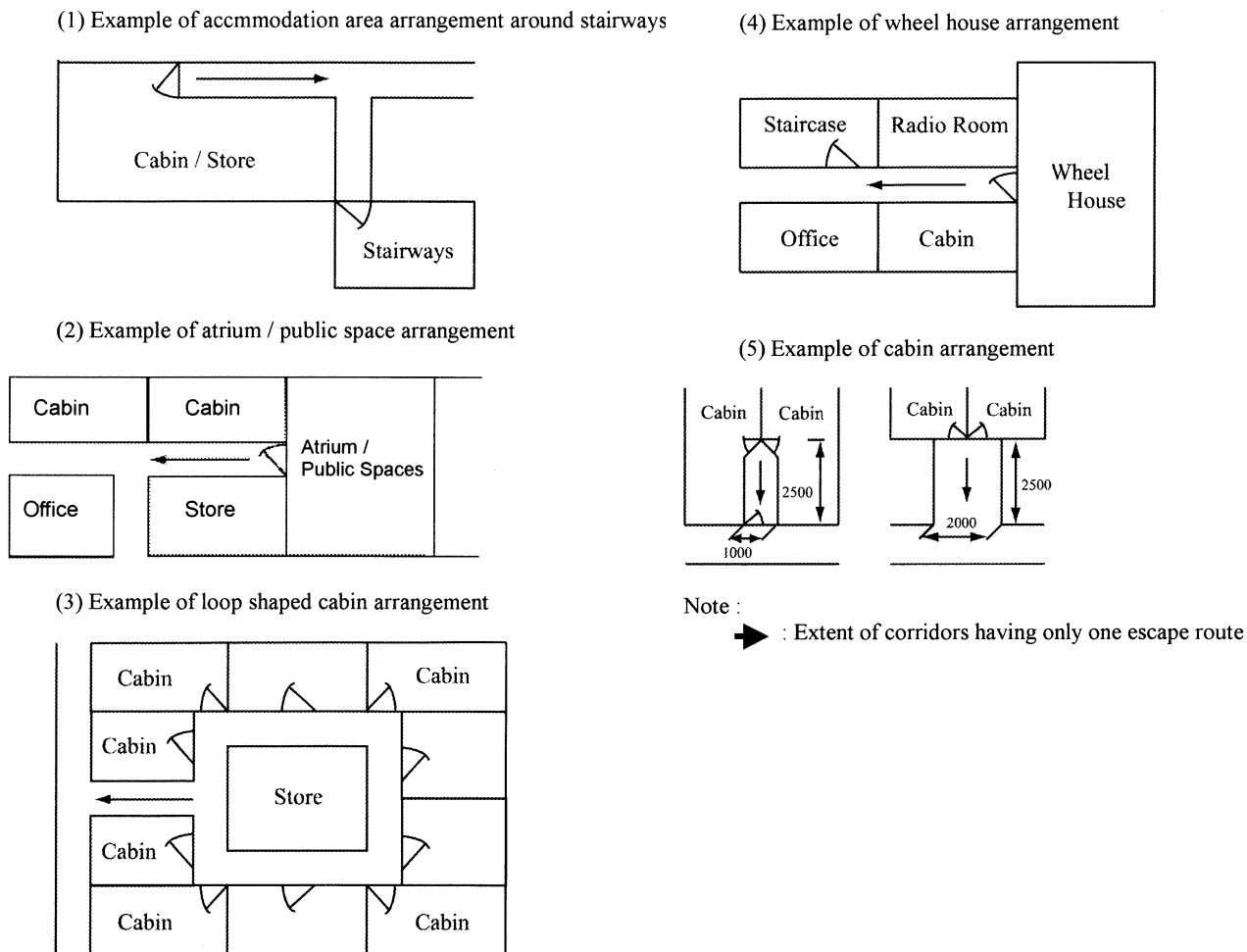


Fig. 7-1-A20 Enclosed Stairway in a Watertight Compartment (Regulation II-2/13.3.2.4.1)

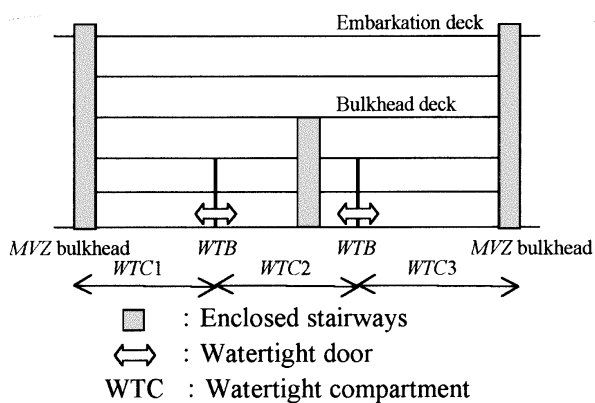




Fig. 7-1-A21 Exit from Stairways (Regulation II-2/13.3.2.4.2)

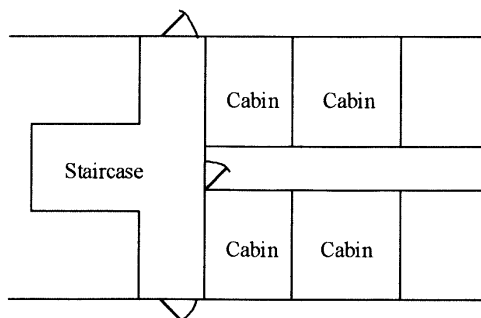
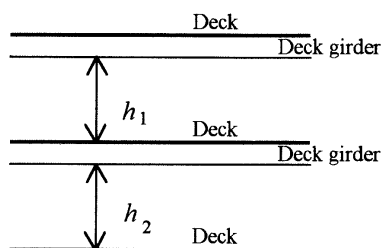
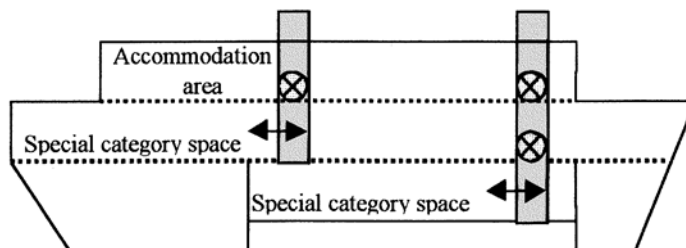


Fig. 7-1-A22 Total Overall Clear Height for Vehicles (Regulation II-2/20.2.2.1)



Total overall clear height for vehicles =  $h_1 + h_2$

Fig. 7-1-A23 Integrity of Main Vertical Zone Division (Regulation II-2/20.2.2.2)

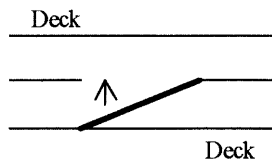


..... "A" class deck as a division of horizontal zone

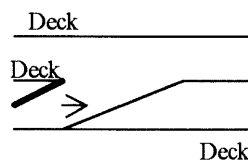


Self-closing fire damper complied with Regulation II-2/9.4.1.1.8

Fig. 7-1-A24 Integrity of "A" Class Deck (Regulation II-2/20.2.2.2)

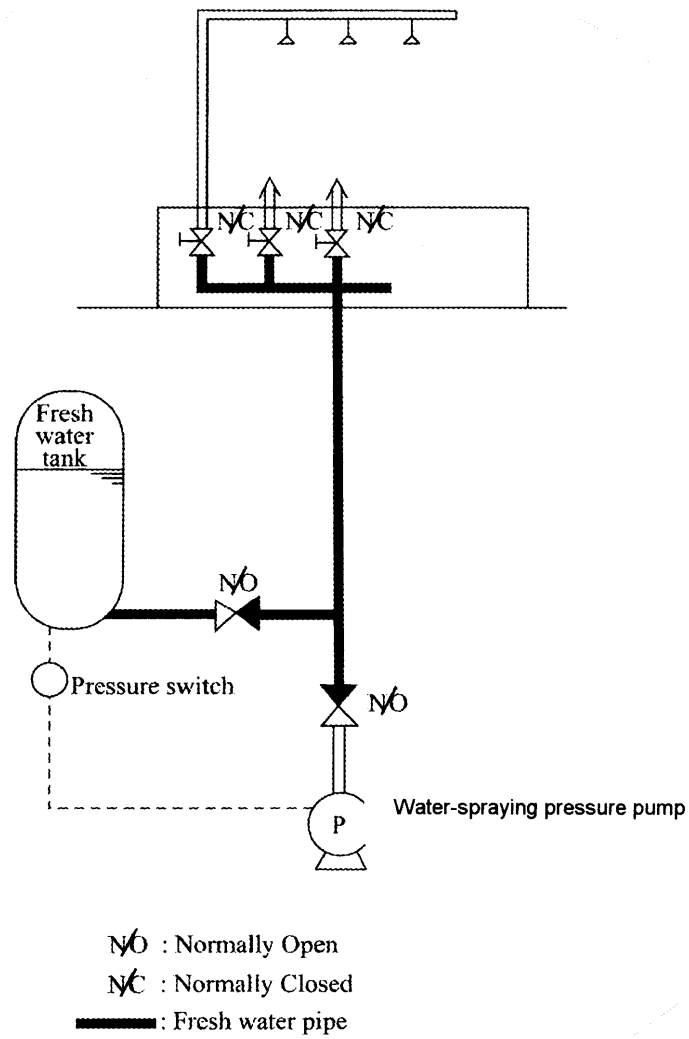


(A) Lampway cover



(B) Lampway cover door

Fig. 7-1-A25 Fixed Pressure Water-spraying System (Regulation II-2/20.6.1.4)



## 2 INTERPRETATION OF PROVISION OF FIRE SAFETY SYSTEMS CODE

### 2.1 Interpretation

Interpretation of provision of the International Code for Fire Safety Systems (Res. MSC.98(73), hereinafter, referred to as *FSS Code*) on passenger ships are to be in accordance with [Table 7-1-B1](#). Figures and tables referred to in interpretations of provision are to comply with [2.2](#).

