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**INTERIM EXPLANATORY NOTES FOR THE ASSESSMENT OF PASSENGER SHIP
SYSTEMS' CAPABILITIES AFTER A FIRE OR FLOODING CASUALTY**

1 The Maritime Safety Committee, at its eighty-seventh session (12 to 21 May 2010), having considered the proposal by the Sub-Committee on Fire Protection, at its fifty-fourth session, approved the Interim Explanatory Notes for the assessment of passenger ship systems' capabilities after a fire or flooding casualty, set out in the annex, to provide additional guidance for the uniform implementation of SOLAS regulations II-1/8-1, II-2/21 and II-2/22, which were adopted by resolution MSC.216(82) and are due to enter into force on 1 July 2010.

2 Member Governments are invited to bring the annexed Interim Explanatory Notes to the attention of passenger shipowners, ship builders, ship designers and other parties concerned.

3 This circular revokes circular MSC.1/Circ.1214.

ANNEX

INTERIM EXPLANATORY NOTES FOR THE ASSESSMENT OF PASSENGER SHIP SYSTEMS CAPABILITIES AFTER A FIRE OR FLOODING CASUALTY

INTRODUCTION

The requirements relevant to the safe return to port for passenger ships, as contained in resolution MSC.216(82), entering into force on 1 July 2010, have been shown to be challenging.

These Interim Explanatory Notes have been developed in the light of the experience gained so far in the early application of the aforementioned requirements, taking into account the guidance contained in the Performance standards for the systems and services to remain operational on passenger ships for safe return to port and orderly evacuation and abandonment after a casualty (MSC.1/Circ.1214).

1 GENERAL

1.1 These Interim Explanatory Notes are intended to outline the process of verification and of approval of a ship's design by the Administration, as well as describing the necessary documentation required, when requirements relevant to safe return to port (regulations II-1/8-1, II-2/21 and 22 of the 1974 SOLAS Convention, as amended) are applied.

1.2 These Interim Explanatory Notes are also intended to support safe engineering design with guidance on all three scenarios to be considered in the light of the above mentioned regulations:

- .1 availability of essential systems after a flooding casualty, according to SOLAS regulation II-1/8-1;
- .2 availability of essential systems to support a ship's safe return to port after a fire casualty, according to SOLAS regulation II-2/21; and
- .3 availability of essential systems to support a ship's evacuation and abandonment after a fire casualty, according to SOLAS regulation II-2/22.

In light of the above, general and specific interpretations to regulations II-2/21 and 22 of the 1974 SOLAS Convention, as amended are given in appendix 1.

1.3 The outcome of these assessments should confirm that the ship is designed and constructed to provide the capabilities required by SOLAS regulations II-1/8-1, II-2/21 and 22.

1.4 Within these Interim Explanatory Notes a system-based approach is primarily intended to be performed. Where a system approach will outline potential weaknesses, a compartment or space-by-space based approach may also be applied. In the latter case, part of or all the spaces subject to individual consideration may be subject to operational restrictions on access, use and installations as one element of the overall system of protection. All such spaces and their restrictions should be identified on drawings or in manuals as appropriate (see paragraphs 7.3 and 7.4). For the application of these Interim Explanatory Notes to be successful, all relevant parties, including the Administration or its designated representative, owners, operators, designers and classification societies, should be in continuous communication from the onset of a specific proposal to utilize these Interim Explanatory Notes.

1.5 A pre-requisite and starting point for this assessment is that the owner of the ship has defined the operating pattern or patterns of the ship (for instance, worldwide liner/cruise ship or point-to-point ferry operations, maximum number of passengers and crew for required routes, foreseeable area of operation and routes, etc.). The capabilities that will be needed to be built into the ship will depend on the above.

1.6 The Administration may (as per SOLAS regulation II-2/21.4.14) determine any system to remain operational after a casualty in addition to those identified.

2 DEFINITIONS

For the purpose of these Interim Explanatory Notes, the following definitions apply:

2.1 *Passenger ship systems' capabilities after a fire or flooding casualty (short: ship systems' capabilities)* are those required for passenger ships according to SOLAS regulations II-1/8-1, II-2/21 and II-2/22. The ship systems' capabilities are addressing:

- .1 availability of essential systems after a flooding casualty, according to SOLAS regulation II-1/8-1;
- .2 availability of essential systems to support a ship's safe return to port under its own propulsion after a fire casualty, according to SOLAS regulation II-2/21.4 (including functional requirements for safe areas according to SOLAS regulation II-2/21.5); and
- .3 availability of essential systems to support a ship's evacuation and abandonment after a fire casualty, according to SOLAS regulation II-2/22.

2.2 *Passenger ship systems' design (short: ship systems' design)* is a design description of systems intended to be installed, including all essential information showing how to achieve the ship systems' capabilities after a fire or flooding casualty according to SOLAS regulations II-1/8-1, II-2/21 and II-2/22.

2.3 *Passenger ship systems' functionality (short: ship systems' functionality)* is part of the passenger ship systems' design and defines how the onboard systems achieve the functional requirements defined in SOLAS regulations II-2/21 and II-2/22.

2.4 *Fire casualty* is any possible fire case on board the ship under consideration. Fire casualties may or may not exceed the casualty threshold stipulated in SOLAS regulation II-2/21.3.

2.5 *Flooding casualty* is any possible flooding cases on board the ship under consideration. Flooding casualties may not exceed a single watertight (WT) compartment flooding as stated in SOLAS regulation II-1/8-1.2.

2.6 Essential systems are all systems and those sections of systems in spaces not directly affected by the casualty that need to remain operational after a fire or flooding casualty, according to SOLAS regulations II-2/21.4 and II-2/22.3, and as referred to in SOLAS regulation II-1/8-1.2.

