2 Preliminary Guidelines for Safe Return to Port Capability of Passenger Ships
The following preliminary Guidelines come into force on 15 December 2009.

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Premise

A. General

1. At the 82nd session of the Maritime Safety Committee (MSC), the safe return to port regulations were adopted by resolution MSC.216(82). In the resolution, amendments to the International Convention for the Safety of Life at Sea 1974 were published. In the same session, MSC approved performance standards for the systems and services under consideration and published them in MSC.1/Circ.1214.

2. These Guidelines refer to the requirements contained in SOLAS II-1 Reg. 8-1, II-2 Regs. 21 and 22, relevant for passenger ships with keel laid on or after 1 July 2010, and having a length of 120 m or more or having three or more main vertical fire zones.

3. The purpose of these Guidelines is to establish design criteria for a ship's safe return to port under its own propulsion after a casualty that does not exceed the casualty thresholds stipulated in Section 2, B. and Section 2, C., and to provide functional requirements and performance standards to ensure health and safety for passengers and crew in safe areas during the return to port. In case of fires exceeding the casualty threshold and affecting one whole main vertical zone, these Guidelines provide design criteria for systems required to remain operational for supporting orderly evacuation and abandonment of a ship.

4. Recognizing that deliberations at IMO with respect to the Safe Return to Port requirements are still ongoing these guidelines are categorised as "preliminary". Recognizing further that in some areas the IMO requirements for Safe Return to Port capabilities describe safety objectives rather than specific requirements, these Preliminary Guidelines aim to provide GL's interpretation of how these objectives can be met. As such they may be used as the basis for discussions with Administrations and other parties involved in the design process on a case by case basis. GL will monitor developments at IMO and provide an update of these Guidelines in due course.

5. The main objectives are

--- with regard to owners, yards and designers: to provide an overview of the objectives and working tasks of design compliant with the safe return to port requirements and the assessment of the ship systems' capabilities according to SOLAS II-1 Reg. 8-1, II-2 Regs. 21 and 22
--- with regard to designers: to provide specific recommendations for the analysis and implementation of individual design solutions
--- with regard to yards: to provide recommendations for the implementation of the safe return to port design

6. In these Guidelines, an analysis process is described that may be used to evaluate the safe return to port capability of passenger ships.

The application of this process may have an effect on the approval. In particular, if results of the analyses that are performed in the course of the process make use of assumptions, in order for approval to be granted, the Administration may ask for the validity of these assumptions to be demonstrated during the design, building, and operation phases of the vessel.

7. As the application of SOLAS II-1 Reg. 8-1, II-2 Regs. 21 and 22 may impact substantially on the ship's design, it is recommended that these Guidelines be considered at an early stage of design.

B. Comments on Formatting of these Guidelines

1. These Guidelines incorporate references from the International Maritime Organization (IMO). Quotations are printed in italics, while source documents are indicated in brackets.

2. Supplementary comments, suggestions, proposals, and proposed interpretations are printed in Roman characters, as this item B.2., without any accentuation.

3. Square brackets [ ] indicate performance standards, limits, specific values or interpretations which are suggested by GL but have to be agreed on with the Administration on a case-by-case basis.

C. Structure of the Guidelines

1. These Guidelines contain the following sections:

--- Application and definitions

This section gives relevant definitions and specifies to which ships these Guidelines apply.
– Casualty cases and thresholds

The fire and flooding casualty cases to be considered during the safe return to port assessment and their thresholds are specified in this section.

– Assessment process

The section recommends possible methodologies for the assessment process.

– Documentation of assessment

Within this section, the main documents required for the safe return to port assessment are outlined. Additional documents of individual systems might be required.

– System requirements for casualties not exceeding the casualty thresholds

The performance requirements of all essential systems after SOLAS II-2 Reg. 21.4 are outlined here. In addition to the minimum requirements to be met during safe return to port operation, information on the availability of individual items after a casualty is provided.

– Functional requirements for safe areas

The minimum functional requirements for safe areas during safe return to port operation are outlined in this section.

– System requirements for casualties exceeding the fire casualty threshold

This section specifies the performance requirements for all essential systems after casualties exceeding the casualty threshold after SOLAS II-2 Reg. 22.

– Trials

Guidelines on establishing a trial programme to verify the safe return to port assessment are formulated in the last section.

2. An overview on the specific system requirements for SOLAS II-1 Reg. 8-1, II-2 Regs. 21 and 22 is given in Appendix A in tabular form.
Section 1

Application and Definitions

A. Application

1. Passenger ships constructed on or after 1 July 2010 having a length, as defined in SOLAS II-1 Reg. 2.5, of 120 m or more or having three or more main vertical zones shall comply with the provisions of these guidelines.

For the purpose of these guidelines, the expression "ships constructed" means ships the keels of which are laid or which are at a similar stage of construction.

2. These guidelines are intended to support safe engineering design and to provide technical justifications for studies addressing the following three scenarios:
   - flooding of any single watertight compartment
   - fire not exceeding a defined casualty threshold
   - fire exceeding a defined casualty threshold, but not exceeding one main vertical fire zone

3. These guidelines are also intended to outline the process of verification of the safe return to port capability, to support the approval of ship designs, and to describe the necessary documentation.

4. Recommendations are made for general and specific interpretations concerning SOLAS II-1 Reg. 8-1, II-2 Regs. 21 and 22.

B. Definitions

For the purpose of these guidelines, the following definitions apply:

Administration means the government of the State whose flag the ship is entitled to fly or its designated representative.

Critical systems are essential systems 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 cases, each not exceeding the fire casualty threshold, or as a consequence of one or more flooding cases, each not exceeding a single watertight compartment.

Emergency conning station is the location of the ship's command after a casualty. An alternative to the wheelhouse has to be considered. It should be possible to observe all objects of interest for the navigation such as ships and lighthouses, in any direction. As far as practicable, the visibility from the emergency conning station should comply with SOLAS V Reg. 22. In case of restricted visibility from the emergency conning station, a sufficient number of additional lookouts are to be posted, ensuring that a field of vision around the ship of 360° is permanently obtained. Remotely located observers shall be provided with means to communicate with the emergency conning station.

Essential systems are all systems which are to remain operational after a fire or flooding casualty according to SOLAS II-2 Regs. 21.4 and 22.3 and as referred to in SOLAS II-1 Reg. 8-1.2.

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.

Fire casualties are all possible fire casualty cases on board the ship under consideration. These fire casualties may or may not exceed the casualty threshold stipulated in SOLAS II-2 Reg. 21.3.

Fire casualty case is one specific fire casualty e.g. in one specific space reaching but not exceeding the casualty threshold defined in SOLAS II-2 Reg. 21.3.

Flooding casualties are all possible flooding cases on board the ship under consideration. These flooding casualties may or may not extend beyond a single watertight compartment as stated in SOLAS II-1 Reg. 8-1.2.

Flooding case is one specific flooding scenario e.g. flooding of one specific watertight compartment.

Main Vertical Zones are those sections into which the hull, superstructure and deckhouses are divided by "A" class divisions, the mean length and width of which on any deck does not in general exceed 40 m. (SOLAS II-2 Reg. 3.32)

Passenger ship systems' design (in short: ship systems' design) is a design description for systems that should be installed to assure the passenger ship systems' capabilities after a fire or flooding casualty (including all essential information showing how to achieve this) according to SOLAS II-1 Reg. 8-1, II-2 Regs. 21 and 22.
Passenger ship systems' functionality (in short: ship systems' functionality) is part of the passenger ship systems' design and defines how the function of systems and the functional requirements, as defined in SOLAS II-2 Regs. 21 and 22 and as referred to in SOLAS II-1 Reg. 8-1.2, are achieved.

Safe area in the context of a casualty is, from the perspective of habitability, any area(s) which is not flooded or which is outside the main vertical zone(s) in which a fire has occurred such that it can safely accommodate all persons onboard to protect them from hazards to life or health and provide them with basic services. (SOLAS II-2 Reg. 3.51)

Safe areas do not need to be continuous, but can be separated, provided the required basic services (SOLAS II-2 Reg. 21.5 and Section 6) are available for all persons on board in these areas.

Safe Return to Port (SRtP) means the passenger ship systems' capabilities after a fire or flooding casualty (in short: ship systems' capabilities) as required by SOLAS II-1 Reg. 8-1, II-2 Regs. 21 and 22. The ship systems' capabilities are intended to address:

- the availability of essential systems after a flooding casualty according to SOLAS II-1 Reg. 8-1.2
- the systems' ability to support a ship's safe return to port under its own propulsion after a fire casualty according to SOLAS II-2 Reg. 21.4 (including functional requirements for safe areas according to SOLAS II-2 Reg. 21.5)
- systems supporting orderly evacuation of the vessel to remain operational after a fire casualty according to SOLAS II-2 Reg. 22

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. (SOLAS II-1 Reg. 2)

Watertight compartment means any space below the bulkhead deck within watertight boundaries.
Section 2

Casualty Cases and Thresholds

A. General

1. Compliance with SOLAS II-1 Reg. 8-1, II-2 Regs. 21 and 22 has to be demonstrated. Therefore the following cases have to be considered: the effects of flooding of one watertight compartment (SOLAS II-2 Reg. 8-1; paragraph B), fire not exceeding the casualty threshold (SOLAS II-2 Reg. 21.3; paragraph C), and fire exceeding the casualty threshold but not exceeding one main vertical zone (SOLAS II-2 Reg. 22).

2. The availability of safe areas for all persons on board for each possible casualty case not exceeding the casualty threshold has to be considered.

3. Flooding casualties

In a flooding casualty case not exceeding the casualty threshold specified in B., the systems specified in SOLAS II-2 Reg. 21.4 (Section 5) have to remain operational. It is not required that the ship is capable of returning to port under its own propulsion. However, all essential systems have to remain operational for the time defined by the operational radius and remaining safe return to port speed for an equivalent fire casualty case not exceeding the casualty threshold.

4. Fire casualties not exceeding the casualty threshold

4.1 If a fire does not exceed the casualty threshold, it has to be demonstrated that the ship is capable of returning to port, while providing safety and basic services to its occupants. The ship systems' capabilities required for the safe return to port operation are defined in Section 5. The requirements to ensure health and safety in so-called safe areas for the ship's occupants are defined in Section 6.

4.2 In a safe return to port case, the maximum distance to port depends on the operational area(s), which have to be specified by the owner and documented in the ship definition (Section 3, C). The required operational time of the systems supporting the basic services of the safe areas in the safe return to port case can be determined by considering the remaining propulsion capacity and the maximal possible distance to port. For the same time span, supplies (such as water and food for all occupants) have to be provided as well.