Table 7-1-B1 Interpretations of FSS Code

Number	FSS Code	Interpretations
FSS 3.2.1.2.2	Compressed air breathing apparatus shall be fitted with an audible alarm and a <i>visual</i> or other <i>device</i> * which will alert the user before the volume of the air in the cylinder has been reduced to no less than 200 l.	*: For a “visual device”, refer to <a href="#">R23.2.1-5, Part R of the Guidance for the Survey and Construction of Steel Ships</a> .
FSS 4.2	All fire extinguishers shall be of <u>approved types and designs</u> * based on the guidelines developed by the Organization.	*: Fire extinguishers are to be in accordance with requirements of <a href="#">R24.1.2, Part R of the Guidance for the Survey and Construction of Steel Ships</a> .
FSS 4.3.1.1.1	Each powder or carbon dioxide extinguisher shall have a capacity of at least 5kg and each foam extinguishers shall have a capacity of at least 9l. The mass of all portable fire extinguishers shall not exceed 23kg and they shall have a fire-extinguishing <u>capability at least equivalent</u> * to that of a 9l fluid extinguisher.	*: Fire extinguishers are to be in accordance with requirements of <a href="#">R24.2.1, Part R of the Guidance for the Survey and Construction of Steel Ships</a> . The types and specific use of extinguishers are to be as given in <a href="#">Table R10.3.2-1, Part R of the Guidance for the Survey and Construction of Steel Ships</a> .
FSS 5.2.1.1.4	Containers for the storage of fire-extinguishing medium and associated pressure components shall be designed to <u>pressure codes of practice to the satisfaction of the Administration</u> having regard to their locations and <u>maximum ambient temperatures</u> * expected in service.	*: For the bulkheads or decks forming the boundaries of the spaces stowed with carbon dioxide gas as a medium of the fire-extinguishing systems, sufficient consideration is to be given so as not to permit the internal temperature rises above 55°C.
FSS 5.2.1.2.3	<u>Spare parts</u> * for the system shall be stored on board and be to the satisfaction of the Administration.	*: The “spare parts” means the rupture seals (including those for activating and their packing) for all containers and rupture discs (including those for activating and their packing) for 1/3 of all containers, packings and o-rings for spare charge for 1/10 of all containers and tools for maintenance and survey.
FSS 5.2.1.3.2	Means shall be provided for automatically giving a audible and visual warning of the release of fire-extinguishing medium into any ro-ro spaces, container holds equipped with integral reefers containers, spaces accessible by doors or hatches, and other spaces in which personnel normally work or to which they have access. The audible alarms shall be located so as to be audible throughout the protected space with all machinery operatin	*: Refer to <a href="#">R25.2.1-7, Part R of the Guidance for the Survey and Construction of Steel Ships</a> for the definition of “conventional cargo spaces”.

	g, and the alarms should be distinguished from other audible alarms by adjustment of sound pressure or sound patterns. The pre-discharge alarm shall be automatically activated (e.g., by opening of the release cabinet door). The alarm shall operate for the length of time needed to evacuate the space, but in no case less than 20 s before the medium is released. <u>Conventional cargo spaces*</u> and small spaces (such as compressor rooms, paint lockers, etc.) with only a local release need not be provided with such an alarm.	
FSS 5.2.1.3.3	The means of control of any fixed gas fire-extinguishing system shall be readily accessible, simple to operate and shall <u>be grouped together in as few locations as possible at positions not likely to be cut off by a fire in a protected space</u> <sup>*1</sup> . At each location there shall be clear instructions relating to <u>the operation of the system</u> <sup>*2</sup> having regard to the safety of personnel.	*1: The arrangement of “means of control of any fixed gas fire-extinguishing medium (including control valves for the release of different quantities of the media into different cargo holds)” is to comply with <b>R25.2.1-4 to -6, Part R of the Guidance for the Survey and Construction of Steel Ships</b> . *2: The control of any fixed gas fire-extinguishing system used CO <sub>2</sub> as a medium is to comply with <b>R25.2.2-3, Part R of the Guidance for the Survey and Construction of Steel Ships</b> .
FSS 5.2.2	<u>Carbon dioxide systems*</u>	*: The carbon dioxide systems are to comply with <b>R25.2.2, Part R of the Guidance for the Survey and Construction of Steel Ships</b> .
FSS 6.3.2.1.2	Sufficient foam generating-capacity shall be provided to ensure the minimum design filling rate for the system is met and in addition shall be adequate to completely fill <u>the largest protected space*</u> within 10 min.	*: The largest protected space within a machinery space of category A is to be in accordance with <b>R26.3.2, Part R of the Guidance for the Survey and Construction of Steel Ships</b> .
FSS 6.3.3.1.2	Sufficient foam generating-capacity shall be provided to ensure the minimum design filling rate for the system is met and in addition shall be adequate to completely fill <u>the largest protected space*</u> within 10 min.	*: The largest protected space within a machinery space of category A is to be in accordance with <b>R26.3.3, Part R of the Guidance for the Survey and Construction of Steel Ships</b> .
FSS 6.4.1.2	The system shall be capable of discharging through fixed discharge outlets, in no more than 5min, a quantity of foam sufficient to produce an effective foam blanket over <u>the largest single area over which oil fuel is liable to spread*</u> .	*: The “largest single area over which oil fuel is liable to spread” is to be in accordance with <b>R26.4.1-2, Part R of the Guidance for the Survey and Construction of Steel Ships</b> .
FSS 7.2.1	The fixed pressure water-spraying fire-extinguishing systems for machinery spaces and cargo pump rooms shall be approved by the Administration based on <u>the guidelines developed by the Organization*</u> .	* Such systems are to be in accordance with MSC/Circ. 1165 (including amendments made by MSC.1/Circ.1269 and MSC.1/Circ.1386) and MSC.1/Circ.1458.
FSS 7.2.2	The equivalent water-mist fire-extinguishing systems for machinery spaces and cargo pump rooms shall be approved by the Administration based on <u>the guidelines developed by the Organization*</u> .	* Such systems are to be in accordance with MSC/Circ. 1165 (including amendments made by MSC.1/Circ.1269 and MSC.1/Circ.1386) and MSC.1/Circ.1458.
FSS 8.2.1.1	Type of sprinkler systems The automatic sprinkler systems shall be of the wet pipe type, but <u>small exposed sections*</u> may	*: The wording “small exposed sections” means the case where pipings in a store room or a similar space are exposed to the room or space and doesn’t mean t

	<p>be of the dry pipe type where, in the opinion of the Administration, this is a necessary precaution. Control stations, where water may cause damage to essential equipment, may be fitted with a dry pipe system or a pre-action system as permitted by regulation II-2/10.6.1.1 of the Convention. Saunas shall be fitted with a dry pipe system, with sprinkler heads having an operating temperature up to 140°C.</p>	<p>the case where the pipings are exposed to external atmosphere.</p> <p>(1) closed, wet pipe type This type is filled with pressurized water in the pipe at all times and sprays with the activation of sprinkler head in the event of fire and contains a fire detection system.</p> <p>(2) closed, dry pipe type This type retains pressurized air in the pipe to keep the balance with the water pressure in dry valve and sprays by opening dry valve where air pressure drops at the activation of sprinkler head and contains a fire detection system. This type is suitable against freezing.</p>
FSS 8.2.2.1	<p>Passenger ships</p> <p>There shall be not less than two sources of power supply for the sea water pump and automatic alarm and detection system. Where the sources of power for the pump are electrical, these shall be a main generator and an emergency source of power. One supply for the pump shall be taken from the main switchboard, and one from the emergency switchboard by separate feeders reserved solely for that purpose. The feeders shall be so arranged as to avoid galleys, machinery spaces and <i>other enclosed spaces of high fire risk</i>*<sup>1</sup> except <u><i>in so far as it is necessary to reach the appropriate switchboards</i></u>*<sup>2</sup>, and shall be run to an automatic changeover switch situated near the sprinkler pump. This switch shall permit the supply of power from the main switchboard so long as a supply is available therefrom, and be so designed that upon failure of that supply it will automatically change over to the supply from the emergency switchboard. The switches on the main switchboard and the emergency switchboard shall be clearly labelled and normally kept closed. No other switch shall be permitted in the feeders concerned. One of the sources of power supply for the alarm and detection system shall be an emergency source. Where one of the sources of power for the pump is an internal combustion engine it shall, in addition to complying with the provisions of paragraph 2.4.3, be so situated that a fire in any protected space will not affect the air supply to the machinery.</p>	<p>*1: The wording “other enclosed spaces of higher risk” means drying rooms, special category spaces and “accommodation spaces of greater fire risk” specified in regulation 9.2.2.3.2.2(8) and “other spaces in which flammable liquids are stowed” specified in regulation 9.2.2.3.2.2(14) and “service spaces (high risk)” (However, lockers are not included.) in regulation 9.2.2.4.2.2(9).</p> <p>*2: Where the cable pass through galleys, machinery spaces and other enclosed spaces of high fire risk, these cables are to be laid in insulated steel pipes or steel ducts equivalent to A-60 or more unless fire resistant cables which have passed the test of IEC331 or equivalent thereto are used.</p>
FSS 8.2.3.1.1	<p>The sprinklers shall be <u><i>resistant to corrosion</i></u>* by the marine atmosphere. In accommodation and service spaces the sprinklers shall come into operation</p>	<p>*: The sprinkler head is to be of corrosion resistant materials such as SUS or brass. The pipings for sprinkler may be of SGP suitably galvanized.</p>

