

SHIP SAFETY  
PASSENGER SHIP OPERATIONS  
AND  
DAMAGED STABILITY  
STANDARDS  
(NON-CONVENTION SHIPS)

Canadian Coast Guard  
Ship Safety Branch  
1991

SHIP SAFETY PASSENGER SHIP OPERATIONS TP10943  
AND DAMAGED STABILITY STANDARDS (NON-CONVENTION SHIPS)

AMENDMENT RECORD

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## PREAMBLE

1. Recognizing that present Canadian regulations applicable to passenger ships do not incorporate the latest international requirements, the Canadian Coast Guard has adopted the following Standards for the design and operation of Canadian registered non-convention passenger ships pursuant to paragraph 305(3) of the Canada Shipping Act.

2. These Standards are based upon amendments to the International Convention for the Safety of Life at Sea (SOLAS) 1974, and the Protocol of 1978 relating thereto. These amendments, adopted by the Maritime Safety Committee (MSC) of the International Maritime Organization (IMO) on 21 April 1988 as Resolution MSC. 11 (55) and on 28 October 1988 as Resolution MSC. 12 (56), are intended to enhance the safety of passenger ships by defining standards of residual damage stability, and by ensuring that a stability assessment of a vessel's condition prior to sailing can be readily performed by ship personnel. The operation of cargo loading doors and monitoring of enclosed ro-ro cargo and special category spaces to ensure the maintenance of the watertight integrity of a vessel are also addressed, as well as supplementary emergency lighting requirements.

3. SOLAS Chapter II-1, Regulation 8 specifies the damaged stability requirements for passenger ships to which the above amendments apply. These requirements have been used for Part II of these Standards, which supersedes the corresponding sections of Part I and Part II (and associated Schedule II) of the Hull Construction Regulations for those ships to which these Standards apply.

4. Parts III, IV and V of these Standards dealing with lightship surveys, stability calculation and cargo door operation are in addition to any existing requirements contained in the Hull Construction Regulations or in TP7301 "STABILITY, SUBDIVISION AND LOAD LINE STANDARDS".

5. Part VI of these Standards concerning monitoring of shell and cargo loading doors supersedes the requirements of Part VII of the Hull Construction Regulations for those passenger ships with enclosed ro-ro cargo spaces or special category spaces to which these Standards apply. Part VII specifies the supplementary emergency lighting required for the same ships in addition to that contained in TP127 "SHIP SAFETY ELECTRICAL STANDARDS".

6. The amendments referred to, and dates of entry into force, are as follows:

	Item	Entry into force	
		New Ships	Existing Ships
1.	Residual Damage Stability	1 April 1991	-
2.	Lightship Survey	1 April 1991	1 April 1991
3.	Stability Assessment	1 Sept. 1991	1 Sept. 1991
4.	Operation of Cargo Doors	1 April 1991	1 April 1991
5.	Door Indicators	1 April 1991	1 April 1991*
6.	Leakage Detection	1 April 1991	1 April 1991
7.	Surveillance of Ro-Ro Spaces	1 April 1991	1 April 1991
8.	Emergency Lighting	1 Aug. 1991	1 Aug. 1991
9.	Draught Indicators	1 Sept. 1991	1 Sept. 1991

\*Unless already fitted with approved door indication system

# SHIP SAFETY PASSENGER SHIP OPERATIONS AND DAMAGED STABILITY STANDARDS

## Interpretation

1. (1) In these Standards,

"Board" means the Board of Steamship Inspection;

"breadth" means the greatest moulded breadth at or below the ship's deepest subdivision load water line;

"deepest subdivision loadline" means the waterline that corresponds to the deepest draught;

"draught" means the vertical distance from the moulded base line amidships to a subdivision load line;

"existing ship" means a ship that is not a new ship:

"factor of subdivision", in relation to any ship or portion thereof, means the factor of subdivision determined in accordance with the provisions of Schedule I of the Hull Construction Regulations;

"ferry vessel" means any vessel, having provision only for deck passengers and for vehicles, that is operated on a short run on a schedule between two points over the most direct water route and offers a public service of a type normally attributed to a bridge or tunnel;

"floodable length" in relation to any portion of a ship at any draught, means the maximum length of that portion having its centre at a given point in the ship that, at that draught and under such of the assumptions of permeability set forth in Section 6 as are applicable in the circumstances, can be flooded without submerging any part of the ship's margin line when the ship has no list;

"length" in respect of a ship, means the horizontal distance between perpendiculars erected at the extreme ends of the deepest subdivision load water line of the ship;