4.3 A vessel has to be capable of covering the maximum distance of [2000 miles] in the safe return to port case. The Administration may determine the maximum distance for vessels operating in restricted areas; e.g. for a ferry operating on one specific route, half of its journey distance is considered sufficient for the safe return to port case, if no other possible ports of refuge are located along the route to shorten the safe return to port distance.

5. Fire casualties exceeding the casualty threshold, but not exceeding one main vertical zone

If a fire exceeds the casualty threshold as defined in C. the ship systems defined in Section 7 have to remain capable of operating for at least 3 hours to allow for orderly evacuation of the vessel. The affected main vertical zone, including all components, is to be considered lost.

B. Casualty Threshold for Flooding Casualties

1. The casualty threshold for flooding casualties is the loss of any single watertight compartment.

2. In the context of a flooding casualty, progressive flooding through unprotected openings and pipes is to be considered.

3. Watertight compartments in which the risk of flooding originating is negligible need not be considered as watertight compartments of origin of a flooding. An example of such compartments include, but may not be limited to, compartments

   - located from the shell side at least [B/10] and from the bottom at least [B/20],
   - not crossed by seawater piping systems, and
   - not containing drainage piping systems collecting external waters.

When crossed by piping systems other than stated above, the impact and consequences of the available fluid quantity susceptible to flood the compartment are to be assessed.

C. Casualty Threshold for Fire Casualties

1. The casualty threshold, in the context of a fire, includes:

   .1 loss of space of origin up to the nearest “A” class boundaries, which may be a part of the
space of origin, if the space of origin is protected by a fixed fire-extinguishing system; or

2. loss of the space of origin and adjacent spaces up to the nearest "A" class boundaries, which are not part of the space of origin.

(SOLAS II-2 Reg. 21.3)

"A" class boundaries refer to "A" class divisions, as defined in SOLAS II-2 Reg. 3.2, formed by bulkheads and decks.

2. If the space of origin is not protected by a fixed fire-extinguishing system (see 1.2) the casualty threshold includes as well the space(s) which are one deck upwards of the space of origin.

3. Spaces exceeding one deck, such as stairwells, lift trunks and atriums shall be considered as single spaces and as lost in their entirety unless they are subdivided by "A" class divisions.

4. Where a space is not protected by a fixed fire-extinguishing system, the nearest "A" class boundaries which are not part of the space of origin, as referred to in SOLAS II-2 Reg. 21.3, may be in a different main vertical zone.

5. For safe return to port analyses according to SOLAS II-2 Reg. 21, any space up to the casualty threshold boundaries will be assumed to be lost by fire.

6. Spaces in which the risk of a fire originating is negligible need not be considered as spaces of origin of a fire. Such spaces include:

   - spaces accessible only through bolted covers when they are
     - void spaces
     - trunks for pipes intended for liquids other than flammable ones
     - cofferdams
   - tanks
   - chain lockers
   - cable trunks only containing cables with no connections, no other equipment or material and which are closed on all boundaries
   - independent ventilation trunks unless containing galley range exhaust and laundry exhaust ducts or any other duct presenting a fire hazard
   - cross-flooding arrangements
   - vertical escape trunks from machinery spaces, service spaces, control stations and other crew accommodation spaces
   - walk-in safes
   - storage rooms for gas-based fire-extinguishing systems
   - rooms dedicated for the storage of bottles for non-flammable gases
   - "A-0" enclosures within spaces of category 1, 2 or 4 (as defined in SOLAS II-2 Reg. 9.2.23.2) only containing isolation valves or section valves forming a part of the fixed fire-extinguishing system for the protection of accommodation spaces, service spaces and control stations
   - shaft tunnels with no fire load other than surface coating
   - spaces with low fire load and risk, equivalent to the spaces listed above

It has to be considered that such spaces can be included within the extended boundary of a space of origin not protected by a fixed fire-extinguishing system.

7. For passenger ships carrying less than 36 passengers, the space of origin is any space bounded by "A" class bulkheads and decks or the external shell of the hull and superstructures. (Where the deck between two spaces is constructed of steel or equivalent material (after SOLAS II-2 Reg. 3.43), it can be considered to form part of the "A" class boundary, provided that all penetrations are fire resistant.)

8. The loss of any special category or ro-ro space extending more than the length of one main vertical zone is considered outside the casualty threshold. However, the location of essential systems or any of their components (including cabling and piping) in such spaces has to be arranged so as to ensure that a casualty which can be controlled with the fixed fire-extinguishing systems within such a space would not compromise the operation of the essential systems in the remaining fire zones of the ship.

9. Open decks (except balconies for passenger cabins) are not assumed to be lost by fire.
Section 3

Assessment Process

A. General

1. In these guidelines, a system based approach is primarily recommended. In some cases, a compartment or space-by-space based approach may also be practicable.

2. For the application of these guidelines to be successful, all involved 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.

3. As a starting point, the operating pattern of the ship needs to be defined (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 required safe return to port capabilities of the ship will depend on the intended operating pattern.

4. The Administration may determine (as per SOLAS II-2 Reg. 21.4.14) whether any systems additional to those identified are required to remain operational after a casualty.

5. The outcome of the assessments shall establish whether the ship is designed and constructed to provide the capabilities required by SOLAS II-1 Reg. 8-1, II-2 Regs. 21 and 22.

B. Assessment of Required Ship Systems’ Capabilities

1. For assessing the ship systems’ capabilities, a definition of the ship (see C.) is required.

2. The assessment of ship systems’ capabilities should follow a systematic approach as, for example, provided by these guidelines. The approach should be based on structured assessment methods and should well document the remaining functions of all essential systems after a fire or flooding casualty. The assessment of the safe return to port capability as defined by SOLAS II-1 Reg. 8-1, II-2 Regs. 21 and 22 should be performed in three separate parts, addressing SOLAS II-1 Reg. 8-1, SOLAS II-2 Reg. 21 and SOLAS II-2 Reg. 22, respectively.

3. The process of a system based approach is sketched in Fig. 3.1. After the ship definition, each essential system should be assessed separately in two steps:
   – The first step is an overall assessment of all essential systems (see D.). The system assessment has to address all essential systems and functional requirements mentioned in SOLAS II-2 Regs. 21 and 22. For each essential system (see SOLAS II-1 Reg. 8-1.2, II-2 Regs. 21.4 and 21.5), the ship’s systems’ capability shall be verified by checking whether or not the system requirements and functional requirements as specified in Sections 6 and 7 can still be met after all fire and flooding casualty cases not exceeding the casualty thresholds. For fire casualties exceeding the casualty threshold but not exceeding one main vertical fire zone, it has to be analysed whether all essential systems (see SOLAS II-2 Reg. 22.3.1) are operational for three hours and fulfil the system requirements specified in Section 7, considering any one main vertical fire zone as lost.
   Any essential system that is identified to have the possibility of failing to operate adequately as a consequence of one or more considered casualty cases is referred to as a critical system.
   – The second step is a detailed assessment of critical systems identified in the overall assessment of the ship in step 1 (as referred to in E.). The detailed assessment is only required if at least one critical system was identified in the previous system assessment.

Special considerations should be given to spaces with installations influencing the safe return to port capability of multiple essential systems. Examples of such spaces include but may not be limited to
   – the bridge
   – the safety centre
   – the engine control room
   – safety stations.

4. As an alternative to a system based approach, the ship’s safe return to port capabilities can be assessed by a space-by-space approach, considering the loss of each space due to fire or flooding individually.

Software based analysers can be used for a systematic space-by-space approach. This might entail a detailed assessment of individual items by the assessment team.
Fig. 3.1 Assessment of passenger ship systems' capability - process flowchart
If software based analysis tools are used, the applied methodology, theories and assumptions used in the analysis tool have to be demonstrated and well documented.

All input parameters such as the chosen discretization of the ship, including relevant cabling and piping, modelled components, their fire and flooding characteristics and considered casualty cases are to be checked systematically for possible errors.

5. SOLAS does not include references to quantitative or performance criteria. To provide guidance in this respect, Section 5, Section 6 and Section 7 suggest minimum requirements for the ship’s return to port capability, for basic services in the safe areas, and orderly evacuation, respectively. The required ship’s ability to return to port should be linked to the area and conditions of operation. The minimum possible capability available for each scenario in the worst case (e.g. minimum propulsion power for return to port, electrical generating capacity, heating capacity, ventilation capacity and AC capacity, [food and water storage/availability] etc.) shall be stated in the certification issued to the ship (refer to Section 4).

C. Ship Definition

1. The yard and/or owner has to provide all necessary design information for the ship under consideration.

2. This design information shall include a description of the ship systems’ functionality following a fire or flooding casualty. Specifically, the following information is to be provided:
   – a description of the main strategy to reach ship systems’ capability
   – the basic layout of the vessel including boundaries of compartments subject to the casualty cases (watertight or "A" class boundaries) (e.g. in the form of plan views and cross-sections, including but not limited to: general arrangement plan, capacity plan, watertight subdivision plan, fire division plan including space categorization (after SOLAS II-2 Reg. 9.2.2.3.2) (or structural fire protection plan), plan of spaces protected by fixed fire-extinguishing system)
   – the basic arrangement of safe areas for all persons on board for each possible casualty case not exceeding the casualty threshold
   – a list of all systems identified for assessment

   Note
   Such a list would include, in the first instance and as a minimum, all essential systems referred to in SOLAS II-2 Reg. 21.4; 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. The definition of ship’s electrical generation systems and their auxiliaries vital to the vessel’s survivability and safety, as given in MSC.1/Circ.1214 Annex 1 paragraph 3, also need to be taken into account.
   – the location, arrangement and connections of essential systems (including any of their components)
   – a description of the power generation concept intended to supply the essential systems
   – any additional design detail necessary to maintain the ship systems’ capabilities

3. Additional information about the purpose of the ship, the intended area of operation of the ship and the operating pattern or patterns of the ship (which may be used to define any intended speed/maximum distance for safe return to port) have to be included in the ship definition (see A.3.).

4. For the purpose of application of SOLAS II-1 Reg. 8-1, II-2 Regs. 21 and 22 (see also Section 1, A.1.) all main vertical zones of the ship should be counted, irrespective of whether they contain accommodation spaces or not.

5. Horizontal fire zones (special category and ro-ro spaces) should not be included in the count.

6. Where the engineering systems or the main vertical zone sub-division layout or the lifesaving system’s design and arrangements of a vessel has been approved following the methodology of respectively
   – SOLAS II-1 Reg. 55 (alternative design and arrangements) or
   – SOLAS II-2 Reg. 17 (alternative design and arrangements) or
   – SOLAS III Reg. 38 (alternative design and arrangements)
the effect on the safe return to port capability of the vessel needs to be considered explicitly in that analysis. Special attention is to be given to the determination and assignment of safe areas and compliance with requirements of SOLAS II-2 Reg. 22.