	within the temperature range from 68°C to 79°C, except that in locations such as drying rooms, where high ambient temperatures might be expected, the operating temperature may be increased by not more than 30°C above the maximum deckhead temperature.	
FSS 8.2.3.2.1	<i>A pressure tank having a volume equal to at least twice that of the charge of water specified in this paragraph</i> <sup>*1</sup> shall be provided. The tank shall contain a standing charge of fresh water, equivalent to the amount of water which would be discharged in 1min by the pump referred to in paragraph 2.3.3.2, and <u>the arrangements shall provide for maintaining an air pressure in the tank</u> <sup>*2</sup> such as to ensure that where the standing charge of fresh water in the tank has been used the pressure will be not less than the working pressure of the sprinkler, plus the pressure exerted by a head of water measured from the bottom of the tank to the highest sprinkler in the system. Suitable means of replenishing the air under pressure and of replenishing the fresh water charge in the tank shall be provided. A glass gauge shall be provided to indicate the correct level of the water in the tank.	<p>*1: The capacities of pressure tanks for automatic sprinkler systems are to be in accordance with <i>MSC.1/Circ.1556</i>.</p> <p>*2: In general, the air pressure in the tank is to be kept by starting a compressor automatically to supply air to the tank. However, where the sprinkler is designed to keep the rated pressure until the sprinkler pump is operated after the activation of sprinkler head, the air supply by compressor is not required.</p> <p>(Fig. 7-1-B1 is shown as an example of automatic sprinkler system.)</p>
FSS 8.2.3.3.1	An independent power pump shall be provided solely for the purpose of continuing automatically the discharge of water from the sprinklers. The pump shall <u>be brought into action automatically</u> * by the pressure drop in the system before the standing fresh water charge in the pressure tank is completely exhausted.	*: The sprinkler pumps are to be capable of providing water before the all standing fresh water is discharged from the pressure tank and of maintaining at the pressure required in regulation 8.2.3.2.1.
FSS 8.2.3.3.2	The pump and the piping system shall be capable of maintaining the necessary pressure at the level of the highest sprinkler to ensure a continuous output of water sufficient for the simultaneous coverage of a minimum area of 280 m <sup>2</sup> at the application rate specified in paragraph 2.5.2.3. The hydraulic <i>capability of the system</i> * shall be confirmed by the review of hydraulic calculations, followed by a test of the system, if deemed necessary by the Administration.	*: The capacities of pumps for automatic sprinkler systems are to be in accordance with <i>MSC.1/Circ.1556</i> .
FSS 8.2.4.2.1	Sprinklers shall be grouped into separate sections, each of which shall contain not more than 200 sprinklers. In passenger ships, any section of sprinklers shall not serve more than two decks and shall not be situated in more than one main vertical zone. However, the Administration may permit such a	*: The case where “it is satisfied that the protection of the ship against fire will not thereby be reduced” means the case considered not impairing safety even if a section of sprinklers to serve includes narrow accommodation spaces, etc.

	section of sprinklers to serve more than two decks or be situated in more than one main vertical zone, if <u>it is satisfied that the protection of the ship against fire will not thereby be reduced*</u>	
FSS 8.2.4.2.2	Each section of sprinklers shall be capable of being isolated by one stop-valve only. The stop-valve in each section shall be readily accessible in a location outside of the associated section or in cabinets within stairway enclosures. The valve's location shall be clearly and permanently indicated. <u>Means shall be provided to prevent the operation of the stop-valves by any unauthorized person.*</u>	*: The wording “means to prevent the operation of the stop valves by any unauthorized person” means, for example, a warning sign. The stop valves are to be provided in spaces where unauthorized person is not accessible.
FSS 8.2.4.2.5	A gauge indicating the pressure in the system shall be provided at each section stop-valve and at <b>a central station*</b> .	*: The wording “central station” means a navigation bridge or a main fire control station.
FSS 8.2.4.3	Location of systems The sprinkler pump and tank shall be situated <u>in a position reasonably remote*</u> from any machinery space of category <i>A</i> and shall not be situated in any space required to be protected by the sprinkler system.	*: Position reasonably remote from any machinery space of category <i>A</i> does not mean that the sprinkler pump and tank is not to be located at the spaces adjacent to machinery space of category <i>A</i> but that they are located at the position reasonably remote from bulkheads adjacent to machinery space of category <i>A</i> such as shown in <b>Fig7-1-B2</b> .
FSS 8.2.5.2.1	Each section of sprinklers shall include means for giving a visual and audible alarm signal automatically at one or more indicating units <u>whenever any sprinkler comes into operation</u> <sup>*1</sup> . Such alarm systems shall be such as to indicate <u>if any fault occurs in the system</u> <sup>*2</sup> . Such units shall indicate in which section served by the system a fire has occurred and shall be centralized on the navigation bridge, or in the continuously-manned central control station and, in addition, visible and audible alarms from the unit shall also be placed in a position other than on the aforementioned spaces to ensure that the indication of fire is immediately received by the crew.	*1: The case where sprinkler comes into operation means both of the following conditions. (1) the operating condition of sprinkler head (2) the operating condition of sprinkler pump *2: The case where the fault occurs in the system means the following: (1) drop of water level in the pressure tank (2) drop of pressure in the pressure tank (3) (main and emergency) power failure of sprinkler pump (4) break down of visual and audible fault signal
FSS 9.2.1.2.4	The system may be arranged with output signals to other fire safety systems including; .1 paging systems, fire alarm or public address systems; .2 fan stops; .3 <b>fire doors*</b> ; .4 fire dampers; .5 sprinkler systems .6 smoke extraction systems .7 low-location lighting systems .8 fixed local application fire-extinguishing systems; .9 closed circuit television (CCTV) systems; and .10 other fire safety systems.	* : Watertight doors complying with <b>2.2.2.3, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships</b> which also serve as fire doors are not to close automatically in the case of fire detection.

FSS 9.2.2.4	The emergency source of power specified in paragraph <b>2.2.1</b> above may be supplied by accumulator batteries or from the emergency switchboard. The power source shall be sufficient to maintain the operation of the fire detection and fire alarm system for the periods required under chapter <b>II-1</b> , regulations <b>42</b> and <b>43</b> , of the Convention and, at the end of that period, shall be capable of operating all connected visual and audible fire alarm signals for a period of at least <b>30 min</b> *.	*: “30 min” means the last 30 minutes of the 36-hour time period required by <b>2.3, Part 6 of the Rules</b> .
FSS 9.2.3.1.1	Detectors shall be operated by heat, smoke or other products of combustion, flame, or any combination of these factors. Detectors operated by other factors indicative of incipient fires may be considered by the Administration provided that <u>they are no less sensitive than such detectors</u> *.	*: In spaces such as provision refrigerating chambers where a state of low temperature is maintained and fire detection is not operated easily, where means are provided in the temperature control so that audible and visible alarms are generated on the control panel and display panel in the event that the temperature of such spaces rises abnormally, the temperature control system may be deemed as the fire detection and alarm systems specified in the above-mentioned requirements.
FSS 9.2.3.1.3	Heat detectors shall be certified to operate before the temperature exceeds 78°C but not until the temperature exceeds 54°C, when the temperature is raised to those limits at a rate less than 1°C per min, when tested according to standards EN 54:2001 and IEC 60092-504. Alternative testing standards may be used as determined by the Administration. At higher rates of temperature rise, the heat detector shall operate within <u>temperature limits</u> * to the satisfaction of the Administration having regard to the avoidance of detector insensitivity or oversensitivity.	*: The “temperature limit” is to comply with <b>R29.2.3-1(3), Part R of the Guidance for the Surveys and Construction of Steel Ships</b> for constant temperature type spot detectors and compensation type spot detectors.
FSS 9.2.4.2.1	Detectors shall be located <u>for optimum performance</u> *. Positions near beams and ventilation ducts, or other positions where patterns of air flow could adversely affect performance, and positions where impact or physical damage is likely, shall be avoided. Detectors shall be located on the overhead at a minimum distance of 0.5m away from bulkheads, except in corridors, lockers and stairways.	*: Installation of detectors is to be in accordance with the requirements in <b>5.2.13-2, Part R of the Rules for the Survey and Construction of the Steel Ships</b> .
FSS 9.2.4.2.3	Detectors in stairways shall be located at least at the top level of the stair and at every second level beneath.	Detectors provided at inside the stairway enclosures are, in principle, to be installed on the ceiling of the upper deck of the two decks which are connected by the stairs (See <b>Fig. 7-1-B3(1)</b> ). However, in cases where the stairway enclosure is continuous throughout the all decks, one detector is to comply with the requirements specified in <b>9.2.4.2.3</b> and to be located at every intervals not exceeding 11 m (See <b>Fig. 7-1-B3(2)</b> ).
FSS	Cables which form part of the system shall be so	*: The wording “other enclosed spaces of higher risk”