2.7 *Critical systems* are essential systems that were identified in the overall assessment of essential systems to have a possibility to fail to operate adequately as a consequence of one or more fire casualty case, each not exceeding the fire casualty threshold, or as a consequence of one or more flooding case, each not exceeding a single WT compartment. The failure of the

system may be caused by a failure of the whole system, of one component or of a connection between system components or by any other failure causing unsatisfactory operation of the essential system under consideration.

3 SHIP'S DESCRIPTION

3.1 For the purpose of the ship's description, any necessary information regarding the design of the ship should be provided to the Administration along with description of ship essential systems' design and functionality following a fire or flooding casualty. As a minimum, such information and description should include:

- .1 the design criteria for each individual essential system or group of essential systems, to achieve compliance (e.g., separation, duplication, redundancy, protection, or a combination of the above);
- .2 the basic layout of the vessel including boundaries of compartments subject to the casualty (watertight or "A" class boundaries), e.g., in the form of plan views and cross-sections, including, but may not be limited to: general arrangement plan, capacity plan, watertight subdivision plan, space fire categorization plan (or structural fire protection plan), plan of spaces protected by fixed fire-extinguishing systems, etc.;
- .3 criteria adopted for the selection of safe areas and intended locations;
- .4 a list of all systems that are intended to be submitted for assessment. It should be noted that although such a list would include, in the first instance and as a minimum, all essential systems referred to in SOLAS regulations II-2/21.4 and 22.3, their actual number and identification may vary depending on the size, type, arrangements, design, etc., (e.g., propulsion systems: shaft or podded propulsion units, etc.) of the ship;
- .5 drawings/documents describing the location, arrangement and connections of essential systems (including any of their components) mentioned in SOLAS regulation II-2/21 or II-2/22;
- .6 the description of the power supply for the essential systems;
- .7 data regarding the minimum speed vs. weather and sea conditions (e.g., results of model tank tests in sea keeping conditions including consideration of wind forces); and
- .8 any additional design detail intended to ensure or support the ship systems' capabilities.

3.2 Additional information about the intended area of operation, the operating pattern or patterns (which may be used to define any intended speed/maximum distance for safe return to port) should be included in the ship's description.

3.3 Interpretations as contained in paragraph 1 of appendix 1 to these Interim Explanatory Notes may be used when completing the ship's description.

4 ASSESSMENT OF REQUIRED SHIP SYSTEMS' CAPABILITIES

4.1 The assessment of ship systems' capabilities should follow the process described in these Interim Explanatory Notes and refer to appendix 2. The assessment should be based on structured methods and should document the intended essential systems functionality after a fire or flooding casualty defined by SOLAS regulations II-1/8-1, II-2/21 and II-2/22. An example of the development of an assessment is given in appendix 3.

4.2 Each assessment should be divided in two steps.

4.2.1 The first step is an overall systems' assessment. The systems' assessment is addressing all essential systems and functional requirements mentioned in SOLAS regulations II-2/21 and II-2/22. This step should include a structured assessment of all essential systems after a fire or flooding casualty, as defined in SOLAS regulations II-1/8-1.2, II-2/21.4 or II-2/22.3.1. Propulsion and steering systems are required to remain in operational and may not be identified as "critical systems". However, manual intervention may be accepted in order to make these systems available in the minimum possible time.

4.2.2 The second step is a detailed assessment of critical systems identified in the systems' assessment. The detailed assessment is only required if any critical system was identified in the previous systems' assessment.

4.3 SOLAS regulations II-1/8-1, II-2/21 and 22 do not include reference to quantities or performance limits. The ability of the ship to return to port should be linked to the area and conditions of operation. The capability available for each system in the worst case (e.g., minimum propulsion power for return to port, electrical generating capacity, heating capacity, ventilation capacity, food and water storage/availability, etc.) should be included in the onboard documentation as a part of the assessment report (see paragraph 7.4).

5 OVERALL ASSESSMENT OF ESSENTIAL SYSTEMS

5.1 Assessment of all essential systems

5.1.1 A structured assessment of all essential systems should be conducted. The systems' assessment can be performed in qualitative terms. Quantitative analysis may be required as part of the detailed systems' assessment as described in section 6. A systems' assessment report should be prepared according to section 7.

5.2 Identification of critical systems

5.2.1 Essential systems identified to be fully redundant for all fire and flooding casualty cases not exceeding the threshold (e.g., when runs of cables, pipes and equipment are duplicated and adequately separated), need not be further analysed as described in section 6.

5.2.2 For the arrangement of equipment, components or connections reference may be made to relevant interpretations contained in paragraph 2 of appendix 1 to these Interim Explanatory Notes. Where other solutions are adopted, equipment, components or connections should be further analysed as described in section 6.

5.2.3 Manual action by the crew, to provide ship systems' capabilities, may also be possible but should be assessed in detail taking into account that:

- .1 manual action should only be acceptable by the Administration in connection with an agreed defined number of fire and flooding casualties and should be clearly described in the documentation that should be prepared as per section 7;
- .2 compliance with the return to port criteria should be based on the assumption that any manual action that may be required for the ship to return to port, or for any essential system to remain operational, following a casualty:
 - .1 is pre-planned, pre-set and instructions as well as necessary materials are available on board;
 - .2 is performed on systems designed to ensure that the required manual action can be completed within one hour from the time the action started; and
 - .3 emergency lighting and a means of communication is demonstrated available in the area where manual actions are to be taken; and
- .3 in general, feasibility of manual actions should be demonstrated by tests or drills, as applicable.