D. Overall Assessment of Essential Systems

1. The objective of the overall assessment is to analyse whether all essential systems comply with the system requirements specified in Section 5 and the functional requirements of the safe areas specified in Section 6 for all fire and flooding casualty cases not exceeding the casualty threshold, and whether all
systems referred to in SOLAS II-2 Reg. 22.3 comply with the system requirements specified in Section 7 for all fire casualties exceeding the casualty threshold but not exceeding one main vertical fire zone.

2. A structured assessment of all essential systems has to be conducted. The assessment is initially performed in qualitative terms. Quantitative analysis may be required as part of the detailed system assessment as described in E. A system assessment report has to be prepared as described in Section 4.

3. In general and where practicable, runs and equipment should be duplicated. Where this is not practicable, the provision of E. might apply, when supported by suitable technical arguments.

4. Essential systems identified as being fully redundant for all flooding and fire casualty cases not exceeding the casualty threshold or, for SOLAS II-2 Reg. 22, exceeding the threshold but not exceeding one main vertical zone do not have to be analysed in detail any further.

5. Where no redundancy is provided, adequate protection or rating of equipment, components or connections is possible but has to be approved on a case-by-case basis.

6. When a stairway, a corridor with "A" class boundaries or any other space which is used to access another space is lost following a fire or flooding casualty, any space accessible through the lost space without a second means of access is considered unaffected but undamaged; hence all equipment and systems located within that space that may require local intervention are not to be considered operational. Piping, cabling, transformers, junction boxes, etc. are considered unaffected.

7. Manual action by the crew to regain the ship systems' capability is also possible but has to be assessed in detail.

Manual action is only acceptable in connection with an agreed and defined number of fire and flooding casualties, has to be agreed with the Administration and has to be clearly described in the documentation to be prepared as per Section 4.

Compliance with the safe return to port requirements should be based on the assumption that any manual action that may be required for the ship's return to port, or for any essential system to remain operational following a casualty

- is pre-planned and instructions as well as necessary materials are available on board
- is performed on systems designed to ensure that the required manual action can be completed within one hour from the time the action started

[This should be demonstrated by tests or drills, as applicable.]

8. Performance requirements applicable to any essential system as per SOLAS and per Section 5, Section 6 and Section 7 may be analysed and documented separately; however, any relevant information has to be included in the report on the overall assessment of essential systems.

9. If no critical system is identified following the overall assessment of all essential systems, the design is considered acceptable without a detailed assessment as described in E. The systems assessment report can be used for the preparation of documentation and approval submission, as referred to in Section 4.

E. Detailed Assessment of Critical Systems

1. Essential systems not identified as being fully redundant for all flooding and fire casualty cases not exceeding the casualty threshold are considered as critical systems and have to be assessed in detail.

2. When performing a detailed assessment, additional information may be necessary. The ship definition, described in C., has to be supplemented with the following details for each identified critical system, as applicable on a case-by-case basis:

- details of pipes, cables or other connections linking the components of the critical system, or linking different critical systems
- details of the power generation concept supplying the critical systems
- details of any manual measures needed to provide the required functionality
- details of any operational / navigational solution forming a part of the main strategy of reaching the ship system's capability (see C.3.)

3. Where the design of critical systems is in general acceptable to the Administration, a quantitative stage of the detailed assessment of all critical systems can be carried out. To demonstrate compliance with the safe return to port requirements, the following may be performed to the satisfaction of the Administration (but may not be limited to):

- Failure Mode Effect Analyses (FMEA) of a system or system component. The analysis should follow established procedures such as IEC 60812, "Analysis techniques for system reliability - Procedure for failure mode and effects
analysis (FMEA)" or IMO MSC Resolution 36(63) Annex 4 – "Procedures for Failure Mode and Effects Analysis".

- detailed analysis of the possibility of flooding of internal watertight compartments and of the effect of flooding on system components
- quantitative analysis of the fire load within a space, supplemented by fire engineering analysis and/or fire testing where necessary (e.g. to assess the effect of a fire casualty on a system or system component)

4. Since effects such as multiple short circuits and earth faults might not be considered in detail by certain assessment methods (e.g. FMEA), the loss of the whole system has to be considered during the assessment.

F. Spatial Assessment of Systems’ Availability for Safe Return to Port

1. As an alternative to a system based approach, it is possible to assess the ship’s safe return to port capability by using a spatial approach.

2. In a spatial approach, all essential systems (including necessary components, auxiliaries and supplies) have to be modelled and allocated to specific spaces on board. This includes all relevant interfaces between components, such as the means of power transmission, medium flow and data transmission as well as the accessibility for manually operated or controlled systems.

3. The water and fire resistance or protection of each system component has to be specified and documented.

4. Each individual space has to be considered for all possible casualty cases (flooding, fire below and above the casualty threshold). It has to be demonstrated that the essential system functions are still provided for the safe return to port journey or orderly evacuation for fire exceeding the casualty threshold, respectively.

5. Spaces and rooms not considered lost as consequences of a casualty have to be documented. Low risk of fire or flooding for these rooms has to be verified.
Section 4

Documentation of Assessment

A. General

1. Various strategies may be followed in the design of a ship and in the design of ship's systems and arrangements to achieve the passenger ship systems' capability after a fire or flooding casualty and to comply with the requirements. How the safe return to port capability is achieved should be well documented.

2. The documentation described in detail below provides a record that will be required for
   - the preparation of the ship's operational procedures for safe return to port operation
   - future design changes
   - change of the specified operational area or operating pattern
   - a transfer to the flag of another State.

B. Documentation of the Assessment of required Ship Systems' Capability

1. The documentation of the assessment has to include the main strategy followed to reach the ship systems' capability and to summarize the entire assessment process. The following information has to be provided for approval of the ship systems' capability:
   - Ship definition (refer to Section 3, C.),
   - Report on the overall assessment of essential systems (refer to Section 3, D.):
     - method of system assessment including assumptions
     - results of system assessment including identified critical systems
   - Detailed assessment of critical systems, if applicable (refer to Section 3, E.):
     - methods and assumptions used for the assessment of each critical system, if applicable
     - engineering judgements, operational and manual actions, and exemptions, if applicable
     - results of detailed assessment of critical systems, if applicable
   - Additional information:
     - list of manual actions as required (Section 3, D.6.)
     - maintenance plan and requirements
     - sea trials and testing programme
     - references

2. All documents forming a basis for the safe return to port assessment should be provided for a ship's safe return to port capability. In addition to the documents listed in B.1., this includes:
   - documents of all essential systems indicating the location of all components and items considered in the assessment
   - documents to verify assumptions and conditions used in the analysis
   - any further documents required for the assessment of each individual essential system

These documents will form part of the safe return to port assessment and will be required for its approval.

C. Onboard Documentation

1. The onboard documentation has to provide all essential information for a fire or flooding casualty and for safe return to port operation. The same documentation may also be used for periodical statutory surveys and for port state control purposes. The documentation shall include:
   - ship definition, results of system assessment including identified critical systems and engineering judgements, operational and manual actions, and exemptions, if applicable
   - any restrictions for locations of safe areas in case of a casualty, if applicable
   - operating manual for flooding and fire 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.)
   - operating manual of essential systems for orderly evacuation after a fire casualty exceeding the casualty threshold
   - list of spaces or compartments requiring manual actions in a casualty situation
– list of watertight compartments considered to have negligible flooding risk (if any)
– list of spaces considered to have negligible fire risk (if any)
– documentation of approval (similar to Appendix B of MSC/Circ 1002)
– [test, inspection, and maintenance requirements]

2. The ship systems’ capabilities are to be included in the list of operational limitations issued to passenger ships (ref. SOLAS V Reg. 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, the food/drink/fuel carriage requirements will depend on the operational area).
Section 5

System Requirements for Casualty Cases not Exceeding the Casualty Thresholds

A. General

1. When fire damage does not exceed the casualty threshold indicated in paragraph 31, the ship shall be capable of returning to port while providing a safe area as defined in regulation 32. To be deemed capable of returning to port, the following systems shall remain operational in the remaining part of the ship not affected by fire:

.1 propulsion;
.2 steering systems and steering-control systems;
.3 navigational systems;
.4 systems for fill, transfer and service of fuel oil;
.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 muster-
.6 external communication;
.7 fire main system;
.8 fixed fire-extinguishing systems;
.9 fire and smoke detection system;
.10 bilge and ballast system;
.11 power-operated watertight and semi-watertight doors;
.12 systems intended to support “safe areas” as indicated in paragraph 5.1.21
.13 flooding detection systems; and
.14 other systems determined by the Administration to be vital to damage control efforts.
(SOLAS II-2 Reg. 21.4)

The ship systems for safe return to port shall maintain the system performance requirements as specified in this section.

2. A passenger ship shall be designed so that the systems specified in regulation II-2/21.4 remain operational when the ship is subject to flooding of any single watertight compartment. (SOLAS II-1 Reg. 8-1.2)

For a flooding casualty, the system performance requirements have to be satisfied for the time equivalent to the time required to sail home after an equivalent fire casualty case not exceeding the casualty threshold. However, the ship does not need to be able to perform this journey after the flooding casualty.

3. Safe areas should provide basic services to all passengers and crew as specified in the functional requirements in Section 6.

4. For the design of electrical and electronic equipment and components, it has to be considered that flooding and fire casualty cases can result in multiple short circuits and earth faults. Regard should be given to the conductive coupling of external voltages.
Examples for measures to minimize such effects:

– emergency off circuits: monitored override switches
– power supply system: splitting off the supply system by advanced contacts of the protective device; directional earth fault protection; separate auxiliary voltage for each compartment
– data transfer: use of fibre optical systems

5. In accordance with the Administration, it may be possible to re-establish the capability to return to port after the fire or flooding has been put under control. It should be possible to complete the required manual action within 1 hour from the time the action started (see Section 3, D.7).

Exceptions are internal and external communication systems, fire main, fire and smoke detection, bilge and ballast systems, flooding detection, power-operated watertight and semi-watertight doors and possibly other systems determined by the Administration to be vital to damage control efforts, which shall remain available during fighting of fire or flooding.

6. The system requirements of all essential systems after a fire or flooding casualty not exceeding the casualty threshold are specified in B. to N., addressing all systems referred to in SOLAS II-2 Reg. 21.4. O. and P. address the cabling, piping and electrical power, respectively.
B. Propulsion

1. Propulsion machinery and auxiliary machinery essential for the propulsion of the ship should remain operable (MSC.1/Circ.1214).