"machinery space" means the space extending from the moulded base line of the ship to the margin line and between the extreme main transverse watertight bulkheads bounding the spaces appropriated to the main and auxiliary propelling machinery, boilers, and the permanent coal bunkers, if any;

"margin line" means a line drawn at least 76mm below the upper surface of the bulkhead deck at the side of a ship, and assumed for the purpose of determining the floodable length of the ship;

"new ship" means, for Part II, of these Standards,

- (a) a Canadian registered passenger ship the keel of which is laid on or after 1 April 1991, or
- (b) a Canadian registered ship, other than a passenger ship, that is converted to a passenger ship on or after 1 April 1991, or
- (c) a passenger ship that is transferred to registry in Canada on or after 1 April 1991;

"passenger" means any person carried on a ship, but does not include

- (a) a person carried on a passenger ship who is
  - (i) the master or a member of the crew or a person employed or engaged in any capacity on board the ship on the business of that ship, or
  - (ii) the owner or charterer of the ship, a member of his family or a servant connected with his household,
  - (iii) a guest of the owner or charterer of the ship if it is used exclusively for pleasure and the guest is carried on the ship without remuneration or any object of profit, or
  - (iv) under one year of age,
- (b) a person carried on any ship in pursuance of the obligation laid upon the master to carry shipwrecked, distressed or other persons or by reason of any circumstances that neither the master nor the owner nor the charterer, if any, could have prevented or forestalled;

"passenger ship" for the purposes of these Standards means a ship carrying more than 12 passengers;

"passenger space" means space provided for the use of passengers;

"permeability", in relation to a space, means the percentage of that space below the ship's margin line that, on the assumption that it is in use for the purpose for which it is appropriated, can be occupied by water;

"ro-ro cargo space" means a space not normally subdivided in any way and extending for either a substantial length or for the entire length of the ship in which 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;

"Safety Convention" means the International Convention for the Safety of Life at Sea, 1974, signed at London on November 1, 1974 and the Protocol of 1978 relating thereto, signed at London on February 17, 1978 and any amendments, whenever made to the Annex to that convention other than Chapter I of the Annex;

"ship" means a vessel of any description used in navigation that is not propelled by oars;

"special category space" means an enclosed space intended for the carriage of motor vehicles with fuel in their tanks for their own propulsion, into and from which such space vehicles can be driven and to which passengers have access;

"steamship" means any ship propelled by machinery and not coming within the definition of sailing ship;

(2) Unless specifically defined in a particular Part, all other words and expressions used in these Standards have the same meaning as in the Canada Shipping Act.

(3) For the purposes of these Standards, passenger ships are classified as follows:

- (a) Class III, consisting of steamships certified to carry passengers on home-trade voyages, Class I, or home-trade voyages Class II, that are not international voyages;
- (b) Class IV, consisting of steamships certified to carry passengers on home-trade voyages, Class III, that are not international voyages;
- (c) Class V, consisting of steamships certified to carry passengers on home-trade voyages, Class IV, that are not international voyages;
- (d) Class VI, consisting of steamships certified to carry passengers on inland voyages, Class I;



- (e) Class VII, consisting of steamships certified to carry passengers on inland voyages, Class II, or minor waters voyages, Class I; and
- (f) Class VIII, consisting of steamships certified to carry passengers on minor waters voyages, Class II.

## **PART I**

### **GENERAL**

#### Application

2. (1) The Standards apply to ships which are not Safety Convention passenger ships and which carry more than 12 passengers.

#### Equivalentents

3. (1) Subject to subsection (2) where these Standards require that a particular fitting, material, appliance, apparatus, item of equipment or type thereof shall be fitted or carried on a ship, or that any particular provision shall be made, or any procedure or arrangement shall be complied with, the Board may allow any other fitting, material, appliance, apparatus, item of equipment or type thereof to be fitted or carried, or any other procedure or arrangement to be made in the ship, if it is satisfied by trial thereof or otherwise that such fitting, material, appliance, apparatus, item of equipment or type thereof or that any particular provision, procedure or arrangement is at least as effective as that required by these Standards.

(2) Approval of an equivalent arrangement may be revoked at any time if it is found that the chosen arrangement is not satisfactory.

#### Submission of Plans and Data

4. The plans and data necessary to verify compliance with the requirements referred to in these Standards shall be submitted for approval in quadruplicate, in legible English or French language form prior to construction or installation being commenced and, if construction or installation is commenced before that approval is obtained, the builder may be required to make such alterations as are necessary to comply with the conditions of approval.