5.2.4 Performance requirements applicable to any essential system may be analysed and documented separately; however, any relevant information should be included in the overall assessment of essential systems' report.

5.3 Results of overall assessment

5.3.1 Should no critical systems be identified, the overall assessment can be considered acceptable without the need for a detailed systems' assessment to be carried out. The systems' assessment report can be used for the preparation of documentation and approval submission, as referred to in section 7.

6 DETAILED ASSESSMENT OF CRITICAL SYSTEMS

6.1 When performing a detailed assessment of critical systems, additional information may be necessary. The ship's description, described in section 3, should be supplemented, for each identified critical system, with the following, as applicable:

- .1 details of pipes, cables or other devices connecting the components of the critical system, or connecting different critical systems including their location within the affected area;
- .2 details of any manual action providing the required ship systems' functionality (see also paragraph 5.2.3); and
- .3 details of any operational solution forming part of the design criteria.

6.2 Where acceptable to the Administration, a quantitative analysis can be carried out as a part of the detailed assessment of all critical systems. As an example, the following may be performed:

- .1 quantitative analysis of fire risk within a space, supplemented by fire engineering analysis and/or fire testing where necessary (e.g., to assess consequences of a fire casualty on a system or system component);

- .2 Failure Mode Effect Analysis (FMEA) of a system or system component analyses in accordance with standard IEC 60812, *Analysis techniques for system reliability – Procedure for failure mode and effects analysis (FMEA)* or resolution MSC.36(63), annex 4 (Procedures for Failure Mode and Effects Analysis), would be acceptable; and
- .3 detailed analysis of possibility of flooding of internal watertight compartments and of consequences of flooding on system components, given the location of the compartment and arrangement of piping within the compartment.

7 DOCUMENTATION

7.1 Design of ship and ship's systems

7.1.1 Different design criteria may be followed in the design of the ship and in the design of the ship's systems and arrangements to achieve the passenger ship systems' capabilities after a fire or flooding casualty and to comply with the requirements. The chosen design criteria should be well documented. This is to form the basis for the preparation of all ship's operational procedures to be adopted by the crew for the case of any such casualty.

7.2 Documentation for future design changes

7.2.1 The documentation to be presented for approval is described in detail in the paragraphs below. Such documentation should also be referred to in case design changes to the ship are proposed and may also be used as evidence of compliance should the ship transfers to the flag of another State.

7.3 Documentation of the assessment of required ship systems' capabilities for approval

7.3.1 The documentation of the assessment to be presented for approval should include the design criteria followed to reach ship systems' capabilities and summarize the whole process of assessment including methods and assumptions. The following information should be provided for approval of ship systems' capabilities:

- .1 ship's description (see section 3);
- .2 overall assessment of essential systems' report (see paragraph 4.2.1 and section 5);
- .3 detailed assessment of critical systems' report (see paragraph 4.2.2 and section 6), if any critical system is identified; and
- .4 additional information:
 - .1 list of manual actions (see paragraph 5.2.3);
 - .2 test programme (for both testing during construction, and sea trials, as applicable) which should include methods of testing, and test facilities provided, where applicable;
 - .3 maintenance plan; and
 - .4 references.

7.4 Onboard documentation

The onboard documentation demonstrating the ship system capabilities should include:

- .1 documentation, as per paragraphs 7.3.1.1, 7.3.1.2 and 7.3.1.3 above;
- .2 operational manual for fire and flooding casualty cases and safe return to port operation, including details of any manual action required to ensure operation of all essential systems, availability of safe areas including provision of basic services therein (e.g., closing/opening of valves, shutting down/start of equipment/fans, etc.);
- .3 description of operation of essential systems after a fire casualty exceeding the casualty threshold;
- .4 list of spaces considered having negligible fire risk, if any; and
- .5 test, inspection, and maintenance plan.

7.5 Record of ship systems' capabilities

7.5.1 The ship systems' capabilities should be included in the list of operational limitations issued to passenger ships (reference SOLAS regulation V/30). The ship's safety management manual should describe in detail the quantities, arrangements and procedures that are to be applied in each particular case. (For example, food/drink/fuel carriage requirements may be different for a ship cruising in the Aegean to one cruising in the Antarctic.) Example of wording concept for this purpose may be as follows:

"Safe return to port voyage planning should be based on:

- .1 habitable conditions for passengers and crew is provided according to "Owners document xyz" dated yyyy-mm-dd (the operational area will determine maximum possible distance to a safe location and the maximum numbers of persons that can be supported during the safe return voyage).
- .2 the ship systems' capabilities of returning to port following a fire casualty is contingent upon the conditions/assumptions given in onboard document xyz, yyyy-mm-dd.
- .3 ships "port/aft/main" propulsion and steering system is capable of x knots in Beaufort x with a consumption of x tonnes of fuel.
- .4 ships "starboard"/forward/emergency propulsion and steering system is capable of x knots in Beaufort x with a consumption of x tonnes of fuel."

APPENDIX 1

INTERPRETATIONS TO SOLAS REGULATIONS II-2/21 (SAFE RETURN TO PORT AND SAFE AREAS) AND II-2/22 (SHIP'S ORDERLY EVACUATION AND ABANDONMENT)

1 Interpretation for ship's description

1.1 The following interpretations are intended to be of assistance when carrying out the ship description contained in section 3 of the Interim Explanatory Notes, before performing assessments as described in sections 4, 5 and 6.

1.2 These interpretations provide design criteria. The decision on whether or not to evacuate the ship remains with the Master. In actual situations the Master may well decide, based on the actual appraisal of the situation that it is safer to evacuate for accidents that are below the casualty threshold and remain on board for accidents that are above it.