For safe return to port operation, at least one independent propulsion system including its auxiliaries has to remain operational, fulfilling the following specifications.

2. The minimum propulsion capacity in safe return to port operation should allow the ship to remain manoeuvrable and keep position even under unfavourable weather conditions. [Within the context of these guidelines, unfavourable weather conditions are regarded as being a wind speed of up to and including 21 m/sec. and a significant wave height of 5.4 m with an average wave period of 8.3 sec.].

The minimum speed the ship should be capable of reaching in normal weather conditions must be at least [7 knots or half the design speed (the lower value may be applied)]. [Normal weather conditions are regarded as being a wind speed of up to and including 11 m/sec. and a significant wave height of 2.8 m with an average wave period of 6.7 sec.]

The minimum performance requirements and unfavourable and normal weather conditions are specified in the GL Rules for Redundant Propulsion and Steering Systems (I-1-14).

Evidence of the above-mentioned performance shall be provided (reference is made to Section 8).

3. The performance requirements for propulsion can be fulfilled either by the systems of the main propulsion system or by an alternative emergency propulsion system capable of being used for safe return to port operation.

4. Essential auxiliary systems (e.g. compressed air, oil, fuel, lubrication oil, cooling water, ventilation, fuel storage and supply systems etc.) have to remain operational.

5. Fuel consumption and time for the journey to a port of refuge have to be determined on the assumption of headwind under normal weather conditions.

Fuel consumption under safe return to port conditions (possibly higher consumption due to the use of a different arrangement of primary movers) has to be determined including the required load for supplying all essential systems (possibly more than just minimum demand).

6. The Administration may determine the expected weather conditions for vessels operating in restricted areas.

7. A steel shaft line passing through a space affected by a flooding or a fire scenario may be considered operational if it is enclosed in an "A-60" tunnel, or alternatively if

a) in the flooding case, it can be shown that it is able to operate under water,

b) in the fire case, it is protected by a water based fire-extinguishing system. A shaft line passing through a machinery space of category A cannot be considered operational.

Particular attention should be paid to bearings and seals (to ensure that, for example, progressive flooding does not occur).

8. Manual control of the propulsion and electrical power generation systems (including but not limited to engines, electric motors, fuel system, etc.) has to be provided at local positions. Adequate communication has to be arranged and it shall be demonstrated that the loss of any automation or control system does not prevent or impair any such manual/local control. Consideration should be given to the provision of machinery alarms when operating in that manner.

C. Steering Systems and Steering-Control Systems

1. Steering systems and steering-control systems should be capable of manoeuvring the ship (MSC.1/Circ.1214).

The manoeuvring capability should be maintained even under unfavourable weather conditions [21 m/s wind speed, 5.4 m significant wave height and 8.3 sec. wave period].

2. For all casualty cases not exceeding the casualty thresholds, at least one system capable of providing sufficient steering capacity under unfavourable weather conditions has to remain operational, including its essential auxiliaries. Evidence of the above-mentioned performance shall be provided (reference is made to Section 8).

The Administration may determine the expected weather conditions for vessels operating in restricted areas.

3. Local control of steering systems is acceptable, provided adequate communication is arranged.

4. Emergency means of steering, e.g. azimuth thrusters, pump jets, rudder propellers, may be considered. Tunnel thrusters are not considered adequate for emergency steering.
D. Navigational Systems

1. 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 (MSC.1/Circ.1214).

2. The following navigation equipment, portable or fixed in another location (emergency conning position), shall be operational in any casualty case not exceeding the casualty threshold (including loss of wheelhouse):
   - a magnetic or gyro compass to determine the ship's heading
   - a compass heading repeater, or other means of supplying heading information to the emergency conning and steering positions
   - means of correcting heading and bearing to true at all times
   - rudder, propeller thrust and pitch and operational mode indicators, or other means, to determine and display rudder angle, propeller revolutions, the force and direction of thrust and, if applicable, the force and direction of lateral thrust and the pitch and operational mode (as an alternative solution, at least a means of communicating the requested information to the emergency conning station may be accepted)
   - updated nautical charts and nautical publications to plan and display the ship's route for the intended safe return to port voyage and to plot and monitor positions throughout the voyage; an operational electronic chart display and information system (ECDIS) may be accepted as meeting the chart carriage requirements
   - a receiver for a global navigational satellite system or a terrestrial radio navigation system, or other means, suitable for use at all times throughout the intended voyage to establish and update the ship's position by automatic means
   - a pelorus or compass bearing device to take bearings (as far as practicable over an arc of the horizon of 360°)
   - a 9 GHz radar, or other means, to determine and display the range and bearing of radar transponders and of other surface craft, obstructions, buoys, shorelines and navigational marks to assist in navigation and in collision avoidance
   - a tracking aid, or other means, to plot (automatically or manually) the range and bearing of other targets to determine collision risk
   - an Automatic Identification System (AIS) to automatically provide information to appropriately equipped shore stations, other ships and aircraft, including the ship's identity, type, position, course, speed, navigational status and other safety-related information; to automatically receive such information from similarly fitted ships; to monitor and track ships; and to exchange data with shore-based facilities
   - navigation and signal lights (by redundant power supply, by portable equipment or equivalent)
   - a weather forecasting source
   - [an echo sounding device, or other electronic means, to measure and display the available depth of water]
   - [international code of signals and signal flags]

The following systems should remain operational:
   - sound signal appliances / ship's whistle
   - a daylight signal lamp, or other means to communicate by light during day and night using an emergency source of power
   - internal and external communication facilities (see F. and G.)

Note: Weather forecasting should be available on a 24-hour basis for the whole safe return to port voyage. Weather forecasts should, as a minimum, contain the following information:
   - synopsis of the area
   - wind speed and direction
   - wave height and period
   - swell height and period
   - outlook for the next 48 hours

In certain high-risk situations, or if such forecast may be seasonally unpredictable, consideration should be given to obtaining a second weather forecast.

Weather forecasts should be received at least every 24 hours during the voyage. Where there are specific weather limitations imposed, then more frequent forecasts may be appropriate, with direct communication possible with the forecaster if significant changes are expected.

E. Systems for Fill, Transfer and Service of Fuel Oil

1. Systems for internal fill transfer and service of fuel oil should be capable of fuel transfer to active propulsion and power generation equipment. (MSC.1/Circ.1214)

2. Systems for fill, transfer and service of fuel, other flammable hydrocarbons, or any fluid that may be flammable or dangerous if heated to a temperature above their flash point (both within the pipe or fittings
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and on going through pumps, orifices or other equipment) are not to be considered operational within spaces affected by a fire casualty.

3. Fuel oil consumption for safe return to port operation shall be considered during the design, based on the assumptions made on propulsion (see B.5.) and on the necessary energy demand for all essential systems (Section 5 and Section 6). Fuel oil consumption is to be determined, and the capacity of fuel oil and the related tanks or processing systems have to be designed accordingly.

F. 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

1. Internal communications should be achieved by any effective portable or fixed means of communications (MSC.1/Circ.1214).

2. Two-way communication has to be provided in any casualty case within the casualty threshold to address the following stations:
   - bridge or alternative emergency conning station
   - engineering spaces
   - safety centre
   - all fire-fighting and damage control teams
   - emergency control stations, muster and embarkation stations and strategic positions on board (according to SOLAS III Reg. 6.4)
   - all stations on board which require manual control or operation to sustain operation of essential systems
   - if the emergency conning station has blind spots, lookout positions to achieve 360° view

3. Portable equipment is considered sufficient. Not all handhels are to be located in one space; sufficient units for all stations have to be provided, loading units to be stationed in more than one MVZ.

   The repeater system needs to remain operational when required to address all stations referred to in 2. Technical alternatives may be possible.

4. PA (public address) systems, arranged as public address and general alarm systems, should remain operational in all main vertical zones not affected by the casualty.

   SOLAS III Reg. 6.5 requirements are to be met for safe return to port operation. One operational loop of the PA system is sufficient.

G. External Communication

1. 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. (MSC.1/Circ.1214)

2. The functional requirements as defined in SOLAS IV Reg. 4 should be fulfilled during the safe return to port voyage.

   It is recommended that the radio installations comply with SOLAS Chapter IV during the safe return to port voyage.

3. Portable equipment (in another location) may be accepted.

   Charging capacity for any portable devices shall be available in more than one main vertical zone.

H. Fire Main System

1. 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. (MSC.1/Circ.1214)

2. The fire main shall be designed as a ring system according to the GL Rules for Machinery Installations (I-1-2), Section 12, E.2.

3. Manual local start of fire main pumps is accepted after a casualty (provided adequate communication can be assured).

4. At least one pump shall fulfil the requirements for an emergency fire pump according to the GL Rules for Machinery Installations (I-1-2), Section 12, E.1.4, which implies locating the pumps in at least two separate compartments.

   For the arrangement of fire pumps with respect to SOLAS II-2 Reg. 22, reference is made to Section 7, B.

5. Isolating valves have to be available in sufficient number, so that sections of the fire main passing through a space affected by fire can be isolated and the principal requirement (each location can be provided with water from two fire hose nozzles simultaneously) is fulfilled in all other areas.

6. The number and position of hydrants shall be in accordance with the GL Rules for Machinery Installations (I-1-2), Section 12, E.2.4

   The principal requirement of SOLAS II-2 Reg. 10.2.1.5.1 (each location can be provided with water
jets from two fire hose nozzles simultaneously) shall be fulfilled in all other areas not affected by the casualty. In safe return to port operation, two lengths of hoses for each of the two water jets are acceptable for reaching each location.

7. Electrical supply of fire pumps has to be assured after a casualty.

I. Fixed Fire-Extinguishing Systems

1. General

1.1 The automatic sprinkler system or any other fixed fire-extinguishing system designed to protect an entire space should be operational in all spaces not directly affected by the casualty. (MSC.1/Circ.1214)

1.2 The GL Rules for Machinery Installations (1-1-2), Section 12 apply for fire-extinguishing systems.

1.3 Sea water supply for fire-fighting purposes has to be assured for all casualties.

2. Automatic sprinkler or water mist system in accommodation areas

2.1 Each sprinkler section shall serve not more than one deck in not more than one main vertical zone.

2.2 In the main line, shutoff valves shall be installed for isolating a damaged pump section or damaged feeding line.

2.3 For low-pressure systems, back-up through fire pumps is accepted if the pressure head is not less than the required pressure head of the sprinkler pump (i.e. second pump not required).

2.4 At least two sprinkler pumps (conventional system acc. to FSS Code Ch. 8) or two pump units (water mist system acc. to Res. A.800(19)) shall be provided. The pumps or pump units shall be located in the foremost and aftmost main vertical zone, or equivalent devices (e.g. interconnecting bypass line without any branches in fire-safe execution) shall be provided.

