Title	MSC Circulars / MSC.1/Circ.1212/Rev.1
Note	Revises MSC.1/Circ.1212

MSC.1/Circ.1212/Rev.1

26 June 2019

REVISED GUIDELINES ON ALTERNATIVE DESIGN AND ARRANGEMENTS FOR SOLAS CHAPTERS II-1 AND III

1 The Maritime Safety Committee, at its eighty-second session (29 November to 8 December 2006), *approved Guidelines on alternative design and arrangements for SOLAS chapters II-1 and III* , developed to provide further guidance on SOLAS regulations II-1/55 and III/38, which were adopted by resolution MSC.216(82)and entered into force on 1 January 2009.

2 The Guidelines serve to outline the methodology for the engineering analysis required by SOLAS regulations II-1/55 and III/38 on Alternative design and arrangements, applying to a specific engineering or life-saving system, design or arrangements for which the approval of an alternative design deviating from the prescriptive requirements of SOLAS chapters II-1 and III is sought.

3 The Maritime Safety Committee, at its 101st session (5 to 14 June 2019), approved amendments to the *Guidelines on alternative design and arrangements for SOLAS chapters II-1 and III* (MSC.1/Circ.1212), prepared by the Sub-Committee on Ship Systems and Equipment, at its sixth session.

4 Member Governments are invited to bring the revised Guidelines set out in the annex to the attention of shipowners, shipbuilders and designers for the facilitation of design within the framework of SOLAS regulations II-1/55 and III/38.

***

ANNEX

REVISED GUIDELINES ON ALTERNATIVE DESIGN AND ARRANGEMENTS FOR SOLAS CHAPTERS II-1 AND III

1 Application

1.1 These Guidelines are intended for application of safe engineering design to provide technical justification for alternative design and arrangements to SOLAS chapters II-1 (parts C, D and E) and III. The Guidelines serve to outline the methodology for the engineering analysis required by part F (Alternative design and arrangements) of SOLAS chapter II-1 and part C (Alternative design and arrangements) of SOLAS chapter III, applying to a specific safety system, design or arrangements for which the approval of an alternative design deviating from the prescriptive requirements of SOLAS chapters II-1 and III is sought.

1.2 These Guidelines are not intended to be applied to the type approval of individual materials, components or portable equipment.

1.3 These Guidelines are not intended to serve as a stand-alone document, but should be used in conjunction with the appropriate engineering design guides and other literature.

1.4 For the application of these Guidelines to be successful, all interested parties, including the Administration or its designated representative, owners, operators, designers and classification societies, should be in continuous communication from the onset of a specific proposal to utilize these Guidelines. This approach usually requires significantly more time in calculation and documentation than a typical regulatory prescribed design because of increased engineering rigor. The potential benefits include more options, cost effective designs for unique applications and an improved knowledge of loss potential.

2 Definitions

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

2.1 *Alternative design and arrangements* means measures which deviate from the prescriptive requirement(s) of SOLAS chapters II-1 or III, but are suitable to satisfy the intent of that chapter. The term includes a wide range of measures, including alternative shipboard structures and systems based on novel or unique designs, as well as traditional shipboard structures and systems that are installed in alternative arrangements or configurations.

2.2 *Design casualty* means an engineering description of the development and severity of a casualty for use in a design scenario.

2.3 *Design casualty scenario* means a set of conditions that defines the development and severity of a casualty within and through ship space(s) or systems and describes specific factors relevant to a casualty of concern.

2.4 *Functional requirements* explain, in general terms, what function the system under consideration should provide to meet the safety objectives of SOLAS.

2.5 *Performance criteria* are measurable quantities to be used to evaluate the adequacy of trial designs.

2.6 *Prescriptive based design or prescriptive design* means a design of safety measures which comply with the regulatory requirements set out in parts C, D and E of SOLAS chapter II-1 and/or chapter III, as applicable.

2.7 *Safety margin* means adjustments made to compensate for uncertainties in the methods and assumptions used to evaluate the alternative design, e.g. in the determination of performance criteria or in the engineering models used to assess the consequences of a casualty.

2.8 *Sensitivity analysis* means an analysis to determine the effect of changes in individual input parameters on the results of a given model or calculation method.