## PART II

### DAMAGE STABILITY

#### Application

5.1 Subject to section 5.2 this Part applies to ships of 150 tons, gross tonnage, or over, that are ships of class III or class IV.

5.2 Section 6.1 applies to the following classes of ships:

- (a) Group A comprising
  - (i) all ships of Class III and Class IV that are 50 tons, gross tonnage, and less than 150 tons, gross tonnage,
  - (ii) all ships of Class VI and Class VII that are 75 tons, gross tonnage, or over, and
  - (iii) ships of Class V and Class VIII that are not ferry vessels and are 75 tons, gross tonnage, or over; and
- (b) Group B comprising all ships of Class V and Class VIII that are ferry vessels.

#### Stability in Damaged Condition

6. (1) Sufficient intact stability shall be provided in all service conditions so as to enable the ship to withstand the final stage of flooding of any one main compartment which is required to be within the floodable length.

(2) Where two adjacent main compartments are separated by a bulkhead which is stepped the intact stability shall be adequate to withstand the flooding of those two adjacent main compartments.

(3) Where the required factor of subdivision is .50 or less but more than .33 intact stability shall be adequate to withstand the flooding of any two adjacent main compartments.

(4) Where the required factor of subdivision is .33 or less the intact stability shall be adequate to withstand the flooding of any three adjacent main compartments.

(5) The requirements of this section shall be determined by calculations which are in accordance with sections 7, 8, and 9 and which take into consideration the proportions and design characteristics of the ship and the arrangement and configuration of the damaged compartments. In making these calculations the ship is to be assumed in the worst anticipated service condition as regards stability and freeboard.

6.1 The requirements for damaged stability in sections 7, 8 and 9 shall apply to all ships required by Part II of the Hull Construction Regulations to have at least one-compartment standard of subdivision.

#### Permeability Factors

7. For the purpose of making damage stability calculations the volume and surface permeabilities shall be in general as follows:

Spaces	Permeability
Appropriated to cargo, coal or stores	60
Occupied by accommodation	95
Occupied by machinery	85
Intended for Liquids	0 or 95*

\* Whichever results in the more severe requirements.

Higher surface permeabilities are to be assumed in respect of spaces which, in the vicinity of the damage waterplane, contain no substantial quantity of accommodation or machinery and spaces which are not generally occupied by any substantial quantity of cargo or stores.

#### Extent of Damage

8. (1) The assumed extent of damage shall be as follows:
- (a) longitudinal extent: 3.0m plus 3 per cent of the length of the ship, or 11.0m whichever is the less; where the required factor of subdivision is 0.33 or less the assumed longitudinal extent of damage shall be increased as necessary so as to include any two consecutive main transverse watertight bulkheads;

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- (b) transverse extent (measured inboard from the ship's side, at right angles to the centreline at the level of the deepest subdivision load line): a distance of one fifth of the breadth of the ship, and
- (c) vertical extent; from the base line upwards without limit;
- (d) if any damage of lesser extent than indicated in this subsection would result in a more severe condition regarding heel, stability, or freeboard, such damage shall be assumed in the calculations.

#### Sufficiency of Stability in Damaged Condition

9. (1) Unsymmetrical flooding is to be kept to a minimum consistent with efficient arrangements. In any case, the maximum angle of heel after flooding but before equalization shall not exceed 15 degrees. Where it is necessary to correct large angles of heel, the means adopted shall, where practicable, be self-acting, but in any case where controls to cross-flooding fittings are provided they shall be operable from above the bulkhead deck. These fittings together with their controls shall be acceptable to the Board. Where cross-flooding fittings are required the time for equalization shall not exceed 15 minutes. Suitable information concerning the use of cross-flooding fittings shall be supplied to the master of the ship.

(2) The final conditions of the ship after damage, and in the case of unsymmetrical flooding after equalization measures have been taken, shall be as follows:

- (a) in the case of symmetrical flooding there shall be a positive residual metacentric height of at least 50 mm as calculated by the constant displacement method;
- (b) in the case of unsymmetrical flooding, the total heel shall not exceed 7 degrees; for the simultaneous flooding of two or more adjacent compartment, a heel of 12 degrees is allowed; and
- (c) in no case shall the margin line be submerged in the final stage of flooding. If it is considered that the margin line may become submerged during an intermediate stage of flooding, the Board may require such investigations and arrangements as it considers necessary for the safety of the ship.