Means shall be provided to prevent an uncontrolled leak in case of loss of any pump or pump unit. In case of loss of one pump or pump unit as a result of one fire or flooding casualty, all sections shall be provided with the total required flow and pressure for each section.

2.5 Section valves located within the space affected by the fire casualty are considered to be non-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 water nozzle, etc.).

Indication of activated sections in the continuously manned central control station, located outside the main vertical zone containing the space affected by the casualty, shall continue to function after a fire or flooding casualty.

Manual non-monitored valves are acceptable for emergency operation after the casualty has occurred; they should be kept locked shut (i.e. the system would still work should they be open). Such valves do not need to be provided with indication in the wheelhouse, provided that they are accessible and clearly marked.

Normally open valves may be installed in a limited number, if these valves are required to be closed for the operation following a casualty. These valves need to be provided with indication at the alarm panel in the wheelhouse.

2.6 If the system includes one or more emergency feed, risers, connections or other emergency means to comply with this regulation, then hydraulic calculations (FSS Code Ch. 8 para. 2.3.3.2) may need to be revised to take this into account.

3. Water-based room protection systems for machinery spaces (MSC/Circ.1165)

3.1 At least two pump units shall be provided. The pump units shall be located in the foremost and aftmost main vertical zone, or equivalent devices (e.g. interconnecting bypass line without any branches in fire-safe execution) shall be provided. In case of a casualty not exceeding the casualty threshold, one pump unit has to remain capable of protecting all machinery spaces not directly affected by the casualty during safe return to port operation. Sea water supply has to be available.

3.2 The main line needs to be provided with shutoff valves to isolate a damaged pump or feeding line.

3.3 The system shall be designed so that in case of a loss of any section valve, the entire system remains operational with the required performance. Duplication, fire protection of valves or fire-rated valves may be considered in the design.

3.4 In the case when the main line passes through different protected spaces, means for each protected space to be isolated shall be provided. Protected spaces not affected by a casualty shall be supplied by at least one pump unit. Alternatively, the piping can be fire-safe ("A-60" standard).

3.5 A second release station shall be provided.
3.6 The requirements for valves are similar to the requirements for valves of the automatic sprinkler or water mist system in accommodation areas (see 2.).

3.7 Local application systems are not required to remain operational after a casualty, unless they form part of a system for room protection of machinery spaces.

3.8 As an alternative to safeguarding the availability of the water based room protection system, another fixed fire-extinguishing system (gaseous system) can be installed to provide protection of these spaces after a casualty case not exceeding the casualty threshold.

4. Drencher systems for special category spaces (ro-pax)

4.1 At least two drencher pumps (conventional systems acc. to Res. A.123(V)) or two pump units (water mist system acc. to MSC.1/Circ.1272) shall be provided. The pumps or pump units shall be located in the foremost and aftmost main vertical zone, or equivalent devices (e.g. interconnecting bypass line without any branches in fire-safe execution) shall be provided. One pump or pump unit has to remain available after any casualty case not exceeding the casualty threshold.

4.2 The main line needs to be provided with shutoff valves for isolating a damaged pump or feeding line.

4.3 The main line shall be designed redundant; alternatively, all piping shall be designed to be fire-safe (“A-60” standard).

4.4 A second release station shall be provided.

5. CO₂ system

5.1 If a carbon dioxide (CO₂) system is the sole fixed fire-extinguishing system for protection of machinery spaces, there should be two rooms each holding a quantity of CO₂ capable of protecting the largest space. In case there is only one room containing all the CO₂ bottles, there should be enough capacity to protect the largest and the second largest space.

5.2 If only one CO₂ room is provided, the flooding lines from the CO₂ room shall be duplicated and installed in such a way that at least the main or redundant flooding lines remain unaffected as a consequence of the same casualty case. In case two CO₂ rooms are provided, the CO₂ rooms and flooding lines shall be so arranged that at least one CO₂ room with its pertinent flooding lines remains unaffected as a consequence of the same casualty case.

J. Fire and Smoke Detection System

1. The fire detection system should remain operational in all spaces not directly affected by the casualty. (MSC.1/Circ.1214)

2. Fire and smoke detection of the same section, as defined by the FSS Code Ch. 9, para. 2.4.1 and not exceeding one deck in one main vertical zone, may be lost provided all other detectors and indication in the continuously manned central control station remain operational.

K. Bilge and Ballast Systems

1. The bilge pumping systems and all associated equipment essential for its operation should be available in all spaces not directly affected by the casualty. (MSC.1/Circ.1214)

2. One of the required bilge and ballast pumps shall be arranged in the foremost compartment and one of the required bilge and ballast pumps shall be arranged in the aftmost compartment of the ship, or alternative equivalent devices (e.g. interconnecting bypass line without any branches in fire-safe execution) shall be provided.

3. Valves in the main bilge line (not in the bypass bilge line) are necessary for separating the spaces.

4. The ballast systems shall remain available for all ballast tanks not directly affected by the casualty.

5. Valves in the main ballast line (not in the bypass ballast line) are necessary for separating the spaces.

6. Electrical energy for bilge and ballast pumps has to be available for all casualty cases.

With reference to SOLAS II-2 Reg. 22, bilge pumps serving spaces not directly affected must be supplied by electrical energy for casualties exceeding the casualty threshold.

7. Manual local control can be accepted, provided adequate communication is arranged.

L. Power-Operated Watertight and Semi-Watertight Doors

1. Functionality of closure has to be ensured.

2. Opening and closing after casualty is necessary. The minimum requirement is local operation of doors.
3. Status control of doors in continuously manned control station is necessary.

4. Operation and indication of doors in direct enclosure of the "A-0" compartment affected by casualty are no longer required.

M. Flooding Detection Systems

1. The flooding detection system should remain operational after a casualty. (MSC.1/Circ.1214)

2. Flooding detection systems are accepted to be lost only in spaces directly affected by the fire or flooding 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.

N. Other Systems Determined by the Administration to be Vital to Damage Control Efforts

1. This includes any system that the Administration determines is vital to damage control pertaining to fire or flooding. (MSC.1/Circ.1214)

2. Systems specified by the Administration to be vital to damage control efforts shall remain available after a fire or flooding casualty not exceeding the casualty thresholds.

O. Availability of Cables and Pipes after a Casualty

1. All pipes and vent ducts passing through (not serving) a compartment affected by a flooding casualty are considered to remain operational provided they, including relevant fittings, are capable of withstanding the head of water expected at their location.

2. Steel pipes permanently carrying non-flammable liquids and passing through (not serving) spaces affected by a fire casualty are considered to remain operational, provided they are of substantial thickness (reference can be made to Load Line Reg. 22.7.b) or insulated to an "A-60" standard.

Fittings are not considered operational after a fire casualty, unless they are fully welded or have been fire-tested according to IACS P2.11.5.5.6 fire test. With respect to the analysis, a non-operational fitting means an open system and consequently a pressure loss.

Temperature increase of liquids carried needs to be considered for affected systems.

3. Power and data cables are considered to continue to work in a space affected by a flooding casualty, provided they have no connections, no joints, no equipment connected to them, etc., within such space, or such connections, joints and devices shall have a suitable degree of protection according to the conditions and head of water expected at their location for a period not shorter than estimated for the safe return to port.

4. Fire-resistant power cables complying with [IEC 60331-21 and IEC 60331-31] (see also IACS UR E15) passing through (not serving) spaces are considered operational after a fire casualty, provided they have no connections, joints and equipment, etc., connected to them within the space affected by the casualty.

These cables should be installed in a way to support their survival in a fire casualty and during its fighting.

Systems or components controlled by data bus systems in normal operation have to be designed in such a way that they can be operated locally when the data connection is lost in safe return to port operation.

For systems or components which cannot be operated without a bus system, redundant bus systems have to be designed in a way that they cannot be lost as a consequence of a casualty not exceeding the casualty threshold.

Data cables connecting items in more than one space with "A" class boundaries have to be optical cables.

P. Power Supply

1. Electrical power should be available and sustainable for all essential services specified in SOLAS regulations II-2/21.4 3 and II-2/21.5.1.2 4, with due regard to such services as may be operated simultaneously. The application of regulation II-2/21.4 3 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. (MSC.1/Circ.1214)

2. An electrical load balance has to be submitted for the safe return to port scenario with minimum electrical generating capacity available.

In connection with the above sentence, it has to be considered that all essential systems at the performance level specified in this section, and their auxiliaries and systems needed to support the functional requirements of the safe areas, should be included with a utilization factor of 1.

3 see Section 5
4 see Section 6
Lower utilization factors for essential systems can be considered for the fuel calculations if essential systems or system performance are not permanently required.

3. As a minimum, two separate electric power plants are needed in two different watertight compartments and "A" class boundaries including auxiliary systems.

For casualties exceeding the casualty threshold (SOLAS II-2 Reg. 22), reference is made to Section 7.

4. An emergency generator, fitted for compliance with SOLAS II-1 Reg. 42, can be used to support the safe return to port functions, as long as its ability to provide emergency services as referred to in SOLAS II-1 Reg. 42 is not impaired (this includes the availability of fuel).
Section 6

Functional Requirements of Safe Areas

A. General

1. Safe area in the context of a casualty is, from the perspective of habitability, any area(s) which is not flooded or which is outside the main vertical zone(s) in which a fire has occurred such that it can safely accommodate all persons onboard to protect them from hazards to life or health and provide them with basic services. (SOLAS II-2 Reg. 3.51)

Safe areas can be separate spaces and are defined for all casualty scenarios. Individual arrangements of safe areas can be defined for specific casualty scenarios. Documentation on the arrangement of safe areas has to be provided for assessment and on board.

2. The safe area(s) shall generally be internal space(s); however, the use of an external space as a safe area may be allowed by the Administration taking into account any restriction due to the area of operation and relevant expected environmental conditions. (SOLAS II-2 Reg. 21.5.1.1)

It is recommended that safe areas are internal spaces. However, if the functional requirements for safe areas can be guaranteed for the expected environmental conditions of the intended operational areas, external spaces are permissible as well.

3. The safe area(s) shall provide all occupants with the following basic services to ensure that the health of passengers and crew is maintained:

   .1 sanitation;
   .2 water;
   .3 food;
   .4 alternate space for medical care;
   .5 shelter from the weather;
   .6 means of preventing heat stress and hypothermia;
   .7 light; and
   .8 ventilation;

(SOLAS II-2 Reg. 21.5.1.2)

4. The basic services specified in SOLAS regulation II-2/21.5.1.2 should be available to all safe areas, as defined in SOLAS regulation II-2/3.51 (MSC.1/Circ.1214).