Regulation	Interpretations
II-2/21.1 Application	Interpretation 1 Horizontal Fire Zones (special category and ro-ro spaces) should not be included in the count of the number of the Main Vertical Zones.
II-2/21.1 Application	Interpretation 2 Where electrical or machinery installation, fire safety, or lifesaving appliances of a ship have been approved following the methodology of SOLAS regulations II-1/55, II-2/17 or III/38 respectively (Alternative design and arrangements), the effect on the ship essential system capability should be explicitly included in the analysis required by the above regulations. Special attention is to be given to the determination and assignment of Safe Areas and compliance with the requirements of SOLAS regulation II-2/22.
II-2/21.2 Purpose	Interpretation 3 For the purpose of assessing the ship systems' capabilities, fire casualties and flooding casualties may be considered as not occurring at the same time.
II-2/21.3 Casualty threshold	Interpretation 4 "A" class boundaries refers to both bulkheads and decks.

Regulation	Interpretations
II-2/21.3 Casualty threshold	Interpretation 5 The rating of "A" class boundaries does not affect the application of this regulation. However, a trunk closed at all boundaries constructed to "A-60" standard and containing ducts, cabling and/or piping is considered operational when passing through a space of origin.
II-2/21.3 Casualty threshold	Interpretation 6 The lay-out of special category and ro-ro spaces, normally extending for more than the length of one MVZ, does not properly fit with the casualty threshold. However, during the assessment of the ship systems' capabilities it has to be verified that a casualty in such spaces would not compromise the operation of the essential systems in the remaining fire zones of the ship.
II-2/21.3.2 Casualty threshold	Interpretation 7 Where a space of origin is not protected by a fixed fire-extinguishing system, for determining the "nearest "A" class boundaries, which are not part of the space of origin": a) only the spaces within the same Main Vertical Zone need to be considered; and b) casualty threshold includes spaces one deck upwards.
II-2/21.3.2 Casualty threshold	Interpretation 8 Spaces in which the risk of a fire originating is negligible ¹ need not be considered as spaces of origin of a fire. Examples of such spaces include but may not be limited to: a) spaces with restricted accessibility for inspection and/or maintenance only, such as: .1 void spaces; .2 trunks closed at all boundaries only containing pipes and/or electrical cables; and .3 cofferdams;

¹ **Note:** A fire/risk assessment may be requested (refer to paragraphs 7.4.4 of the Interim Explanatory Notes), to determine whether a space other than those listed in the above can be considered as being "space in which the risk of a fire originating is negligible". Different factors should be taken into account while performing the assessment such as:

- a) presence of combustible material, flammable liquids and/or flammable gases;
- b) presence of electrical switchboards and relevant power;
- c) statistics on fire within spaces having the same purpose;
- d) intended service of equipment/machinery installed; and
- e) other factors considered appropriate for the space under consideration.

Regulation	Interpretations
<p>II-2/21.3.2 Casualty threshold</p>	<p>Interpretation 8 (cont'd)</p> <ul style="list-style-type: none"> b) tanks; c) chain lockers; d) ventilation trunks except those containing ducts presenting fire hazard such as galley range exhaust ducts, laundry exhaust ducts, category "A" machinery spaces ducts, special category and ro-ro spaces ducts; e) cross flooding ducts connecting void spaces. In the case where connected spaces are not with a negligible fire risk, ducts should be separated from those spaces by non-watertight fire resistant boundaries to be considered as a space where fire risk is negligible; f) vertical escape trunks from machinery spaces, service spaces, control stations and other crew accommodation spaces; g) store rooms for gaseous fixed fire-extinguishing systems; h) busbars enclosed in "A" class divisions; i) "A" class enclosures within spaces of Category 1, 2 or 4 only containing isolation valves or section valves forming part of the fixed fire-extinguishing system for the protection of accommodation spaces, service spaces and control stations; and j) shaft tunnels only used for this purpose, i.e. no storage is allowed.
<p>II-2/21.3.2 Casualty threshold</p>	<p>Interpretation 9</p> <p>Concealed spaces (spaces above ceilings, behind bulkheads linings) are considered as part of the space of origin. Lack of a fixed fire-extinguishing system above ceilings or behind linings need not be considered under regulation II-2/21.3.2.</p>
<p>II-2/21.3.2 Casualty threshold</p>	<p>Interpretation 10</p> <p>In case of manual actions, equipment and systems the controls of which cannot be reached without accessing the space affected by the casualty should not be considered operational.</p>
<p>II-2/21.3.2 Casualty threshold</p>	<p>Interpretation 11</p> <p>For passenger ships carrying not more than 36 passengers space of origin is any space bounded by "A" class boundaries or divisions of steel or equivalent material. Where the deck between two spaces is constructed of steel or equivalent material it should be considered to form part of the "A" class boundary provided all penetrations are tight to prevent the passage of flame or smoke.</p>

2 Interpretations for detailed assessment of critical systems

2.1 The following interpretations are intended to be of assistance when performing detailed assessments of critical systems, as described in section 6.