9.2.4.3.1	arranged as to avoid galleys, machinery spaces of category <i>A</i> , and <u><b>other enclosed spaces of high fire risk*</b></u> except where it is necessary to provide fire detection or fire alarm in such spaces or to connect to the appropriate power supply.	k” means drying rooms, special category spaces and “accommodation spaces of greater fire risk” specified in regulation <b>9.2.2.3.2.2(8)</b> and “other spaces in which flammable liquids are stowed” specified in regulation <b>9.2.2.3.2.2(14)</b> and “service spaces (high risk)” (However, lockers are not included.) in regulation <b>9.2.2.4.2.2(9)</b> .
FSS 9.2.5.1.1	The activation of any detector or manually operated call point shall initiate a visual and audible fire detection alarm signal at the <u><b>control panel and indicating units*</b></u> . If the signals have not been acknowledged within 2 <i>min</i> , an audible fire alarm shall be automatically sounded throughout the crew accommodation and service spaces, control stations and machinery spaces of category <i>A</i> . This alarm sounder system need not be an integral part of the detection system.	*: The control panels have two functions of control and indication, and the indicating units have only function of indication. In the requirements relating to regulation <b>9</b> , this interpretation is to be referred to.
FSS 9.2.5.1.5	Power supplies and electric circuits necessary for the operation of the system shall <u><b>be monitored*</b></u> for loss of power or fault conditions as appropriate including: .1 a single open or power break fault caused by a broken wire; .2 a single ground fault caused by the contact of a wiring conductor to a metal component; and .3 a single wire to wire fault caused by the contact of two or more wiring conductors. Occurrence of a fault condition shall initiate a visual and audible fault signal at the control panel which shall be distinct from a fire signal.	*: In the event of the loss of power or fault condition, means are to be provided so that audible and visible signal is automatically to be monitored until the loss is restored. In this case, where there is provided with switch gear to stop audible alarm, the signal of stopping audible alarm is to be monitored automatically.
FSS 9.2.5.2	Testing Suitable instructions and <u><b>component spares*</b></u> for testing and maintenance shall be provided. Detectors shall be periodically tested using equipment suitable for the types of fires to which the detector is designed to respond. <b><i>On ships constructed on or after 1 July 2014, detectors installed within cold spaces such as refrigerated compartments shall be tested using procedures having due regard for such locations.</i></b> **_Ships with self-diagnostic systems that have in place a cleaning regime for areas where heads may be prone to contamination may carry out testing in accordance with the requirements of the Administration.  ** Refer to the recommendations of the International Electrotechnical Commission, in particular publication <i>IEC 60068-2-1 – Section one - Test Ab, En</i>	*: The wording “component spares” means the following: (1) Spare detectors are to be provided for 5% for each type of detectors. In this case, at least of 2 (1, where the number of type of detectors is not more than 5) detectors are to be provided for each type of detectors on board. (2) Replaceable parts on control panels and display such as fuses and lamps (Spare parts are to be provided for 100%). (3) Tools for operation test of smoke or heat detectors.

	<i>Environmental Testing - Part 2-1: Tests - Test A: Cold.</i>	
FSS 10.2.4.1.2	The control panel shall be located on the navigation bridge or in <b>the fire control station</b> *. An indicating unit shall be located on the navigation bridge if the control panel is located in <b>the fire control station</b> *.	*: The fire control station is to be in accordance with requirements of <b>R30.2.4, Part R of the Guidance for the Survey and Construction of Steel Ships</b> .
FSS 11.2.1	Any <b>required low-location lighting systems</b> * shall be approved by the Administration based on the guidelines developed by the Organization, or to an international standard acceptable to the Organization.	<p>*: Reference is made to <b>Annex 7-3 - GUIDELINES FOR EVALUATION, TESTING AND APPLICATION OF LOW-LOCATION LIGHTING</b> (hereinafter referred to as "LLL") <b>ON PASSENGER SHIPS (IMO Resolution A752(18))</b>. Furthermore, the requirement for electric LLL is to comply with the follows;</p> <p>(1) The requirement for the electric power supply of emergency electric power source is to comply with paragraph <b>2.3, Part 6 of the Rules</b>.</p> <p>(2) The power supply circuit to the LLL are to be arranged such that a single fault in the circuit does not result in the complete loss of the lighting in any fire zone and a fire in one fire zone does not result in loss of the lighting in any other fire zone. For this purpose, the power supply circuits are to be used the fire resistant cables complying with IEC Publication 331 or may supply by the independent batteries which located adequate place and can supply for LLL for at least 60 <i>minutes</i>.</p> <p>(3) Single lights and lighting assemblies are to be designed or arranged so that any single fault or failure in a light or lighting assembly, other than a short circuit, will not result in non visible area exceeding 1m in continuous lighting.</p> <p>(4) Lighting fixtures and assemblies are to be flame retardant as a minimum, have an ingress protection of at least <i>IP55</i> and are to meet the type test requirements as specified in <b>UR E10</b>.</p> <p>(5) The LLL system is to be capable of being manually activated by a single action from the continuously manned central control station. However it may be acceptable by continuously operating or be switched on automatically, e.g. by the presence of smoke within the space(s) being served.</p> <p>(6) The electric LLL systems are to achieve the following minimum luminance:</p> <p>(a) For any planar source:- 10cd/m<sup>2</sup> from the active parts in a continuous line of 15mm minimum width;</p> <p>(b) For any point source:- 35mcd in the typical track directions of approach and viewing which is</p>

		<p>to be considered;</p> <p>(i) For sources which are required to be viewed from a horizontal position, i.e. deck mounted or horizontally bulkhead mounted fittings, within a 60 degrees cone having its centre located 30 degrees from the horizontal mounting surface of the point source and in line with the track direction. (see <b>Fig. 7-1-B4(1)</b>)</p> <p>(ii) For sources which are required to be viewed vertically, i.e. the vertical LLL marking up to the door handles, within a 60 degrees cone having its centre located perpendicular to the mounting service of the point source. (see <b>Fig. 7-1-B4(2)</b>)</p> <p>Spacing between sources is not to exceed 300mm.</p> <p>(7) The lights or lighting assemblies are to be continuous except as interrupted by constructional constraints, such as corridors or cabin doors etc. and are to provide a visible delineation along the escape route and, where applicable, are to lead to the exit door handles. Interruption of the LLL system, due to constructional constraints is not to exceed 2metres.</p> <p>(8) The lighting is to be provided on at least one side of the corridor or stairway. In corridors and stairways, in excess of 2meters width, lighting is to be provided on both sides.</p> <p>(9) In corridors the lighting is to be installed either on the bulkhead within 300mm from the deck or on the deck within 150mm from the bulkhead.</p> <p>(10) The lighting in stairways is to be installed within 300mm above the steps in order to be easily identified from either above or below the stairways.</p> <p>(11) The condition of the LLL system and its power source(s) is to be verified every 5 years.</p>
FFS 12.2.2.1.1	<p>Capacity of the pump</p> <p>The capacity of the pump shall not be less than 40% of the total capacity of the fire pumps required by <i>SOLAS</i> regulation <b>II-2/10.2.2.4.1</b>. and in any case not less than the follow:</p> <p>.1 for passenger ships less than 1,000 <i>gross tonnage</i> and for cargo ships of 2,000 <i>gross tonnage</i> and upwards <math>25m^3/h</math> ; and</p> <p>.2 for cargo ships less than 2,000 <i>gross tonnage</i> <math>15m^3/h</math></p>	<p>If the emergency fire pump is the main supply of water for any fixed fire extinguishing system provided to protect the space where the main fire pumps are located, the pump is to have the capacity for this system and , in addition, the capacity required by this requirement.</p>
FSS 12.2.2.1.3	<p>Suction heads</p> <p>The total suction head and the net positive suction</p>	<p>The emergency fire pump is to be of the self-priming type.</p>