2.9 *SOLAS* means the International Convention for the Safety of Life at Sea, 1974, as amended.

3 Engineering analysis

3.1 The engineering analysis used to show that the alternative design and arrangements provide the equivalent level of safety to the prescriptive requirements of SOLAS chapters II-1 and III should follow an established approach to safety design. This approach should be based on sound science and engineering practice incorporating widely accepted methods, empirical data, calculations, correlations and computer models as contained in engineering textbooks and technical literature.

3.2 Other safety engineering approaches recognized by the Administration may be used.

4 Design team

4.1 A design team acceptable to the Administration should be established by the owner, builder or designer and may include, as the alternative design and arrangements demand, a representative of the owner, builder or designer, and expert(s) having the necessary knowledge and experience in safety, design and/or operation as necessary for the specific evaluation at hand. Other members may include marine surveyors, ship operators, safety engineers, equipment manufacturers, human factors experts, naval architects and marine engineers.

4.2 The level of expertise that individuals should have to participate in the team may vary depending on the complexity of the alternative design and arrangements for which approval is sought. Since the evaluation, regardless of complexity, will have some effect on a particular field of safety, at least one expert with knowledge and experience in that appropriate safety field should be included as a member of the team.

4.3 The design team should:

.1 appoint a coordinator serving as the primary contact;

.2 communicate with the Administration for advice on the acceptability of the engineering analysis of the alternative design and arrangements throughout the entire process;

.3 determine the safety margin at the outset of the design process and review and adjust it as necessary during the analysis;

.4 conduct a preliminary analysis to develop the conceptual design in qualitative terms. This includes a clear definition of the scope of the alternative design and arrangements and the regulations which affect the design; a clear understanding of the intent requirements of the relevant regulations; the development of appropriate casualty scenarios, if necessary, and trial alternative designs. This portion of the process is documented in the form of a report that is reviewed and agreed by all interested parties and submitted to the Administration before the quantitative portion of the analysis is started;

.5 conduct a quantitative analysis to evaluate possible trial alternative designs using quantitative engineering analysis. This consists of the specification of design thresholds, development of performance criteria based upon the performance of an acceptable prescriptive design and evaluation of the trial alternative designs against the agreed performance criteria. From this step the final alternative design and arrangements are selected and the entire quantitative analysis is documented in a report; and

.6 prepare documentation, specifications and a life-cycle maintenance programme. The alternative design and arrangements should be clearly documented and approved by the Administration and a comprehensive report describing the alternative design and arrangements and required maintenance programme should be kept on board the ship. An operations and maintenance manual should be developed for this purpose. The manual should include an outline of the design conditions that should be maintained over the life of the ship to ensure compliance with the approved design.

5 Preliminary analysis in qualitative terms

5.1 *Definitions of scope*

5.1.1 The ship, ship system(s), component(s), space(s) and/or equipment subject to the analysis should be thoroughly defined. This includes the ship or system(s) representing both the alternative design and arrangements and the regulatory prescribed design. Depending on the extent of the desired deviation from prescriptive requirements, some of the information that may be required includes: detailed ship plans, drawings, equipment information and drawings, test data and analysis results, ship operating characteristics and conditions of operation, operating and maintenance procedures, material properties, etc.

5.1.2 The regulations affecting the proposed alternative design and arrangements, along with their functional requirements, should be clearly understood and documented in the preliminary analysis report (see paragraph 5.5). This should form the basis for the evaluation referred to in paragraph 6.4.

5.2 *Development of casualty or operational scenarios*

Casualty or operational scenarios should provide the basis for analysis and trial alternative design evaluation and, therefore, are the backbone of the alternative design process. Proper casualty or operational scenario development is essential and, depending on the extent of deviation from the prescribed design, may require a significant amount of time and resources. This phase should outline why an alternative design may be beneficial. For life-saving arrangements, this may focus on casualty scenarios where an alternative design or arrangement will provide an equivalent (or greater) level of safety. Mechanical or electrical arrangements may focus on an operational scenario that will provide an equivalent level of safety, but may increase efficiencies or reduce cost to the operator.