Regulation	Interpretations
<p>II-2/21.4 Safe Return to Port/Fire Casualty</p>	<p>Interpretation 12</p> <p>Steel pipes other than those carrying flammable liquids and passing through (not serving) spaces affected by a fire casualty may be considered to remain operational provided they are of substantial thickness (reference can be made to ICLL 66 regulation 22(3), as interpreted by IACS UI LL36/Rev. 2 paragraph (b)) or "A-60" insulated ("A-60" class insulation approved in accordance with resolution A.754(18) for bulkheads or decks may be used for this purpose). In both cases the pipes should be adequately supported.</p> <p>In order to be considered as remaining operational after a fire casualty, steel pipes should be joined by welding otherwise mechanical joints should be tested according to IACS UR P2.11.5.5.6 fire test or equivalent to the satisfaction of the Administration.</p> <p>Temperature increase of liquids carried may need to be considered, and measures taken where necessary, so that the performance and purpose of the affected systems can be maintained as intended after the casualty has occurred.</p> <p>Plastic pipes can be considered to remain operational after a fire casualty if tested to resolution A.753(18), Level 1.</p>
<p>II-2/21.4 Safe Return to Port/Fire casualty</p>	<p>Interpretation 13</p> <p>Fire-resistant cables complying with standards IEC 60331-1 and IEC 60331-2 (see also IACS UR E15) passing through (not serving) spaces may be considered to remain operational after a fire casualty provided they have no connections, joints and equipment connected to them, etc., within the space affected by the casualty.</p> <p>Installation of these cables should be made to support their survival in a fire casualty and during fire fighting efforts.</p>

Regulation	Interpretations
<p>II-2/8.1 Flooding casualty II-2/21 Fire casualty</p>	<p>Interpretation 14 An electrical balance should be submitted for each of the following return to port scenarios: a) minimum electrical-generating capacity available; and b) any other scenario of reduced power that would cause any essential system to run at reduced capacity due to lack of electrical generating capacity.</p> <p>In connection with the above, all essential systems and their auxiliaries and systems needed to support safe areas should be accounted according to their use in these particular conditions.</p>
<p>II-2/21 Fire casualty</p>	<p>Interpretation 15 Emergency generator, fitted for compliance with SOLAS regulation II-1/42, may be used to meet the requirements on safe return to port and ship's orderly evacuation and abandonment providing that its ability to supply emergency services as referred to in SOLAS regulation II-1/42.2, is not impaired (e.g., the availability of fuel needed for providing those services listed in regulation II-1/42 should be maintained). In the evaluation of the emergency generator capacity, the most demanding condition between regulations II-1/42, II-2/21 and 22 may be considered.</p>
<p>II-2/21.4 Safe return to port</p>	<p>Interpretation 16 Electrical power should be available and sustainable for all essential services specified in SOLAS regulations II-2/21.4 and II-2/21.5.1.2, with due regard being paid to such services as may be operated simultaneously. The application of regulation II-2/21.4 requires that other systems (e.g., engine-room ventilation, lighting of spaces outside safe areas not affected by the casualty, etc.) remain operational to support the functionalities listed therein.</p>
<p>II-2/21.4.1 Propulsion</p>	<p>Interpretation 17 Propulsion machinery and auxiliary machinery essential for the propulsion of the ship should remain operable.</p>
<p>II-2/21.4.1 Propulsion</p>	<p>Interpretation 18 Following a fire casualty within the threshold, the ship should be able to maintain an adequate speed for sufficient time to permit the ship's planned safe return to port in sea and wind conditions acceptable to the Administration taking into account the intended area of operation. A minimum speed of 6 knots while heading into Beaufort 8 weather and corresponding sea conditions is recommended. Configuration for power generation and propulsion in the worst case scenario in terms of casualty cases should be verified during normal sea trials.</p>

Regulation	Interpretations
II-2/21.4.1 Propulsion	Interpretation 19 A steel shaft line including relevant bearings passing through a space affected by a flooding or a fire casualty (see also interpretation 11), may be considered operational if it is enclosed in a watertight and "A" class tunnel or alternatively if: <ul style="list-style-type: none"> a) in the flooding case it can be shown that it can operate under water; and b) in the fire case it is protected by a dedicated water spray system capable of delivering not less than 5 l/m²/min on the protected area or equivalent.
II-2/21.4.1 Propulsion	Interpretation 20 Manual control at local positions can be accepted provided adequate communication and emergency lighting are arranged and it is demonstrated that the loss of any control and monitoring system does not prevent or impair any such manual/local control of the propulsion and electrical power generation systems (including, but may not be limited to, engines, electric motors, fuel system, etc.). Consideration should be given to the provision of machinery alarms when operating in that manner.
II-2/21.4.2 Steering systems and steering-control systems	Interpretation 21 When documenting that steering system is operable the following should be taken into consideration: <ul style="list-style-type: none"> a) local control of remaining steering system is acceptable provided adequate communication and emergency lighting are arranged; b) emergency means of steering, e.g., azimuth thrusters, pump jets, rudder, propellers, may be considered; and c) in general, tunnel thrusters should not be considered adequate for emergency steering.
II-2/21.4.3 Navigational systems	Interpretation 22 Equipment essential for navigation, position fixing and detection of risk of collision should be available. The ship should be capable of displaying the proper light configuration in compliance with the International Regulations for Preventing Collisions at Sea in force.
II-2/21.4.4 Systems for fill, transfer and service of fuel oil	Interpretation 23 Systems for internal fill transfer and service of fuel oil should be capable of fuel transfer to active propulsion and power generation equipment.