	<p>head of the pump shall be determined having due regard to the requirements of the Convention and this chapter on the pump capacity and on the hydrant pressure under all conditions of list, trim, roll and pitch likely to be encountered in service.</p> <p>The ballast condition of a ship on entering or leaving a dry dock need not be considered a service condition.</p>	
FSS 13.2.1.1	<p>Basic requirements for stairway width</p> <p>Stairways shall not be less than 900mm in clear width. The minimum clear width of stairways shall be increased by 10mm for every one person provided for in excess of 90 persons. The total number of persons to be evacuated by such stairways shall be assumed to be two thirds of the crew and the total number of passengers in the areas served by such stairways. <b><u>The width of the stairways shall not be inferior to those determined by paragraph 2.1.2.*</u></b></p>	<p>*: When the total width of the exit of stairway on deck which the master station is situated in is calculated by the width of all stairway which reach this deck, the actual result may be used for stairways which are decided the width by minimum value (900mm).</p>
FSS 13.2.2.4	<p>Landings</p> <p>With the exception of intermediate landings, <b><u>landings*</u></b> at each deck level shall be not less than 2m<sup>2</sup> in area and shall increase by 1m<sup>2</sup> for every 10 persons provided for in excess of 20 persons, but need not exceed 16m<sup>2</sup>, except for those landings servicing public spaces having direct access onto the stairway enclosure. Intermediate landings shall be sized in accordance with paragraph 2.3.1.</p>	<p>*: If landings can be entered directly via entrance doors, situated in stairway enclosures, the area of such landings is to comply with this requirements. However, if landings can not be entered by entrance doors, such landings are to be considered as intermediate landings which are comply with the capacity requirements as given in 13.2.3.1.</p>
FSS 13.2.3.1	<p><b><u>Doorways*</u></b> and corridors and intermediate landings included in means of escape shall be sized in the same manner as stairways.</p>	<p>*: The width of all doors (which are situated in stairways and between corridors and the exit from stairways to exposed spaces), corridors and landings is to be at least 900mm. However, the door of the exit from passenger rooms to corridors, the door of the exit from public rooms to corridors (which are differently required the width of at least 600mm) and the doors of emergency exit required to regulation II-2/13.7.1.4 need not to be applied them.</p>

## 2.2 Figures and Tables Referred to in Interpretation of FSS Code

Fig. 7-1-B1 Example of Automatic Sprinkler System (FSS 8.2.3.2.1)

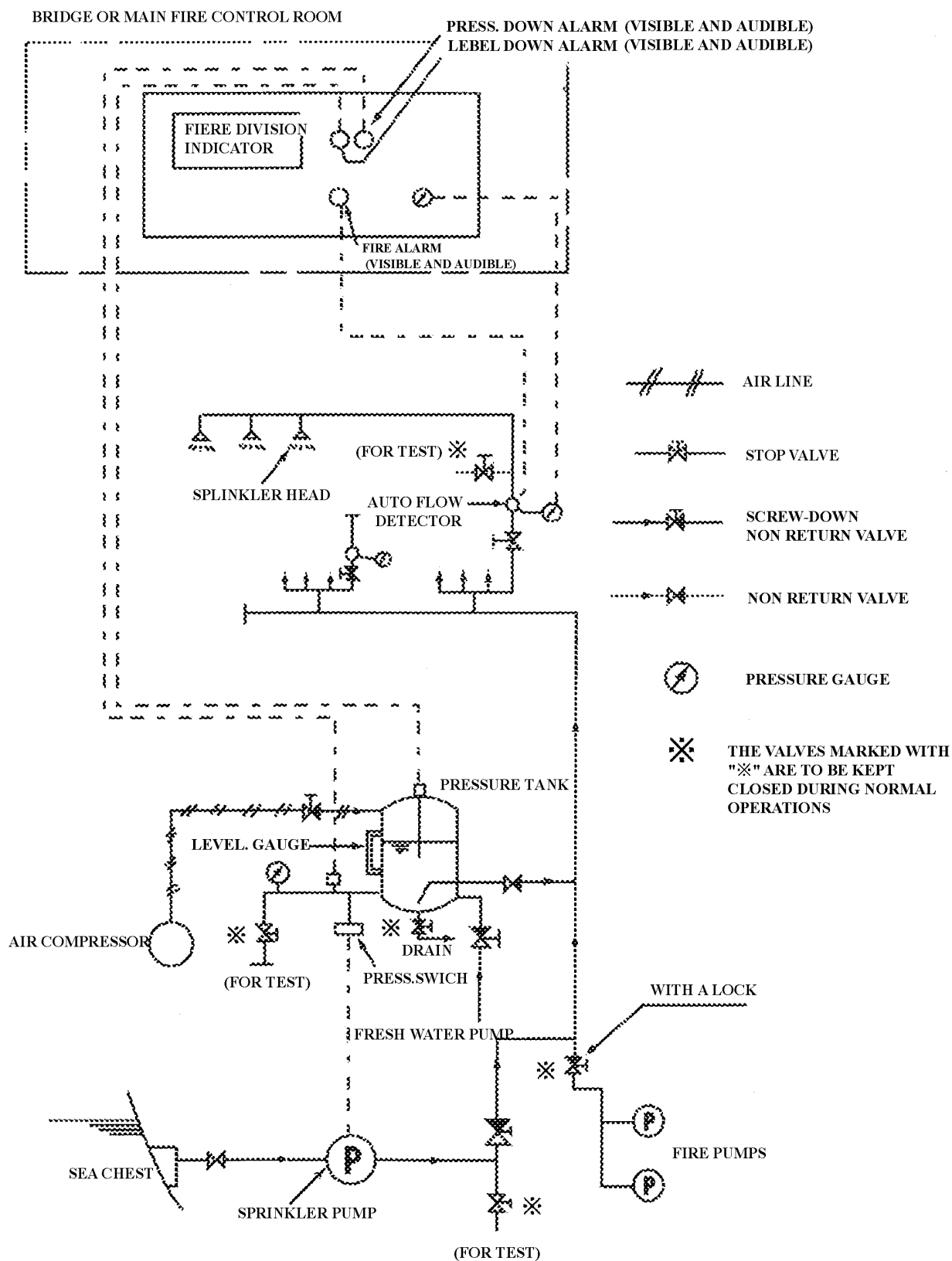


Fig. 7-1-B2 Arrangement of Sprinkler Pump (FSS 8.2.4.3)

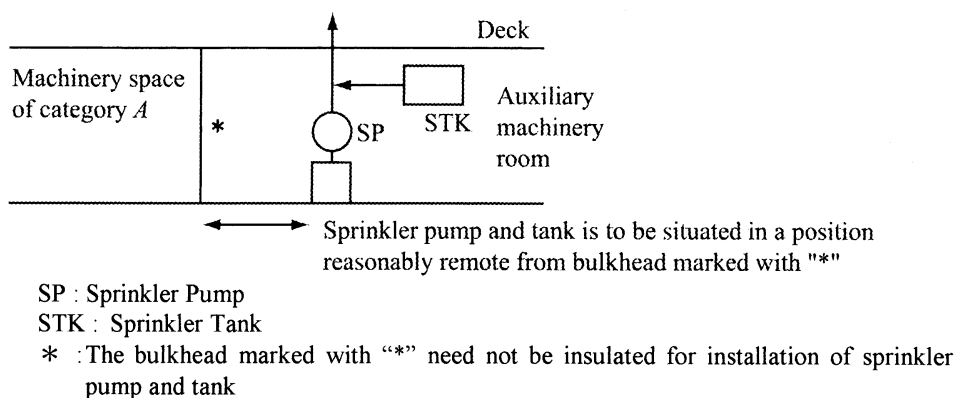


Fig. 7-1-B3 Arrangements of Fire Detectors within Stairway Enclosures (FSS 9.2.4.2.3)

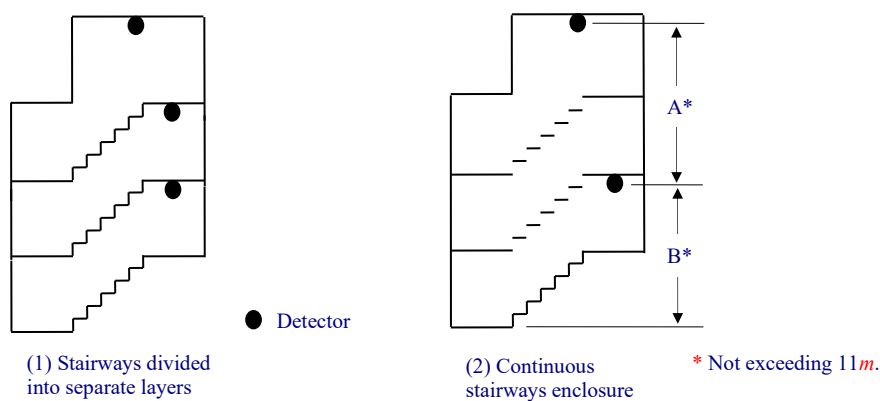
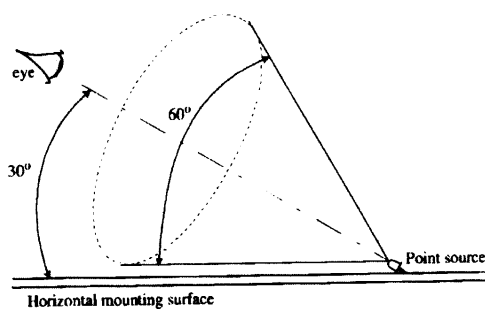
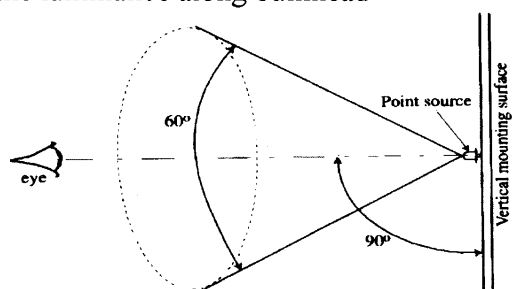