The specifications of minimum requirements suggested in this section should ensure that the health of passengers and crew is maintained during the safe return to port voyage.

5. The time period to provide the defined functional requirements is defined by the minimum speed for safe return to port operation under normal weather conditions ([head wind of 11 m/sec. and 2,8 m significant wave height with a wave period of 6,7 sec.]) and the maximal possible distance according to the ship's operational area.

6. For casualty cases with full propulsion performance, full propulsion can be considered to determine the time period the functional requirements shall be provided.

7. Safe areas have to provide a minimum area of [2 m² per person] and volume of [4 m³ per person]. However, if the specified operational area and the remaining propulsion performance assure a maximum safe return to port journey time of less than [12 hours], the minimum amount of space and volume can be reduced to [1 m² per person and 2.5 m³ per person].

B. Sanitation

1. At least one operational toilet facility per each [50 persons] or fraction thereof should remain operational within the safe areas.

2. For a safe return to port operational time over [24 hours], water and facilities for basic hygienic demands have to be available.

3. Grey and black water do not need to be treated under safe return to port operation (after MARPOL Annex I, Chapter 1, Regulation 4).

C. Water

1. A minimum amount of drinking water of [3 L per person and day] shall be provided. The drinking water shall be accessible from the safe areas. The drinking water can be stored in tanks or bottles. Available capacities of water production units can be considered.
2. Additional water for food preparation and personal hygiene shall be considered. The amount depends on the choice of food rations.

3. For food preparation and personal hygiene, at least [4 L per person and day] is to be provided. The amount can be reduced for short return to port voyages.

D. Food

1. For safe return to port journey times over [6 hours], food rations for every person on board have to be stored so as to be accessible from the safe areas.

2. Minimum rations of [8,000 kJ per person per day] have to be available.

3. Food rations can be provided from normal stores, dry food or alternatives.

4. Depending on the choice of food, facilities and resources for preparation of food should be considered.

5. Galleys required for food preparation shall be accessible from safe areas but need not necessarily be located within safe areas.

E. Alternate Space for Medical Care

1. Alternate space for medical care shall conform to a standard acceptable to the Administration. (SOLAS II-2 Reg. 21.5.2)

This can be any space within safe areas e.g. in cabin area of a different main vertical zone than the shipborne hospital.

2. Medicines and basic medical appliances conforming to a standard acceptable to the Administration shall be available in the alternate space for medical care.

3. The location of the alternate space of medical care has to be easily accessible.

4. [Oxygen supply should be considered for medical treatment.]

F. Shelter from the Weather

If outside areas are considered as safe areas, shelter from the weather has to be provided.

G. Means of Preventing Heat Stress and Hypothermia

Temperatures in safe areas shall remain between [10 °C and 30 °C]. Depending on the expected environmental conditions in the operational area, cooling or heating systems have to operate in safe areas.

H. Lighting

Sufficient illumination of safe areas shall be assured. The proposed minimum illumination level is [50 lux].

I. Ventilation

1. Ventilation design shall reduce the risk that smoke and hot gases could affect the use of the safe area(s). (SOLAS II-2 Reg. 22.5.1.3)

2. A minimum air exchange in safe areas of [4.5 m³ per person and hour] is required.

J. Access to Life-Saving Appliances

1. Means of access to life-saving appliances shall be provided from each area identified or used as a safe area, taking into account that a main vertical zone may not be available for internal transit. (SOLAS II-2 Reg. 22.5.1.4)

2. Means of access from safe areas to lifesaving appliances have to be provided from all safe areas in case of any casualty, either externally or via internal routes which have to remain available within the main vertical zone where the casualty had occurred.

[The availability of considered internal transit routes has to be proven.]
A. General

1. The purpose of this regulation is to provide design criteria for systems required to remain operational for supporting the orderly evacuation and abandonment of a ship, if the casualty threshold, as defined in regulation 21.3\(^1\), is exceeded. (SOLAS II-2 Reg. 22.2)

2. In case any one main vertical zone is unserviceable due to fire, the following systems shall be so arranged and segregated as to remain operational:
   .1 fire main;
   .2 internal communications (in support of fire-fighting as required for passenger and crew notification and evacuation);
   .3 means of external communications;
   .4 bilge systems for removal of fire-fighting water;
   .5 lighting along escape routes, at assembly stations and at embarkation stations of life-saving appliances; and
   .6 guidance systems for evacuation shall be available.

(SOLAS II-2 Reg. 22.3.1)

Suggested minimum performance requirements of these systems are specified within this section.

3. The above systems shall be capable of operation for at least 3 h based on the assumption of no damage outside the unserviceable main vertical zone. These systems are not required to remain operational within the unserviceable main vertical zones. (SOLAS II-2 Reg. 22.3.2)

4. Cabling and piping within a trunk constructed to an "A-60" standard shall be deemed to remain intact and serviceable while passing through the unserviceable main vertical zone for the purposes of paragraph 3.1\(^2\). An equivalent degree of protection for cabling and piping may be approved by the Administration. (SOLAS II-2 Reg. 22.3.3)

B. Fire Main

1. 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. (MSC.1/Circ.1214)

2. The fire main shall be designed as a ring system according to the GL Rules for Machinery Installations (I-1-2), Section 12, E.2.

3. Automatic start of a fire pump is not necessarily required (manual local start is accepted, provided efficient communication is available).

4. The disposition of the three required fire pumps shall be such that, in the event of loss of an entire main vertical fire zone, water for fire fighting is still available in all other fire zones. This can be achieved by locating one pump in the fore ship, one pump in the aft ship, and one pump in between. Alternatively, fire main piping shall be fire-safe ("A-60" standard).

5. Shutoff valves for isolating of each fire zone are required, so that, in the event of loss of an entire fire zone, damaged sections can be isolated.

6. With one main fire zone isolated, the principle requirement of SOLAS II-2 Reg. 10.2.1.5.1 (each location can be provided with water jets from two fire hose nozzles simultaneously) shall still be fulfilled in all other main fire zones.

In the safe return to port operation, two lengths of hoses for each of the two water jets are acceptable to reach each location.

7. Electrical power supply of fire pumps has to be assured after a casualty exceeding the casualty threshold.

C. Internal Communications (in Support of Fire-Fighting as required for Passenger and Crew Notification and Evacuation)

1. A means should be available for communicating orders to fire-fighting and damage control teams and personnel in charge of evacuation and abandonment. (MSC.1/Circ.1214)

Two-way communication shall be provided in any casualty case exceeding the casualty threshold but not exceeding one main vertical zone to communicate...
orders to fire-fighting and damage control teams and personnel in charge of evacuation and abandonment.

2. Portable equipment is sufficient (not all located in one main vertical zone, sufficient spare units, normally fully charged and distributed in strategic positions; a repeater system or other technical alternative is possibly needed).

The loss of the repeater system of the portable communication equipment has to be considered; a communication plan for the event of a casualty shall be developed if a loss of the system is possible. [This can imply handheld relay positions, when the operability can be proven.]

Alternatively, fixed installations may be accepted.

3. At least one loop of the PA/GA system is to remain operational for passenger and crew notification within all MVZs not affected by a casualty.

D. Means of External Communication

1. 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. (MSC.1/Circ.1214)

2. The ship shall be capable
   – as provided in SOLAS IV Regs. 8.1.1 and 10.1.4.3, of transmitting ship-to-shore distress alerts by at least two separate and independent means, each using a different radio communication service, and
   – of transmitting and receiving search and rescue co-ordinating communications.

3. Duplication of equipment (VHF and INMARSAT C) in another main vertical zone is recommended.

Alternatively, it is recommended that additional GMDSS systems be installed in another main vertical zone.

E. Bilge System for Removal of Fire-Fighting Water

1. The bilge pumping system and all associated equipment essential for its operation should be available in all spaces not directly affected by the casualty. (MSC.1/Circ.1214)

   All main vertical zones not directly affected by the casualty shall be served by the system.

2. One of the required bilge pumps shall be arranged in the foremost main vertical zone and one of the required bilge pumps in the aftmost main vertical zone of the ship, or alternative equivalent devices (e.g. interconnecting bypass line without any branches in fire-safe execution) shall be provided.

3. Valves in the main bilge line (not in bypass bilge line) are necessary for separating the spaces.

4. Electrical power supply of the bilge pumps and associated equipment essential for its operation has to be assured.

5. An independent local control system is required for each main fire zone.

F. Lighting along Escape Routes, at Assembly Stations and at Embarkation Stations of Life-Saving Appliances

1. Emergency lighting has to be available for the abandonment of the ship. The lighting has to be supplied from the main, emergency or temporary energy source.

2. Fireproof or fire-protected cables are necessary when wiring across or from other main vertical zones.

3. Battery operated systems shall have the capacity for uninterrupted operation of at least 3 hours.

G. Guidance Systems for Evacuation

1. At least one loop of the PA/GA system shall be available.

   Electric power supply from the main or transitional emergency source shall be available.

2. In addition to emergency lighting, as specified by F. above, the means of escape shall be marked by lighting or photoluminescent exit lights and strip indicators according to SOLAS II-2 Reg. 13.3.2.5.

   The lighting system shall be supplied by cables which remain operational. Alternatively, batteries can be used.

H. Electrical Power

1. 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. (MSC.1/Circ.1214)

2. One source of electrical power for operation of all essential systems specified in this Section shall remain available, including all its essential auxiliary systems, after the total loss of any one main vertical zone.

3. A load balance has to be submitted for all essential systems specified in this Section with a utilization factor of 1.
Section 8

Trials

A. General

1. The safe return to port assessment should be verified by tests and sea trials, as far as practicable.

2. The trial programme for the verification of the analysis should be established and documented during the assessment.

3. The trial programme shall be agreed upon between Administration, yard, classification society [and client].

4. The availability of essential systems should be confirmed by trials.

5. These trials should demonstrate that the essential systems' design provides the required capabilities.

B. Availability of essential systems

1. The assumptions and conclusions of the assessment of essential systems should be verified by tests during the trial programme.

   Special attention is to be given to the loss of spaces, where essential items are located. This incorporates spaces at which essential systems are controlled during normal operation, e.g. bridge, engine control room, safety stations or similar.