Regulation	Interpretations
<p>II-2/21.4.4 Systems for fill, transfer and service of fuel oil</p>	<p>Interpretation 24 Systems for internal fill, transfer and service of: a) fuel; b) other flammable hydrocarbons; or c) any fluid that may be flammable or dangerous if heated to a very high temperature (both within the pipe and on going through pumps, orifices or other equipment), should not be considered operational within spaces affected by a fire casualty.</p>
<p>II-2/21.4.5 Internal communication between the bridge, engineering spaces, safety centre, fire-fighting and damage control teams, and as required for passenger and crew notification and mustering</p>	<p>Interpretation 25 Internal communications should be achieved by any effective portable or fixed means of communications. However, portable equipment may be accepted provided that repeater system or equivalent remains operational after the casualty and charging capability is available in more than one MVZ.</p>
<p>II-2/21.4.5 Internal communication between the bridge, engineering spaces, safety centre, fire-fighting and damage control teams, and as required for passenger and crew notification and mustering</p>	<p>Interpretation 26 PA systems, arranged as general alarm systems, should remain operational in the MVZs not affected by the casualty.</p>

Regulation	Interpretations
<p>II-2/21.4.6 External communication</p>	<p>Interpretation 27 The ship should be capable of communicating via the GMDSS or the VHF Marine and Air Band distress frequencies, even if the main GMDSS equipment is lost.</p>
<p>II-2/21.4.7 Fire main</p>	<p>Interpretation 28 Automatic start of remaining pumps may not be necessarily required (manual local start may be accepted after a casualty). The system should be so arranged that SOLAS regulation II-2/10.2.1.5.1 is fulfilled in all other Main Vertical Zones of the ship not affected by the casualty. Isolating valves should be arranged as appropriate. The remaining part of the affected deck in a Main Vertical Zone may be served from hydrants of adjacent zone or water tight compartment. Fire hoses may be extended for fire-fighting within the affected Main Vertical Zone; however, for complying with this requirement, two lengths of hoses from each hydrant may be accepted.</p>
<p>II-2/21.4.8 Fixed fire-extinguishing systems</p>	<p>Interpretation 29 When a gaseous based system located outside the protected space is the sole fixed fire-extinguishing system as defined in regulations II-2/10.4.1 and 10.7.1 and it is designed to protect more than one space:</p> <ul style="list-style-type: none"> a) there should be enough capacity to protect the two largest spaces; b) where the application of the fire casualty threshold leads to the loss of the storage room due to fire in an adjacent space, there should be two rooms, not being lost by the result of the same casualty, each holding a quantity of gas, capable of protecting the largest space; and c) the system should be so arranged that a casualty in one protected space does not impair the operation of the system in another protected space. <p>When a gaseous based system located outside the protected space is the sole fixed fire-extinguishing system as defined in regulations II-2/10.4.1 and 10.7.1 and it is designed to protect a single space, where the application of the fire casualty threshold leads to the loss of the storage room due to fire in an adjacent space, there should be two rooms, not being lost by the result of the same casualty, each holding the quantity of gas required for the protected space.</p>
<p>II-2/21.4.8 Fixed fire-extinguishing systems</p>	<p>Interpretation 30 Sprinkler or equivalent fixed fire-extinguishing systems may be considered to be lost only in spaces directly affected by the fire casualty and in other spaces that are protected by the same section (i.e. are controlled by the same section valve) provided each section should not serve more than one deck area in one MVZ. However, all levels of a stairway enclosure may be protected by the same section.</p>

Regulation	Interpretations
II-2/21.4.8 Fixed fire-extinguishing systems	Interpretation 31 Section valves (as referred to in FSS Code, chapter 8, paragraph 2.4.2.2) located within the space affected by the fire casualty should be considered to be not operational unless they are suitably fire rated or fire protected (e.g., contained within a solely dedicated enclosure having "A" class boundaries, or protected by a water nozzle, etc.).
II-2/21.4.8 Fixed fire-extinguishing systems	Interpretation 32 Equivalent water based fire-extinguishing systems intended for the protection of machinery spaces (total flooding, as referred to in MSC/Circ.1165, as amended) should be so designed that in case of loss of any section valve it would still be possible to supply the entire system at the required performance, except where another fixed fire-extinguishing system is provided for the protection of such spaces (e.g., gaseous based systems). Duplication, fire protection of valves (e.g., contained within a solely dedicated enclosure having "A" class boundaries, or protected by a water nozzle, etc.), fire rated valves* or location of valves in spaces as identified by interpretation 11 may be considered. * Reference may be made to IACS UR P2.11.5.5.6.
II-2/21.4.8 Fixed fire-extinguishing systems	Interpretation 33 Indication of activated sections in the continuously manned central control station for sprinkler or equivalent fixed fire-extinguishing systems, located outside the Main Vertical Zone, where the space affected by the casualty is located, should continue to function after a fire or flooding casualty.
II-2/21.4.8 Fixed fire-extinguishing systems	Interpretation 34 Arrangement of piping distribution for sprinkler systems or equivalent, or for water based fixed fire-extinguishing systems for machinery spaces, may include isolation valves, to ensure the system can be reconfigured as to remain operational after a casualty, which should be kept to a minimum, clearly marked and easily accessible. Valves whose uncorrected status may jeopardize the operation of the system under normal condition should be provided with status indication in the continuously manned control station.
II-2/21.4.8 Fixed fire-extinguishing systems	Interpretation 35 When sprinkler or equivalent water based fixed fire-extinguishing systems include one or more emergency feed, risers, connection, or other emergency means to comply with this regulation, then hydraulic calculations (as referred to in the FSS Code, chapter 8, paragraph 2.3.3.2) should take this into account.