Fig. 7-1-B4 Location for Measuring Luminance of Powered LLL (FSS 11.2.1.1)

(1) Location for measuring the luminance on deck



(2) Location for measuring the luminance along bulkhead



## Annex 7-2 STANDARDS FOR THE CALCULATION OF THE WIDTH OF STAIRWAYS FORMING MEANS OF ESCAPE ON PASSENGER SHIPS (IMO RESOLUTION A.757(18) ADOPTED ON 4 NOVEMBER 1993)

### 1.1.1 Scope

1 These standards should be used when applying regulation II-2/28.1.5.1 of the 1974 *SOLAS* Convention as amended by resolution MSC.27(61).

2 It should be recognized that the evacuation routes to the embarkation deck may include a muster station. In this case consideration should be given to the fire-protection requirements and sizing of corridors and doors from the stairway enclosure to the muster station and from the muster station to the embarkation deck using these guidelines noting that evacuation of persons from muster stations to embarkation positions will be carried out in small controlled groups.

3 It is the intention that the calculation method should consider evacuation from enclosed spaces within each main vertical zone individually and take into account all of the persons using the stairway enclosures in each zone, even if they enter that stairway from another main vertical zone.

4 For each main vertical zone the calculation should be completed for the night time (case 1) and day time (case 2) and the largest dimension from either case used for determining the stairway width for each deck under consideration.

5 The calculation method determines the stairway width at each deck level taking into account the three consecutive stairways leading into the stairway under consideration.

### 1.1.2 Calculation of the Stairway Widths

1 In considering the design of stairway widths for each individual case which allow for the timely flow of persons evacuating to the muster stations from adjacent decks above and below, the following calculation method should be used (see Fig. 7-2-1 and Fig. 7-2-2):

when joining two decks:  $W = (N1+N2) \times 10 \text{ mm};$

when joining three decks:  $W = (N1+N2 + 0.5 \times N3) \times 10 \text{ mm};$

when joining four decks:  $W = (N1+N2 + 0.5 \times N3 + 0.25 \times N4) \times 10 \text{ mm};$

when joining five or more decks the width of the stairways should be determined by applying the above formula for four decks to the deck under consideration and to the consecutive deck,

where:

$W$  = the required tread width between handrails of the stairway.

The calculated value of “ $W$ ” may be reduced where available landing area “ $S$ ” is provided in stairways at the deck level defined by subtracting “ $P$ ” from “ $Z$ ”, such that:

$$P = S \times 3.0 \text{ persons/m}^2; \quad P_{\max} = 0.25 Z$$

where:

$Z$  = the total number of persons expected to be evacuated on the deck being considered;

$P$  = the number of persons taking temporary refuge on the stairway landing, which may be subtracted from “ $Z$ ” to a maximum value of  $P = 0.25 Z$  (to be rounded down to the nearest whole number);

$S$  = the surface area ( $m^2$ ) of the landing, minus the surface area necessary for the opening of doors and minus the surface area necessary for accessing the flow on stairs (see Fig. 7-2-1);

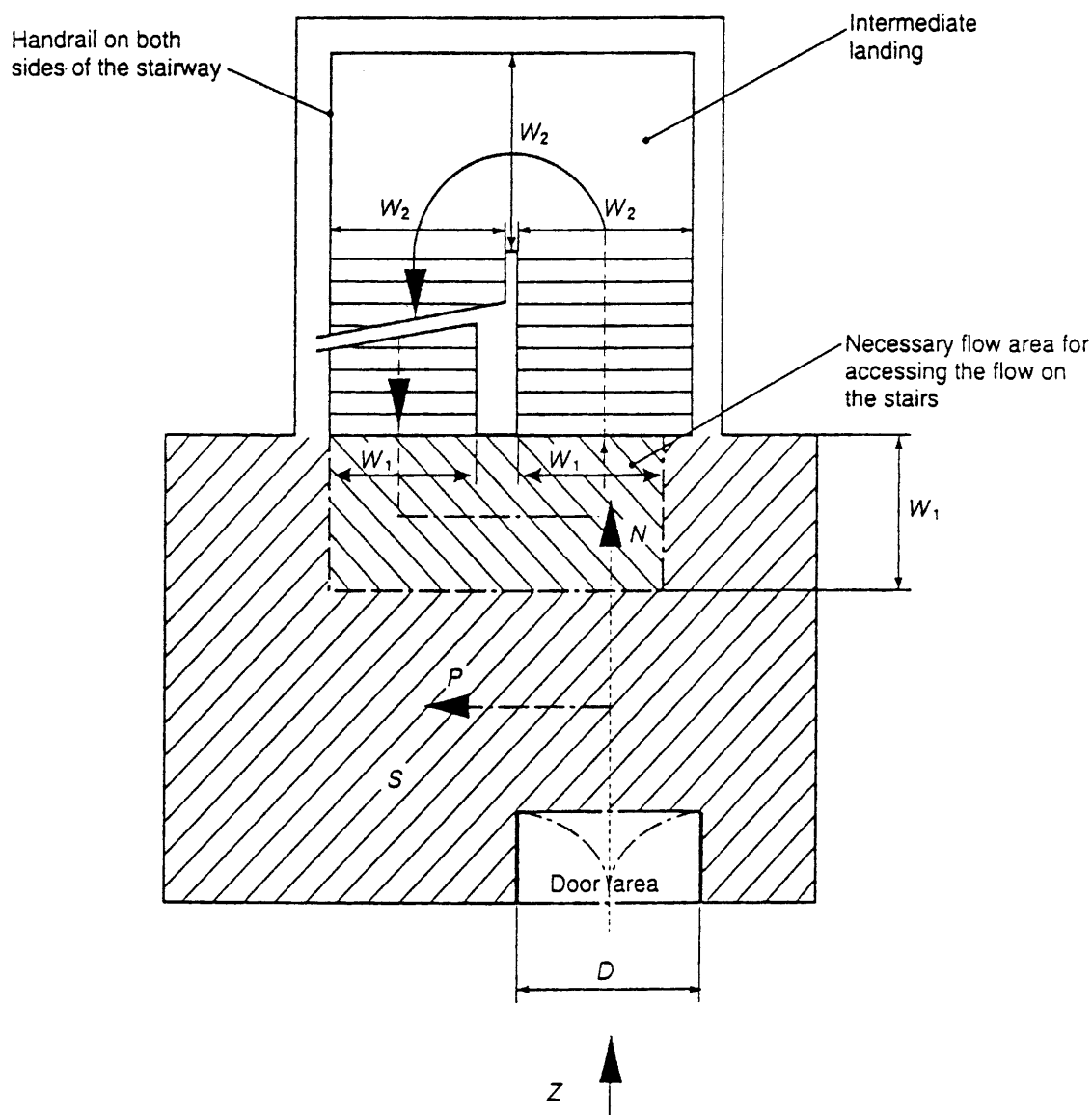
$N$  = the total number of persons expected to use the stairway from each consecutive deck under consideration;  $N1$  is for the deck with the largest number of persons using that stairway;  $N2$  is taken for the deck with the next highest number of persons directly entering the stairway flow such that when sizing the stairway width at each deck level,  $N1 > N2 > N3 > N4$  (see Fig. 7-2-2). These decks are assumed to be on or upstream (i.e. away from the embarkation deck) of the deck being considered.

2 The stairway should not decrease in width in the direction of evacuation to the muster station, except in the case of several muster stations in one main vertical zone the stairway width should not decrease in the direction of the evacuation to the most distant muster station.

3 Where the passengers and crew are held at a muster station which is not at the survival craft embarkation position the

dimensions of stairway width and doors from the muster station to this position should be based on the number of persons in the controlled groups. The width of these stairways and doors need not exceed 1,500mm unless larger dimensions are required for evacuation of these spaces under normal conditions.