5.3 *Casualty scenario development*

5.3.1 *General*

Casualty scenario development can be broken down into four areas:

.1 identification of hazards;

.2 enumeration of hazards;

.3 selection of hazards; and

.4 specification of design casualty scenarios.

5.3.2 *Identification of hazards*

This step is crucial in the casualty scenario development process as well as in the entire alternative design methodology. If a particular hazard or incident is omitted, then it will not be considered in the analysis and the resulting final design may be inadequate. Hazards may be identified using historical and statistical data, expert opinion and experience and hazard evaluation procedures. There are many hazard evaluation procedures available to help identify the hazards including Hazard and Operability Study (HAZOP), Process Hazard Analysis (PHA), Failure Mode and Effects Analysis (FMEA), "what-if", etc. As a minimum, the following conditions and characteristics should be identified and considered:

.1 pre-casualty situation: ship, platform, compartment, available potential and kinetic energy, environmental conditions;

.2 potential initiating events, causes;

.3 detailed technical information and properties of potential hazards;

.4 secondary hazards that might be subject to effects of initial hazard;

.5 extension potential: beyond compartment, structure, area (if in open);

.6 target locations: note target items or areas associated with the performance parameters;

.7 critical factors relevant to the hazard: ventilation, environment, operational, time of day, etc.; and

.8 relevant statistical data: past casualty history, probability of failure, frequency and severity rates, etc.

5.3.3 *Enumeration of hazards*

All of the hazards identified above should be grouped into one of three incident classes: localized, major or catastrophic. A localized incident consists of a casualty with a localized effect zone, limited to a specific area. A major incident consists of a casualty with a medium effect zone, limited to the boundaries of the ship. A catastrophic incident consists of a casualty with a large affect zone, beyond the ship and affecting surrounding ships or communities. In the majority of cases, only localized and/or major incidents need to be considered. Examples where the catastrophic incident class may be considered would include transport and/or offshore production of petroleum products or other hazardous materials where the incident effect zone is very likely to be beyond the ship vicinity. The hazards should be tabulated for future selection of a certain number of each of the incident classes.

5.3.4 *Selection of hazards*

The number and type of hazards that should be selected for the quantitative analysis is dependent on the complexity of the trial alternative design and arrangements. All of the hazards identified should be reviewed for selection of a range of incidents. In determining the selection, frequency of occurrence does not need to be fully quantified, but it can be utilized in a qualitative sense. The selection process should identify a range of incidents which cover the largest and most probable range of enumerated hazards. Because the engineering evaluation relies on a comparison of the proposed alternative design and arrangements with prescriptive designs, demonstration of equivalent performance during the major incidents should adequately demonstrate the design's equivalence for all lesser incidents and provide the commensurate level of safety. In selecting the hazards it is possible to lose perspective and to begin selecting highly unlikely or inconsequential hazards. Care should be taken to select the most appropriate incidents for inclusion in the selected range of incidents.

5.3.5 *Specification of design casualty scenarios*

Based on the hazards selected, the casualty scenarios to be used in the quantitative analysis should be clearly documented. The specification should include a qualitative description of the design casualty (e.g. initiating and subsequent chain of events, location, etc.), description of the vessel, compartment or system of origin, safeguard systems installed, number of occupants, physical and mental status of occupants and available means of escape. The casualty scenarios should consider possible future changes to the hazards (increased or decreased) in the affected areas. The design casualty or casualties will be characterized in more detail during the quantitative analysis for each trial alternative design. Operational scenario development for a mechanical or electrical alternative design or arrangement should include the operating scenarios under which the alternative will be utilized.

5.4 *Development of trial alternative designs*

At this point in the analysis, one or more trial alternative designs should be developed so that they can be compared against the developed performance criteria. The trial alternative design should also take into consideration the importance of human factors, operations and management. It should be recognized that well defined operations and management procedures may play a big part in increasing the overall level of safety.

5.5 *Preliminary analysis report*

5.5.1 A report of the preliminary analysis should include clear documentation of all steps taken to this point, including identification of the design team, their qualifications, the scope of the alternative design analysis, the functional requirements to be met, the description of the casualty scenarios and trial alternative designs selected for the quantitative analysis.