(3) Every ship shall be constructed so as to provide sufficient intact stability in all service conditions to enable the ship to withstand the damage defined in section 7 and remain afloat, after equalization where provided, in the following condition of equilibrium.

- (a) the positive residual righting lever curve shall have a minimum range of 15 degrees beyond the angle of equilibria; and

- (b) the area under the righting lever curve shall be at least 0.015 metre-radians measured from the angle of equilibrium to the lesser of:
- (i) the angle at which progressive flooding occurs, or
  - (ii) 22 degrees (measured from the upright) in the case of the flooding of one main compartment, or 27 degrees (measured from the upright) in the case of simultaneous flooding of two or more adjacent compartments; and
- (c) a residual righting lever is to be obtained within the range specified in subsection (a) taking into account the greatest of the following heeling moments:
- (i) the crowding of all passengers towards one side;
  - (ii) the launching of all fully loaded davit-launched survival craft on one side;
  - (iii) due to wind pressure;

as calculated by the formula

$$GZ(\text{metres}) = \frac{\text{heeling moment}}{\text{displacement}} + 0.04$$

This righting lever is to be not less than 0.10 metre.

- (d) for the purposes of calculating the heeling moments in subsection (c) the following assumptions shall be made:
- (i) moments due to crowding of passengers:
    - 4 persons per square metre;
    - a mass of 75 kg for each passenger;

-passengers shall be distributed on available deck areas towards one side of the ship on the decks where muster stations are located and in such a way that they produce the most adverse heeling moment.
  - (ii) moments due to launching of all fully loaded davit-launched survival craft on one side:

-all lifeboats and rescue boats fitted on the side to which the ship has heeled after having sustained damage shall be assumed to be swung out fully loaded and ready for lowering;

-for lifeboats which are arranged to be launched fully loaded from the stowed position, the maximum heeling moment during launching shall be taken;

-a fully loaded davit-launched liferaft attached to each davit on the side to which the ship has heeled after having sustained damage shall be assumed to be swung out ready for lowering;

-persons not in the life-saving appliances which are swung out shall not provide either additional heeling or righting moment;

-life-saving appliances on the side of the ship opposite to the side to which the ship has heeled shall be assumed to be in a stowed position.

(iii) moments due to wind pressure:

-a wind pressure of  $120 \text{ N/m}^2$  to be applied;

-the area applicable shall be the projected lateral area of the ship above the waterline corresponding to the intact condition;

-the moment arm shall be the vertical distance from a point at one half of the mean draught corresponding to the intact condition to the centre of gravity of the lateral area.

(iv) in intermediate stages of flooding, the maximum righting lever shall be at least 0.05 m and the range of positive righting levers shall be at least 7 degrees.

## **PART III**

### **LIGHTSHIP SURVEY**

#### Application

10. (1) This Part applies to all passenger ships, required to comply with the intact or damaged stability requirements of the Hull Construction Regulations.

(2) In the case of existing passenger ships the lightship survey will be due at the first drydocking on or after 1 April 1991.

#### Lightship Survey

11. (1) At periodical intervals not exceeding five years, a lightweight survey shall be carried out on all passenger ships to verify any changes in lightship displacement and longitudinal centre of gravity. The ship shall be re-inclined whenever, in comparison with the approved stability information, a deviation from the lightship displacement exceeding 2% or a deviation of the longitudinal centre of gravity exceeding 1% of the length is found.

(2) In cases where the stability characteristics of a passenger ship (intact and/or damaged) are marginal or where a ship has been granted an exemption from the minimum stability requirements (intact and/or damaged) the lightship survey interval may be reduced.



## PART IV

### DOCUMENTATION

#### Application

12. (1) This Part applies to all passenger ships required to comply with the damaged stability requirements of the Hull Construction Regulations.

(2) The Part applies to all new and existing passenger ships on 1 September 1991.

#### Stability Information

13. (1) The master of the ship shall be supplied with the data necessary to maintain sufficient intact stability under service conditions to enable the ship to withstand critical damage. In the case of ships requiring cross-flooding the master of the ship shall be informed of the conditions of stability on which the calculations of heel are based and be warned that excessive heeling might result should the ship sustain damage when in a less favourable condition.

(2) The data required to enable the master to maintain sufficient intact stability shall 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 of draughts or displacements sufficient to include all service conditions. The information shall show the influence of various trims taking into account the operational limits.