Fig. 7-2-1 Landing Calculation for Stairway Width Reduction



$P = S \times 3 \text{ persons/m}^2 =$  the number of persons taking refuge on the landing to a maximum of  $P = 0.25Z$ ;

$N = Z - P =$  the number of persons directly entering the stairway flow from a given deck;

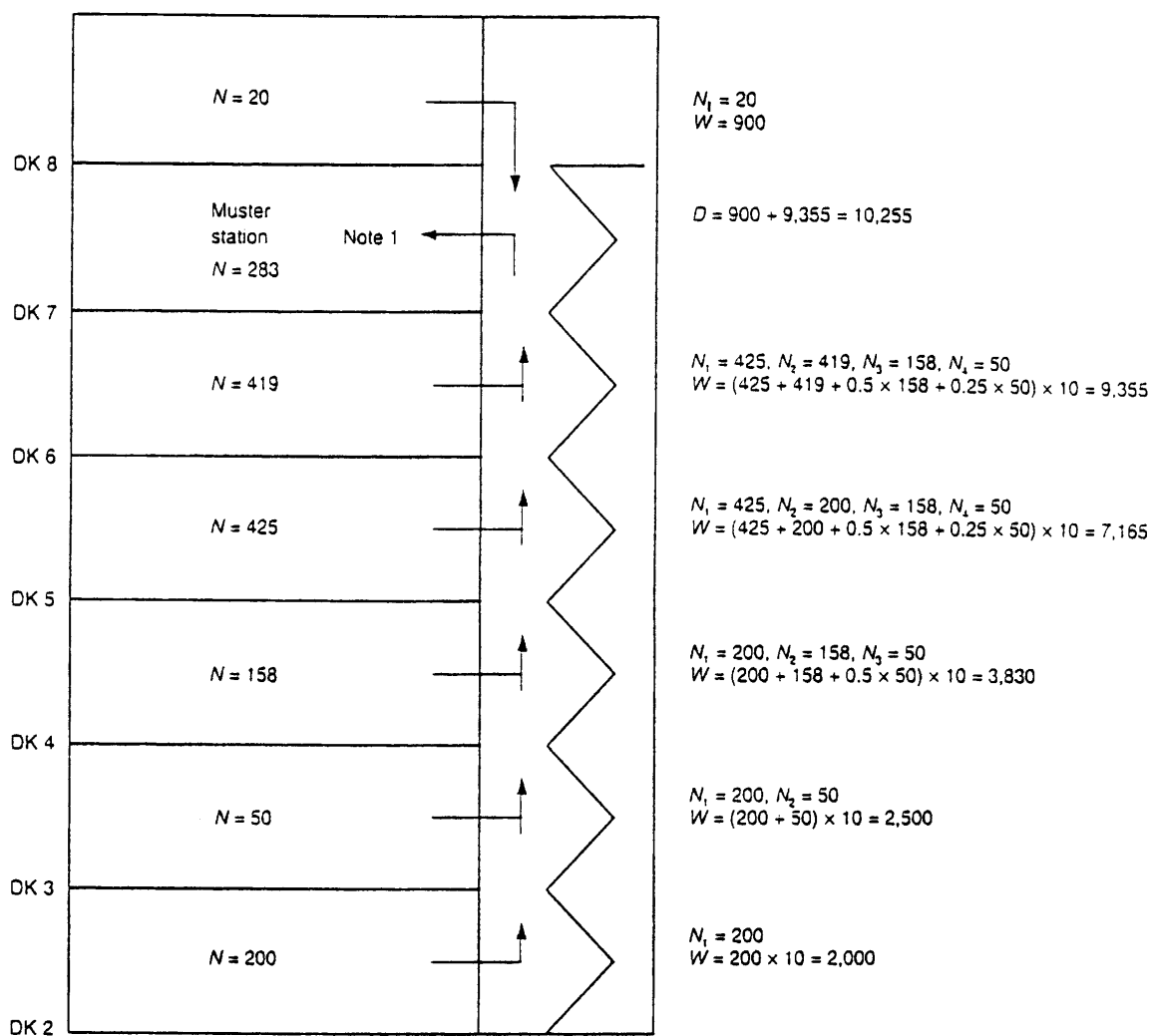
$Z =$  number of persons to be evacuated from the deck considered;

$S =$  available landing area ( $\text{m}^2$ ) after subtracting the surface area necessary for movement and subtracting the space taken by the door swing area. Landing area is a sum of flow area, credit area and door area;

$D =$  width of exit doors to the stairway landing area (mm)



Fig. 7-2-2 Minimum Stairway Width (W) Calculation Example



Z (pers) = number of persons expected to evacuate through the stairway

N (pers) = number of persons directly entering the stairway flow from a given deck

W (mm) =  $(N_1 + N_2 + 0.5 \times N_3 + 0.25 \times N_4) \times 10$  = calculated width of stairway

D (mm) = width of exit doors

$N_1 > N_2 > N_3 > N_4$  where:

N<sub>1</sub> (pers) = the deck with the largest number of persons N entering directly the stairway

N<sub>2</sub> (pers) = the deck with the next largest number of persons N entering directly the stairway, etc.

Note 1: The doors to the muster station should have aggregate width of 10,255 mm

**1.1.3 Initial Distribution of Persons On Board**

1 The calculations of stairway widths should be based upon the crew and passenger load on each deck. Occupant loads should be as rated by the designer for passenger and crew accommodation spaces, service spaces, control spaces and machinery spaces. For the purpose of the calculation the maximum capacity of a public space should be defined by either of the following two values: the number of seats or similar arrangements, or the number obtained by assigning  $2m^2$  of gross deck surface area to each person.

2 The dimensions of the means of escape should be calculated on the basis of the total number of persons expected to escape by the stairway and through doorways, corridors and landing (*see Fig. 7-2-3*).

Calculations should be made separately for the two cases of occupancy of the spaces specified below. For each component part of the escape route, the dimension taken should not be less than the largest dimension determined for each case:

Case 1: Passengers in cabins with maximum berthing capacity fully occupied;  
members of the crew in cabins occupied to 2/3 of maximum berthing capacity;  
and service spaces occupied by 1/3 of the crew.

Case 2: Passengers in public spaces occupied to 3/4 of maximum capacity;  
members of the crew in public spaces occupied to 1/3 of maximum capacity;  
service spaces occupied by 1/3 of the crew, and  
crew accommodation occupied by 1/3 of the crew.

3 The maximum number of persons contained in a vertical zone including persons entering stairways from another main vertical zone should not be assumed to be higher than the maximum number of persons authorized to be carried on board for the calculation of the stairway widths only.

**1.1.4 Additional Notations**

1 The aggregate width of stairway exit doors to the muster station should not be less than the aggregate width of stairways serving this deck.

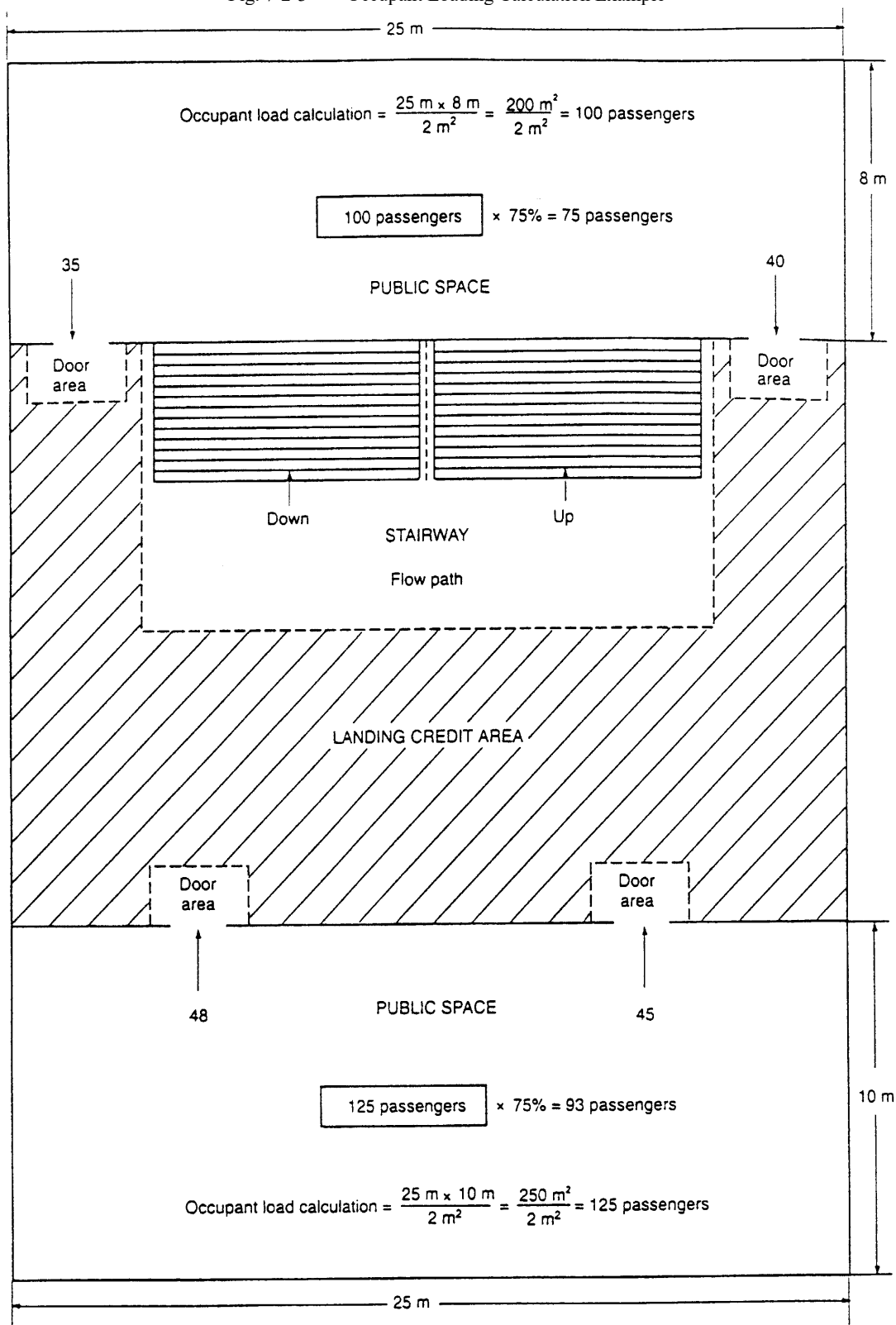
2 The area of landings at each deck level required by regulation II-2/28.1.5.5 should be based on the total number of persons ( $Z$ ) expected to be evacuated in accordance with regulation II-2/28.1.5.5 and should be considered prior to the calculation of the stairway width " $W$ ".