2. Trials are to be performed to check whether the performance determined in the assessment can still be met. This can be done
   - in a system based assessment, by setting all items of the systems related to a specific casualty case into switched-off conditions
   - in a room based approach, by disabling all items in the space under consideration for the relevant casualty

3. Trials not related to the ship's sailing or manoeuvring performance do not have to be performed at sea.

C. Performance requirements for propulsion and steering systems

1. Tests should be performed during sea trials in accordance with an approved sea trials programme. The tests are to demonstrate that
   - the ship is able to meet the requirements set out in Section 5, B. and C.
   - the propulsion and steering systems have the necessary redundancy in line with the safe return to port requirements
   - the conclusions drawn in the analysis regarding the effects of casualties and measures to control these effects are correct and adequate.

2. The performance should be verified for the worst-case scenario of available propulsion performance determined in the analysis.

   This implies the availability of only one prime mover or any casualty case of limited electrical power supply. Alternatively, this could imply the remaining propulsion and steering performance under take-me-home thrusters or an equivalent solution.

3. Sea trials can be performed in calm weather conditions, provided that the ship's propulsion and manoeuvring performance is determined for the conditions specified in Section 5, B. by means of
   - model tank tests or
   - calculations, extrapolating the weather conditions observed during testing.

D. Orderly evacuation

[The systems availability for orderly evacuation (according to SOLAS II-2 Reg. 22) shall be tested by switching off all main vertical zones individually. Systems specified in Section 7 shall be available in all fire zones not affected.]
Annex A

Tabular Summary of Minimum Requirements

The Tables are intended to provide a fast overview over the requirements of SOLAS II-1 Reg. 8-1, II-2 Regs. 21 and 22. In case of potential conflicts, the main text will remain valid instead of this informative overview.

### Table A.1  Ship's safe return to port under its own propulsion after a casualty that does not exceed the casualty threshold (SOLAS II-I/8-1 and II-2/21.4)

<table>
<thead>
<tr>
<th>System</th>
<th>Function</th>
<th>Performance after Casualty</th>
<th>Example Solution</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propulsion</td>
<td>Manoeuvrability</td>
<td>Control ship up to wind speed of 21 m/sec. and 5.4 m significant wave height with avg. wave period of 8.3 sec.</td>
<td>Two redundant main electric propulsion motors including redundant power supply; alternatively, separate take-me-home thrusters with required performance; local operation possible.</td>
<td>Sea trial (or model tank tests) under SRtP operational conditions</td>
</tr>
<tr>
<td></td>
<td>Position keeping</td>
<td>Keep position for wind of 21 m/sec. and 5.4 m significant wave height with avg. wave period of 8.3 sec.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sailing speed</td>
<td>Minimum speed of 7 kn (or half design speed if lower) against headwind of 11 m/sec. and 2.8 m significant wave height with avg. wave period of 6.7 sec.</td>
<td>Reundant fuel oil service; sufficiently dimensioned emergency fuel supply</td>
<td>Approval by fuel oil calculations</td>
</tr>
<tr>
<td></td>
<td>Operational range</td>
<td>Operational range for safe return to port conditions is 2000 nm, considering fuel consumption with headwind of 11 m/sec. and 2.8 m significant wave height with avg. wave period of 6.7 sec. Energy supply for all SRtP essential systems has to be considered</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steering systems and steering control systems</td>
<td>Manoeuvrability</td>
<td>Control ship (21 m/sec. wind speed, 5.4 m sign. wave height and 8.3 sec. wave period)</td>
<td>Two rudders; two podded drives; pump jets</td>
<td>Sea trial (or model tank tests) under SRtP operational conditions</td>
</tr>
</tbody>
</table>

1. can be reduced for restricted operational area
2. for flooding casualties (SOLAS II-I/8-1) systems have to be capable of required performance, ship does not need to be able to return to port (see Section 2, C.2.)
<table>
<thead>
<tr>
<th>System</th>
<th>Function</th>
<th>Performance after Casualty</th>
<th>Example Solution</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Navigational systems</td>
<td>Navigation and position fixing</td>
<td>Magnetic or gyro compass</td>
<td>Magnetic compass on compass deck and means to communicate heading information</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Supply heading information to emergency conning and steering positions</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Means of correcting heading and bearing at all times</td>
<td>Second magnetic correction table in other compartment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Updated nautical charts and nautical publications to plan and display the ship's route</td>
<td>Second ECDIS separated from bridge</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Establish and update the ship's position by automatic means at all times</td>
<td>Additional portable receiver for a global navigational satellite system or a terrestrial radio navigation system stored separately from main</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Determine and display rudder angle, propeller revolutions, the force and direction of thrust and, if applicable, the force and direction of lateral thrust and the pitch and operational mode; alternative: means to communicate</td>
<td>Means of communication from local positions</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>[Means to measure available depth of water]</td>
<td>2 echo sounding devices in different locations</td>
<td></td>
</tr>
<tr>
<td>Detection and prevention of risk of collision</td>
<td>Pelorus or compass bearing device to take bearings</td>
<td>Pelorus on compass deck or second device in alternate space</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Means to communicate by light during day and night</td>
<td>Second daylight signal lamp in another space</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Means to determine and display the range and bearing of radar transponders and of other surface craft, obstructions, buoys, shorelines and navigational marks</td>
<td>9 GHz radar with two display units in different spaces</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Means to plot (automatically or manually) the range and bearing of other targets to determine collision risk</td>
<td>Radar display unit</td>
<td></td>
</tr>
</tbody>
</table>
Table A.1  Ship’s safe return to port under its own propulsion after a casualty that does not exceed the casualty threshold (SOLAS II-1/8-1 and II-2/21.4)  

<table>
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<tr>
<th>System</th>
<th>Function</th>
<th>Performance after Casualty</th>
<th>Example Solution</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Navigational systems</td>
<td>Detection and prevention of risk of collision</td>
<td>Automatic Identification System (AIS) to automatically provide to appropriately equipped shore stations, other ships and aircraft information, including the ship’s identity, type, position, course, speed, navigational status and other safety-related information; to receive automatically such information from similarly fitted ships, to monitor and track ships and to exchange data with shore-based facilities</td>
<td>Two AIS systems in different locations on board</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sound signal appliances/ ship's whistle</td>
<td>Second release station for whistle; compressor in mast</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Navigation and signal lights</td>
<td>Redundant power supply or portable devices</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Internal and external communication facilities</td>
<td>See communication</td>
<td></td>
</tr>
<tr>
<td>Weather forecast (at least every 24 hours)</td>
<td>Synopsis of the area, wind speed and direction, wave height and period, swell height and period, and outlook for the next 48 hours 1</td>
<td>Radio communication devices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>International code of signals and signal flags</td>
<td>Store at second space on board</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systems for fill, transfer and service of fuel oil</td>
<td>Provide fuel oil for propulsion and power generation 2</td>
<td>Provide fuel oil for 2000 nm propulsion against headwind of 11 m/s and 2.8 m wave height and 6.7 sec. wave period 1</td>
<td>Redundant fuel oil treatment or MGO supply for return to port distance</td>
<td></td>
</tr>
</tbody>
</table>

1 can be reduced for restricted operational area
2 for flooding casualties (SOLAS II-1/8-1) systems have to be capable of required performance, ship does not need to be able to return to port (see Section 2, C.2.)
### Table A.1  Ship’s safe return to port under its own propulsion after a casualty that does not exceed the casualty threshold (SOLAS II-1/8-1 and II-2/21.4) (continued)

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<tr>
<th>System</th>
<th>Function</th>
<th>Performance after Casualty</th>
<th>Example Solution</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>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</td>
<td>Two-way communication to strategic positions on board</td>
<td>Two-way communication with muster and embarkation stations and strategic positions on board (according to SOLAS III Reg. 6.4), all stations on board which require manual control or operation to sustain operation of essential systems, all fire fighting and damage control teams, and, if emergency conning station has blind spots, lookout positions to achieve 360° view.</td>
<td>Mobile or fixed means of communication</td>
<td>Demonstration of effective communication to all parts of the ship under consideration of possible lost systems or system components (e.g. repeater system)</td>
</tr>
<tr>
<td>PA system</td>
<td>Requirements after SOLAS III, Reg. 6.5 for all MVZs not directly affected by casualty; one available amplifier sufficient</td>
<td>Two separate loops with two amplifiers in different MVZs; fire-safe cabling through different MVZs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>External communication</td>
<td>External communication during whole SRtP journey</td>
<td>Capability of communication via GMDSS or VHF Marine and Air Band distress frequencies</td>
<td>Portable equipment with charging unit in other MVZ than main radio equipment</td>
<td></td>
</tr>
<tr>
<td>Fire main system</td>
<td>Fire-extinguishing water</td>
<td>Ring system acc. to GL Rules for Machinery Installations (I-1-2), Section 12, E.2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Supply all hydrants in non-affected MVZs</td>
<td>Sufficient isolating valves; doubling of risers</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>All points on ship to be reached by two nozzles simultaneously, both hoses with two lengths of hoses; number and positions of hydrants shall comply with SOLAS II-2 Reg. 10.2.1.5.1 for all non-affected MVZs</td>
<td>Hydrants close to main fire bulkheads</td>
<td>Demonstration of layout of hydrants</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pressure specified in SOLAS II-2 Reg. 2.1.6 shall be available at hydrant</td>
<td>Dimensioning of pumps and hydraulic calculations considering loss of pumps and/or loss of parts of system</td>
<td>Hydraulic calculations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>At least one emergency pump fulfilling the GL Rules for Machinery Installations (I-1-2), Section 12, E.1.4.</td>
<td>Pumps located in two different MVZs</td>
<td></td>
</tr>
</tbody>
</table>
Table A.1  Ship's safe return to port under its own propulsion after a casualty that does not exceed the casualty threshold (SOLAS II-1/8-1 and II-2/21.4) (continued)

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<tr>
<th>System</th>
<th>Function</th>
<th>Performance after Casualty</th>
<th>Example Solution</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed fire-extinguishing systems</td>
<td>Automatic sprinkler system in accommodation areas</td>
<td>Each sprinkler section should only serve one deck in one MVZ</td>
<td>Section valves for each deck</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pumps installed in foremost and aftmost compartments, continuous bypass line or combination thereof</td>
<td>Install pumps as fwd and aft as practical, and serve remaining compartments by bypass line</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Damaged sections to be isolated</td>
<td>Installation of separating valves</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total required flow and pressure shall be maintained</td>
<td>Hydraulic calculations considering loss of system components</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Indication of activated section in continuously manned station in other MVZs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water based room protection system for machinery spaces</td>
<td>In case of loss of a section valve whole system shall still be supplied by required performance</td>
<td>Sufficient dimensioning or CO₂ as a back-up system</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>At least two pump units</td>
<td>Two pumps in different MVZs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Second release station for room protection system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drencher systems for special category spaces (ro-pax)</td>
<td>Main line shall be redundant or protected (A-60)</td>
<td>Second drencher pump in another MVZ or equivalent solution</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Second release station for drencher system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sea water supply</td>
<td></td>
<td>Enough sea water supply has to be available for all casualty cases</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO₂ system</td>
<td></td>
<td>Redundant means of fire extinguishing</td>
<td>Second CO₂ system in second room or enough capacity for the two largest rooms; alternatively room protection by other system; doubling and redundant routing of CO₂ feeding lines</td>
<td></td>
</tr>
</tbody>
</table>
### Table A.1  Ship's safe return to port under its own propulsion after a casualty that does not exceed the casualty threshold (SOLAS II-1/8-1 and II-2/21.4)  (continued)