(3) On completion of loading of the ship and prior to its departure, the master shall determine the ship's trim and stability and also ascertain and record that the ship is in compliance with stability criteria in relevant regulations. The Board may accept the use of an electronic loading and stability computer or equivalent means for this purpose, or other methods which provide an equivalent degree of safety.

(4) No relaxation from the requirements for damage stability may be considered by the Board unless it is shown that the intact metacentric height in any service condition necessary to meet these requirements is excessive for the service intended.

(5) Relaxations from the requirements for damage stability shall be permitted only in exceptional cases and subject to the condition that the Board is to be satisfied that the proportions, arrangements and other characteristics of the ship are the most favourable to stability after damage which can practically and reasonable be adopted in the particular circumstances.

(6) Each ship shall 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 shall also be fitted with a reliable draught indicating system by which the bow and stern draughts can be determined.

(7) Where the master is prepared to operate a vessel with a stability booklet containing an envelope of absolute maximums regarding stability and freeboard (both intact and/or damaged), which provide the required degree of safety, the Board may accept this arrangement provided that the stability book is suitably endorsed to the effect that any load condition, which falls outside of the envelope contained in the book, must receive prior clearance from the owner before the vessel's departure. A copy of the condition should be forwarded to Coast Guard for record purposes.

## PART V

### WATERTIGHT AND WEATHERTIGHT INTEGRITY

#### Application

14. This Part applies to all passenger ships on 1 April 1991.

#### Closure of Cargo Loading Doors

15. (1) The following doors located above the margin line shall be closed and locked before the ship proceeds on any voyage and shall remain closed and locked until the ship is at its next berth:

- (a) cargo loading doors in the shell or the boundaries of enclosed superstructures
- (b) bow visors fitted in positions as indicated in paragraph (a);
- (c) cargo loading doors in the collision bulkhead;
- (d) weathertight ramps forming an alternative closure to those defined in subsections (a) and (b).

Provided that where a door cannot be opened or closed when 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.

(2) Notwithstanding the requirements of paragraphs (1)(a) and (1)(d), the Board may authorize that particular doors can be opened at the discretion of the master, if necessary for the operation of the ship or the embarking and disembarking of passengers when the ship is at safe anchorage and provided that the safety of the ship is not impaired.

(3) The master shall ensure that an effective system of supervision and reporting of the closing and opening of the doors referred to in subsection (1) is implemented.

(4) The master shall ensure, before the ship proceeds on any voyage, that an entry in the log book is made of the time of the last closing of the doors specified in subsection (1) and the time of any opening and closing of particular doors in accordance with subsection (2).

## PART VI

### DAMAGE PREVENTION AND CONTROL

#### Application

16. (1) This Part applies to all passenger ships on 1 April 1991.

(2) Existing ships which are already fitted with approved door indicators need not comply with the requirements of subsection 13(1) Monitoring of Cargo Loading and Shell Doors.

17. (1) Indicators shall be provided on the navigating 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 Board, lead to major flooding of a special category space or ro-ro cargo space. The indicator system shall be designed on the fail safe principle and shall show if the door is not fully closed or not secured. The power supply for the indicator system shall be independent of the power supply for operating and securing the doors.

(2) Means shall be arranged, such as television surveillance or a water leakage detection system, to provide an indication to the navigating bridge of any leakage through bow doors, stern doors or any other cargo or vehicle loading doors which could lead to major flooding of special category spaces or enclosed ro-ro cargo spaces.

(3) Special category spaces and enclosed ro-ro cargo spaces shall either be 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 whilst the ship is underway.

## **PART VII**

### **SUPPLEMENTARY EMERGENCY LIGHTING**

#### Application

18. This Part applies to all passenger ships on 1 August 1991.

#### Supplementary Emergency Lighting

19. (1) All passenger public spaces and alleyways shall be provided with supplementary electric lighting that can operate for at least three hours when all other sources of electric power have failed and under any condition of heel. The illumination provided shall be such that the approach to the means of escape can be readily seen. The source of power for the supplementary lighting shall consist of accumulator batteries located within the lighting units that are continuously charged, where practicable, from the emergency switchboard. Alternatively, any other means of lighting which is at least as effective may be accepted by the Board. The supplementary lighting shall be such that any failure of the lamp will be immediately apparent. Any accumulator battery provided shall be replaced at intervals having regard to the specified service life in the ambient conditions that they are subject to in service; and

(2) A portable rechargeable battery operated lamp shall be provided in every crew space alleyway, recreational space and every working space which is normally occupied unless supplementary emergency lighting, as required by sub-section (1) is provided.