3 Means of escape plans should be provided indicating the following:

- (1) the number of crew and passengers in all normally occupied spaces;
- (2) the number of crew and passengers expected to escape by the stairway and through doorways, corridors and landing;
- (3) muster stations and survival craft embarkation positions;
- (4) primary and secondary means of escape,
- (5) widths of stairways, doors, corridors and landing areas.

4 Means of escape plans should be accompanied by detailed calculations for determining the width of escape stairways, doors, corridors and landing areas.

Fig. 7-2-3 Occupant Loading Calculation Example



## **Annex 7-3 GUIDELINES FOR EVALUATION, TESTING AND APPLICATION OF LOW-LOCATION LIGHTING ON PASSENGER SHIPS (IMO RESOLUTION A.752(18) ADOPTED ON 4 NOVEMBER 1993)**

### **1.1.1 Scope**

These guidelines cover the approval, installation and maintenance of low-location lighting (*LLL*) required by the regulations II-2/28, paragraph 1.10 and II-2/41-2, paragraph 4.7 of the 1974 *SOLAS* Convention, as amended, on all passenger ships carrying more than 36 passengers, to readily identify the passengers' route of escape when the normal emergency lighting is less effective due to smoke.

### **1.1.2 General**

**1** In addition to the emergency lighting required by regulations II-1/42 and III/11.5 of the 1974 *SOLAS* Convention, as amended, the means of escape including stairways and exits should be marked by *LLL* at all points of the escape route including angles and intersections. In addition, all escape route signs and fire equipment location markings should be of photoluminescent material, or marked by lighting, or a combination of both.

**2** The supplementary emergency lighting for ro-ro passenger ships required by regulation II-1/42-1 of the 1974 *SOLAS* Convention, as amended, may be accepted to form partly or wholly the *LLL* system provided that such a system complies with the requirements of these guidelines.

**3** The *LLL* system should function at all times for at least 60 *min* after its activation. Entire systems, including those that are automatically activated or continuously operating, are to be capable of being manually activated by a single action from the continuously manned central control station.

### **1.1.3 Definitions**

**1** Low-location lighting (*LLL*) - Electrically powered lighting or photoluminescent indicators placed at points of the escape route to readily identify all routes of escape.

**2** Photoluminescent (*PL*) system - An *LLL* 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.

**3** Electrically powered (*EP*) system - An *LLL* system which requires electrical power for its operation, such as systems using incandescent bulbs, light emitting diodes, electroluminescent strips or lamps, electrofluorescent lamps, etc.

### **1.1.4 Particulars**

**1** The Administration should ensure that the *LLL* systems meet the requirements of international standards acceptable to the organization. \*

\* Pending the development of international standards acceptable to the Organization, national standards as prescribed by the Administration should be applied.

**2** In all passageways, the *LLL* should be continuous except as interrupted by corridors and cabin doors in order to provide a visible delineation along the escape route. Systems tested to an international standard \* to demonstrate a visible delineation without being continuous should also be acceptable. The *LLL* should be installed at least on one side of the corridor, either on the bulkhead within 300mm of the deck, or on the deck within 150mm of the bulkhead. In corridors more than two metres wide, *LLL* should be installed on both sides.

**3** In dead-end corridors, *LLL* should have arrows placed at intervals of no more than 1m, or equivalent direction indicators, pointing away from the dead-end.

**4** In all stairways, *LLL* should be installed on at least one side at a height less than 300mm above the steps which will make the location of each step readily identifiable to any person standing above and below that step. *LLL* should be installed on both sides if the width of the stairway is two metres or more. The top and bottom of each set of stairs should be identified to show that there are no further steps.

**5** IMO symbols should be incorporated into the *LLL* which directs the passengers to the muster stations required by regulation

III/24 of the 1974 *SOLAS* Convention, as amended.

6 In all passenger cabins a placard explaining the *LLL* system should be installed on the inside of the cabin door. It should also have a diagram showing the location of, and the way to, the two closest exits with respect to the cabin.

7 Materials used in the manufacture of *LLL* products should not contain radioactive or toxic materials.

#### 1.1.5 Doors

1 *LLL* should lead to the exit door handle. To prevent confusion, no other doors should be similarly marked.

2 Sliding fire doors and watertight doors should be marked with an *LLL* sign showing how the door opens.

#### 1.1.6 Signs and Markings

1 All escape route signs and fire equipment location marking should be of photoluminescent material or marked by lighting and fitted in the lower 300mm of the bulkhead. The dimensions of such signs and markings are to be commensurate with the rest of the *LLL* system.

2 *LLL* exit signs should be provided at all exits. The signs should be located within the lower 300mm on the side of exit doors where the handle is located.

3 All signs should contrast in colour to the background (bulkhead or deck) on which they are installed.

#### 1.1.7 Photoluminescent Systems

1 Except where noted, *PL* strips should be no less than 75mm wide. *PL* having a width less than that stated herein should be used only if their luminance is increased proportionally to compensate for their width.

2 *PL* materials should provide at least 15mcd/m<sup>2</sup> measured 10 min after the removal of all external illuminating sources. The system should continue to provide luminance values greater than 2mcd/m<sup>2</sup> for 60 min.

3 Any *PL* system materials should be provided with not less than the minimum level of ambient light necessary to charge the *PL* material to meet the above luminance requirements.

#### 1.1.8 Electrically Powered Systems

1 *EP* systems should be connected to the emergency switchboard required by regulation II-1/42 of the 1974 *SOLAS* Convention, as amended, so as to be powered by the main source of electrical power under normal circumstances and also by the emergency source of electrical power when the latter is in operation. Alternatively, for existing ships only, *EP* systems may be connected to the main lighting system, provided independent batteries provide a backup of at least 60 min and are charged from the main lighting system. Performance of the system while powered by batteries should meet all the requirements stated herein.

2 Where electrically powered systems are installed the following standards of luminance are to be applied:

- (1) the active parts of electrically powered system should have a minimum luminance of 10cd/m<sup>2</sup>;
- (2) the point sources of miniature incandescent lamps should provide not less than 150mcd mean spherical intensity with a spacing of not more than 100mm between lamps;
- (3) the point sources of light emitting diode systems should have a minimum peak intensity of 35mcd. The angle of half intensity cone should be appropriate to the likely track directions of approach and viewing. Spacing between lamps should be no more than 300mm ; and
- (4) for electroluminescent systems these should function for 60 min from the instant when the main power supply to which it was required to be connected by paragraph 8.1 is removed.

3 All *EP* systems should be arranged so that the failure of any single light, lighting strip, or battery will not result in the marking being ineffective.

4 *EP* systems should meet the relevant requirements for emergency luminaries in the current edition of publication 598-22-2 published by the International Electrotechnical Commission (*IEC*) when tested at a reference ambient temperature of 40°C.

5 *EP* systems should meet the requirements for vibration and electromagnetic interference in the current edition of publication 945 published by the *IEC*.

6 *EP* systems should provide a minimum degree of ingress protection of at least IP 55 in accordance with publication 529 published by the *IEC*.

#### 1.1.9 Maintenance

1 All *LLL* systems should be visually examined and checked at least once a week and a record kept. All missing, damaged or inoperable *LLL* should be replaced.

2 All *LLL* systems should have their luminance tested at least once every five years. Readings should be taken on site. If the

luminance for a particular reading does not meet the requirement of these guidelines, readings should be taken in at least ten locations equally spaced apart in the space. If more than 30% of the readings do not meet the requirements of these guidelines, the *LLL* should be replaced. If between 20% and 30% of the readings do not meet the requirements of these guidelines, the *LLL* should be checked again in one *year* or may be replaced.