Regulation	Interpretations
II-2/21.4.8 Fixed fire-extinguishing systems	Interpretation 36 Local application systems need not to remain operational following a casualty unless they form part of a system for the protection of machinery spaces (total flooding, as referred to in MSC/Circ.1165, as amended).
II-2/21.4.9 Fire and smoke detection systems	Interpretation 37 Fire and smoke detection systems may be considered to be lost only in spaces directly affected by the fire casualty and in other spaces on the same deck that are part of the same section, as defined by the FSS Code, chapter 9, paragraph 2.4.1, provided that all other detectors remain operational in any other decks served by that section.
II-2/21.4.10 Bilge and ballast systems	Interpretation 38 The bilge and ballast pumping systems and all associated essential equipment should be operational in all spaces served by the systems and not directly affected by the casualty. Manual control at local positions may be accepted provided fixed or portable means of communication are available from those positions to the Safety Centre or the Engine Control room.
II-2/21.4.11 Power-operated watertight and semi-watertight doors	Interpretation 39 Indication to show whether each door is open or closed should be provided for any fire casualty not exceeding the casualty threshold except for those doors in the boundary of spaces directly affected by the casualty.
II-2/21.4.13 Flooding detection systems	Interpretation 40 Flooding detection systems may be considered to be lost only in spaces directly affected by the fire casualty and in other spaces in the same compartment that are part of the same section provided that all other detectors remain operational in any other compartment served by that section.
II-2/21.5 Safe areas	Interpretation 41 When considering a fire casualty in a certain MVZ, only spaces within the casualty threshold are to be considered lost. Food, water and equipment for the support of the basic services to the safe areas, stored in spaces not directly affected by the fire casualty and belonging to the same MVZ, could be considered still available.

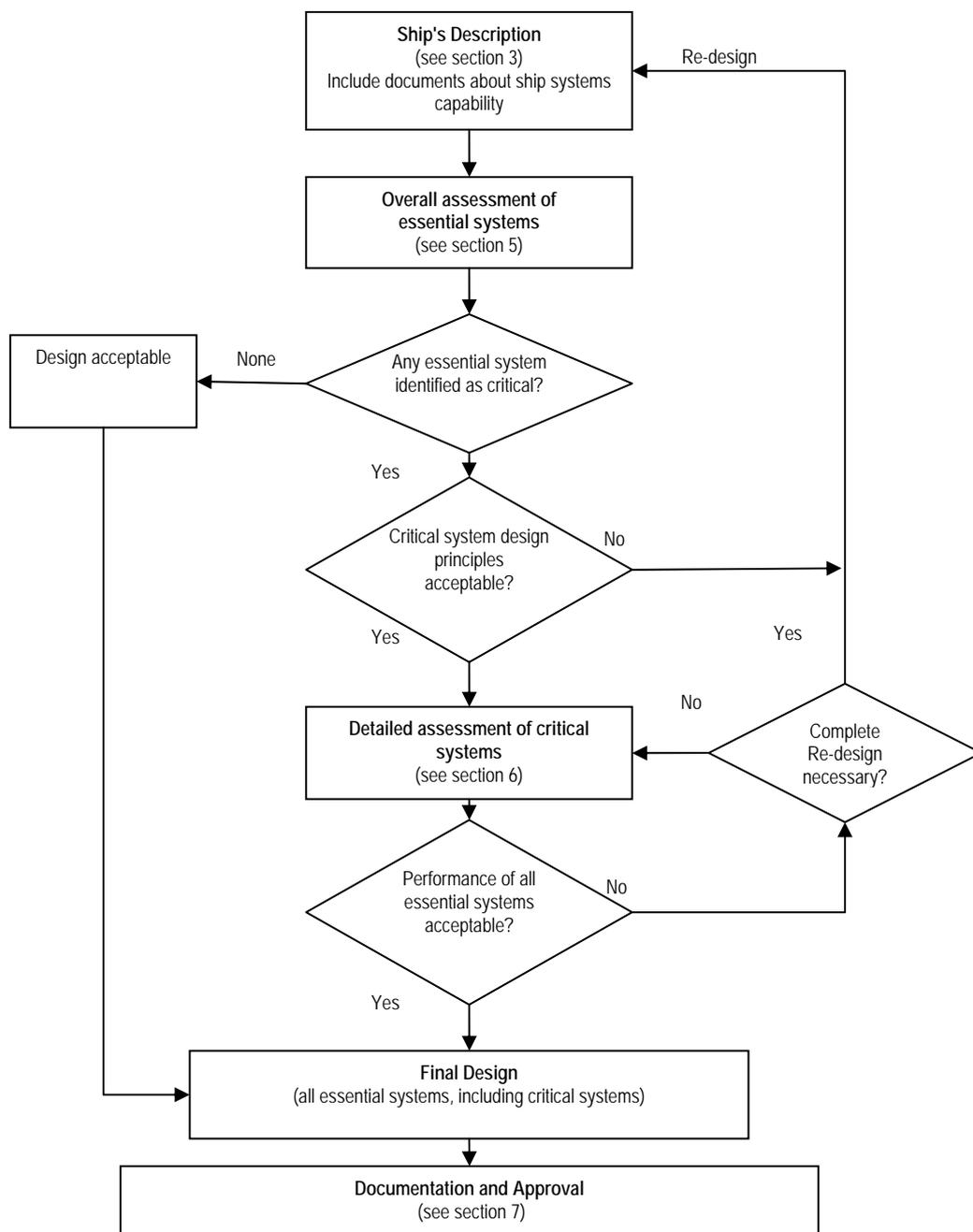
Regulation	Interpretations
II-2/21.5.1.1 Safe areas Functional requirements	Interpretation 42 Safe areas could be a number of spaces distributed on board and should preferably be arranged in accommodation spaces. Sizing of safe areas where persons are accommodated could be based on the time needed for safe return to port operation. For safe return to port operations longer than 12 h a minimum space of 2 m ² per person, calculated on the basis of the gross deck surface of the space(s) being considered, should be provided. For safe return to port operations shorter than 12 h a minimum space of 1 m ² per person should be provided.
II-2/21.5.1.2.1 Safe areas, sanitation	Interpretation 43 As a minimum one toilet for every 50 persons or fraction should remain operational. Grey and black water can be disposed of into the sea, allowed by MARPOL (reference MARPOL Annex IV, regulation 3).
II-2/21.5.1.2.2 Safe areas, water	Interpretation 44 As a minimum 3 litres per person per day drinking water should be available. Additional water for food preparation and hygiene may need to be provided.
II-2/21.5.1.2.3 Safe areas, food	Interpretation 45 Food could be of any kind including dry food. Storage of food should be distributed as necessary, so that an access route is available from the safe areas.
II-2/21.5.1.2.4 Safe areas Alternate space for medical care	Interpretation 46 In addition to the ship's hospital or medical centre one or more locations on the ship should be provided which should: <ul style="list-style-type: none"> a) be in a different Fire Zone (from the hospital or primary medical centre); b) be easily accessible; and c) have lighting and power supply on the main and emergency source of electrical power. Reference should also be made to MSC/Circ.1129.