<table>
<thead>
<tr>
<th>System</th>
<th>Function</th>
<th>Performance after Casualty</th>
<th>Example Solution</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire and smoke detection system</td>
<td>Fire and smoke detection</td>
<td>Not more than one deck in one MVZ may be lost</td>
<td>Design of systems with back-up control units or function can be taken over by control units of other MVZ</td>
<td></td>
</tr>
<tr>
<td>Indication</td>
<td>Fire and smoke indication</td>
<td>Fire and smoke indication in continuously manned central control station</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bilge and ballast system</td>
<td>Bilge</td>
<td>System available in all spaces not directly affected</td>
<td>Valves necessary for isolating affected spaces/pumps</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Disposition in foremost and aftmost compartment or alternative equivalent devices</td>
<td>Pumps located in foremost and aftmost compartment, continuous bypass lines or combination thereof</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>System available in all spaces containing ballast tanks not directly affected</td>
<td>Valves for separating affected spaces/pumps necessary</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Disposition in most forward and aft compartment or alternative equivalent devices</td>
<td>Pumps located in foremost and aftmost compartment, continuous bypass lines or combination</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>Manual or automatic control</td>
<td></td>
<td>Manual control accepted, provided communication is arranged</td>
<td></td>
</tr>
<tr>
<td>Power-operated</td>
<td>Closure</td>
<td>Function of closure has to be ensured</td>
<td></td>
<td></td>
</tr>
<tr>
<td>watertight and semi-</td>
<td></td>
<td>Opening and closing after casualty necessary; local operation possible; not required for doors in direct enclosure of casualty</td>
<td>Local operation</td>
<td></td>
</tr>
<tr>
<td>watertight doors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indication</td>
<td>Indication of all doors</td>
<td>Indication of all doors (not required for doors in direct enclosure of casualty)</td>
<td>Cabling of indication to two different control units relaying to bridge</td>
<td></td>
</tr>
<tr>
<td>Systems intended to support 'safe areas' as indicated in SOLAS II-2/21.5.1.2</td>
<td>See safe areas</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table A.1  Ship’s safe return to port under its own propulsion after a casualty that does not exceed the casualty threshold (SOLAS II-1/8-1 and II-2/21.4)  (continued)

<table>
<thead>
<tr>
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<th>Performance after Casualty</th>
<th>Example Solution</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Flooding detection systems</td>
<td>Detection</td>
<td>Detection of flooding in all compartment not directly affected by the casualty</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Indication</td>
<td>Indication of flooding in continuously manned central control station</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other systems determined by the administration to be vital to damage control efforts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SAFE AREAS**

<table>
<thead>
<tr>
<th>System</th>
<th>Function</th>
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<th>Example Solution</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sanitation</td>
<td>Toilet facilities</td>
<td>1 per 50 persons or fraction thereof</td>
<td>Disposal of grey water into sea</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Basic hygienic demands</td>
<td>Washing facilities and water for personal hygiene 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>Drinking water</td>
<td>3 L per person and day drinking water assessable from safe areas</td>
<td>Tanks, bottles or water production (incl. chem. dosing) or combination thereof</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Food preparation and personal hygiene</td>
<td>4 L per person and day for food preparation and personal hygiene 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food</td>
<td>Food capacity</td>
<td>8,000 kJ per person and day 1</td>
<td>Operational manual for normal stores, or extra SRtP food stores</td>
<td></td>
</tr>
<tr>
<td>Galleys</td>
<td>Provide galleys for food preparation (must not be in safe areas) 1</td>
<td></td>
<td>Main and crew galley in different spaces; galleys distributed on ship</td>
<td></td>
</tr>
<tr>
<td>Alternate space for medical care</td>
<td>Space</td>
<td>Alternate space for medical care</td>
<td>E.g. allocated passenger/crew cabin with sufficient room in different MVZ than main hospital</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Equipment</td>
<td>Medicine and basic medical appliances; [medical oxygen]</td>
<td>Store place next to emergency hospital</td>
<td></td>
</tr>
<tr>
<td>Shelter from the weather</td>
<td>Shelter for outside areas</td>
<td>Indoor spaces; or if operational area allows outside spaces shelter from wind, sun, perception if operational area allows outside spaces 1</td>
<td>Use only indoor spaces for safe areas</td>
<td></td>
</tr>
</tbody>
</table>

1 can be reduced for restricted operational area
<table>
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</thead>
<tbody>
<tr>
<td>Means of preventing heat stress and hypothermia</td>
<td>Prevention from heat stress</td>
<td>Temperature in safe areas &lt; 30 °C</td>
<td>Distribution of chilling capacity or local chillers for SRtP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Prevention from hypothermia</td>
<td>Temperature in safe areas &gt; 10 °C</td>
<td>Local electric heating units</td>
<td></td>
</tr>
<tr>
<td>Lighting</td>
<td>Illumination of safe areas</td>
<td>At least [50 lux] of illumination</td>
<td>Emergency lighting system from alternative power supply</td>
<td></td>
</tr>
<tr>
<td>Ventilation</td>
<td>Minimize risk of smoke and hot gases</td>
<td>Design ventilation system, that risk of smoke or hot gases is minimal</td>
<td>Fans separated for each MVZ; air intakes on both sides</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Air exchange</td>
<td>At least 4,5 m³ fresh air per person and hour</td>
<td>Fans separated for each MVZ</td>
<td></td>
</tr>
<tr>
<td>Access to LSA</td>
<td>Access from all safe areas</td>
<td>External or internal access, considering MVZ may not be available for internal transit</td>
<td>Design of external routes (or, alternatively, detailed approval of availability of internal escape routes)</td>
<td></td>
</tr>
<tr>
<td>Electrical systems</td>
<td>Electrical power</td>
<td>Enough power for propulsion</td>
<td>Two redundant power plants</td>
<td>Calculating energy balance for reduced energy production or any other casualty which results in a reduced electrical energy availability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Supply of all essential systems with utilization factor 1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electrical capacity</td>
<td>Provide energy for propulsion for whole SRtP journey</td>
<td>Enough supplies to maintain energy production for whole SRtP journey; MGO or consideration of fuel treatment</td>
<td>Calculating fuel oil consumption for SRP journey, considering the system configuration under SRtP operation</td>
</tr>
<tr>
<td>Fire main system</td>
<td>Fire-extinguishing water</td>
<td>Ring system according to GL Rules for Machinery Installations (I-1-2), Section 12, E.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Supply all hydrants in non-affected MVZs</td>
<td>Sufficient isolating valves; doubling of risers</td>
<td></td>
</tr>
</tbody>
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**Table A.1** Ship’s safe return to port under its own propulsion after a casualty that does not exceed the casualty threshold (SOLAS II-1/8-1 and II-2/21.4) (continued)

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<tr>
<td>Fire main system</td>
<td>Fire-extinguishing water</td>
<td>All points in other main vertical zones to be reached by two nozzles simultaneously, both hoses with two lengths of hoses; number and positions of hydrants shall comply with SOLAS II-2 Reg. 10.2.1.5.1 for all non-affected MVZs</td>
<td>Disposition of the three required fire pumps that in the event of loss of a MVZ; water for fire fighting is still available in all other MVZs</td>
<td>Demonstration of layout of hydrants</td>
</tr>
<tr>
<td>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</td>
<td>Two-way communication with strategic positions on board</td>
<td>Two-way communication with all stations on board which require manual control or operation to sustain operation of essential systems, all fire fighting and damage control teams and persons in charge of evacuation and abandonment</td>
<td>Mobile or fixed means of communication</td>
<td>Demonstration of effective communication to all parts of the ship under consideration of possible lost systems or system components (e.g. repeater system)</td>
</tr>
<tr>
<td>PA system</td>
<td></td>
<td>Operational within all MVZs not affected</td>
<td>Two separate loops with two amplifiers in different MVZs; fire-safe cabling through different MVZs</td>
<td></td>
</tr>
<tr>
<td>External communication</td>
<td>Transmitting ship-to-shore distress alerts</td>
<td>Transmitting by at least two separate means, each using different radio communication service</td>
<td>Portable equipment with charging unit in other MVZ than main radio equipment</td>
<td></td>
</tr>
<tr>
<td>Bilge system</td>
<td>Bilge</td>
<td>System available in all MVZs not directly affected</td>
<td>Valves for separating affected spaces/pumps necessary</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Disposition in foremost and aftmost compartment or alternative equivalent devices</td>
<td>Pumps located in foremost and aftmost compartment, continuous bypass lines or combination thereof</td>
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<tr>
<td>Control</td>
<td>Manual or automatic control</td>
<td></td>
<td>Manual control accepted, provided communication is arranged</td>
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<tr>
<td>Lighting along escape routes</td>
<td>Emergency lighting</td>
<td>Illuminate escape routes, assembly stations and embarkation stations of life-saving appliances</td>
<td>Electrical supply from emergency and main or alternatively batteries with 3 h capacity</td>
<td></td>
</tr>
<tr>
<td>Guidance system for evacuation</td>
<td>PA/GA</td>
<td>See internal communication</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Marking acc. to SOLAS II-2 Reg. 13.3.2.5</td>
<td>Lighting</td>
<td>Photoluminescent, suitable cables or local batteries</td>
<td></td>
</tr>
<tr>
<td>Electrical systems</td>
<td>Electrical power</td>
<td>Separated source after loss of any one main vertical zone</td>
<td>Main and emergency source of electrical power in two different MVZs</td>
<td>Trial by disabling of energy sources of all MVZs individually</td>
</tr>
<tr>
<td></td>
<td>Supply of all essential systems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>with utilization factor 1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical capacity</td>
<td>Provide energy for propulsion for 3 hours</td>
<td>Supply of all essential systems with utilization factor 1.0</td>
<td>Enough supplies to maintain energy production for 3 hours; local battery operation of systems possible</td>
<td></td>
</tr>
<tr>
<td>Energy distribution</td>
<td>Supply all essential systems after loss of any one MVZ</td>
<td>Distribute energy generating capacities to most forward and aft MVZ, use suitable protected cables or combination</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>