Regulation	Interpretations
<p>II-2/21.5.1.2.6 Means of preventing heat stress and hypothermia</p>	<p>Interpretation 47 Definition of means for protection against heat stress and hypothermia should take into account external weather conditions, which may depend on area(s) of operation of the vessel. Casualty scenarios for which there is a reduction in ventilation or heating capacity should be identified and consequences assessed. The temperature within the internal safe areas should be maintained in the range of 10 to 30°, consideration being paid to the external temperature during expected operations.</p>
<p>II-2/21.5.1.2.7 Safe areas, light</p>	<p>Interpretation 48 Portable rechargeable battery operated lighting may be acceptable for use in spaces which are not covered by the ship's emergency lighting system. Adequate charging capability should be available for these lights. Supplementary lighting complying with regulation II-1/42-1 is also acceptable.</p>
<p>II-2/21.5.1.2.8 Safe areas, ventilation</p>	<p>Interpretation 49 Ventilation volume should be available as a minimum of 4.5 m³/h per person.</p>
<p>II-2/21.4.14 Safe areas, other systems vital to damage control efforts</p>	<p>Interpretation 50 This includes any system that the Administration determines is vital to damage control pertaining to fire or flooding.</p>
<p>II-2/21.5.1.4 Safe areas, access to embarkation deck</p>	<p>Interpretation 51 Means of access from safe areas to life-saving appliances should be provided from all safe areas in case of any casualty, either internally through areas unaffected by the fire or via external routes. External routes are considered to remain available also in the portion of the ship containing the MVZ where the casualty had occurred.</p>
<p>II-2/22.3.1 Evacuation and abandonment, Systems</p>	<p>Interpretation 52 Electrical power should be available for the abandonment of the ship, including life-saving appliances and arrangements and the systems referred to in SOLAS regulation II-2/22.3.1, with due regard being paid to such services as may be operated simultaneously.</p>

Regulation	Interpretations
II-2/22.3.1.1 Evacuation and abandonment, Fire Main Safe	Interpretation 53 The fire main should remain operational in all main vertical zones not directly affected by the casualty. Water for fire-fighting purposes should be available to all areas of the ship.
II-2/22.3.1.2 Evacuation and abandonment, Internal communications	Interpretation 54 A means should be available for communicating orders to fire-fighting and damage control teams and personnel in charge of evacuation and abandonment.
II-2/22.3.1.4 Evacuation and abandonment, Means of external	Interpretation 55 The ship should be capable of communicating via the GMDSS or the VHF Marine and Air Band distress frequencies even if the main GMDSS equipment is lost.
II-2/22.3.1.3 Evacuation and abandonment, Bilge system	Interpretation 56 The bilge pumping system and all associated equipment essential for its operation should be available in all spaces not directly affected by the casualty.

APPENDIX 2

Assessment of passenger ship systems' capabilities process flowchart



APPENDIX 3

**EXAMPLE OF THE DEVELOPMENT OF AN ASSESSMENT
(refers to an assessment for SOLAS regulation II-2/22)**

Note: Users should note that the example provided represents one way of handling an assessment as other approaches could be equally effective.

The assessment is developed adopting the following steps:

Step 1 – Identification of all essential systems and any required auxiliaries and support systems.

Step 2 – For each deck of each MVZ, determination of which essential systems are present.

Step 3 – For each essential system that is located in the MVZ under analysis, verification of the availability of an alternative in another location.

Step 4 – Essential systems without a suitable alternative in another location must be protected from a fire/flooding casualty.

Step 5 – For each critical system, determination of how the cables, pipes, components will be protected. A hierarchy for protecting critical systems is proposed as follows:

1. First solution – Provide an alternative in a MVZ not affected by the casualty

Example: A main power cable for the GMDSS system passes through the MVZ on deck 3. In a fire this cable could be damaged. An emergency power cable is routed from a different direction to the navigation bridge that does not pass through this area. The conclusion is that further analysis is not needed. Damage to the power cable does not affect the ship's safe return to port capability.

2. Second solution – Protect the essential system within the MVZ under analysis

Example: In the case of the a.m. power cable, it is determined that only a short length of cable passes through the MVZ under consideration, located 5 m above the deck. An A-60 trunk is installed to protect the cable to preclude fire damage.

3. Third solution – Provide a repair or manual action to compensate for loss of the system

Example: – Another essential system cable is analysed, and it is determined that the cable is routed throughout the MVZ at various levels and construction of an A-60 trunk is not practicable. Instead, a repair cable is prepared and staged with necessary tools at a protected location. If the cable is damaged from a fire in the MVZ under analysis, the crew is able to temporarily re-route power from another location using the repair cable.