5.5.2 The preliminary analysis report should be submitted to the Administration for formal review and agreement prior to beginning the quantitative analysis. The report may also be submitted to the port State for informational purposes, if the intended calling ports are known during the design stage. The key results of the preliminary analysis should include:

.1 a secured agreement from all parties to the design objectives and engineering evaluation;

.2 specified design casualty scenario(s) acceptable to all parties; and

.3 trial alternative design(s) acceptable to all parties.

6 *Quantitative analysis*

6.1 *General*

6.1.1 The quantitative analysis is the most labour intensive from an engineering standpoint. It consists of quantifying the design casualty scenarios, developing the performance criteria, verifying the acceptability of the selected safety margins and evaluating the performance of trial alternative designs against the prescriptive performance criteria.

6.1.2 The quantification of the design casualty scenarios may include calculating the effects of casualty detection systems, alarm and mitigation methods, generating timelines from initiation of the casualty until control of the casualty or evacuation, and estimating consequences in terms of damage to the vessel, and the risk of harm to passengers and crew. This information should then be utilized to evaluate the trial alternative designs selected during the preliminary analysis.

6.1.3 Risk assessment may play an important role in this process. It should be recognized that risk cannot ever be completely eliminated. Throughout the entire performance based design process, this fact should be kept in mind. The purpose of performance design is not to build a fail-safe design, but to specify a design with reasonable confidence that it will perform its intended function(s) when necessary and in a manner equivalent to or better than the prescriptive requirements of SOLAS chapters II-1 and III.

6.2 *Quantification of design casualty scenarios*

6.2.1 After choosing an appropriate range of incidents, quantification of the casualties should be carried out for each of the incidents. Quantification will require specification of all factors that may affect the type and extent of the hazard. The casualty scenarios should consider possible future changes to the affected systems and areas. This may include calculation of specific casualty parameters, ship damage, passenger exposure to harm, time-lines, etc. It should be noted that, when using any specific tools, the limitations and assumptions of these models should be well understood and documented. This becomes very important when deciding on and applying safety margins. Documentation of the alternative design should explicitly identify the models used in the analysis and their applicability. Reference to the literature alone should not be considered as adequate documentation. The general procedure for specifying design casualties includes casualty scenario development completed during the preliminary analysis, timeline analysis and consequence estimation which is detailed below.

6.2.2 For each of the identified hazards, a range of casualty scenarios should be developed. Because the alternative design approach is based on a comparison against the regulatory prescribed design, the quantification can often be simplified. In many cases, it may only be necessary to analyse one or two scenarios if this provides enough information to evaluate the level of safety of the alternative design and arrangements against the required prescriptive design.

6.2.3 A timeline should be developed for each of the casualty scenarios beginning with initiation. Timelines should include the entire chain of relevant events up to and including escape times (to assembly stations, evacuation stations and lifeboats, as appropriate). This timeline should include personnel response, activation of damage control systems or active damage control measures, untenable conditions, etc. The timeline should include a description of the extent of the casualty throughout the scenario, as determined by using the various correlations, models and data from the literature or actual tests.

6.2.4 Consequences of various casualty scenarios should be quantified in relevant engineering terms. This can be accomplished by using existing correlations and calculation procedures for determining the characteristics of a casualty. In certain cases, full scale testing and experimentation may be necessary to properly predict the casualty characteristics. Regardless of the calculation procedures utilized, a sensitivity analysis should be conducted to determine the effects of the uncertainties and limitations of the input parameters.

6.3 *Development performance criteria*

6.3.1 Performance criteria are quantitative expressions of the intent of the requirements of the relevant SOLAS regulations. The required performance of the trial alternative designs are specified numerically in the form of performance criteria. Performance criteria may include tenability limits or other criteria necessary to ensure successful alternative design and arrangements.

6.3.2 Compliance with the prescriptive regulations is one way to meet the stated functional requirements. The performance criteria for the alternative design and arrangements should be determined, taking into consideration the intent of the regulations.

6.3.3 If the performance criteria for the alternative design and arrangements cannot be determined directly from the prescriptive regulations because of novel or unique features, they may be developed from an evaluation of the intended performance of a commonly used acceptable prescriptive design, provided that an equivalent level of safety is maintained. In the case of life-saving appliances and arrangements according to SOLAS chapter III, the goals, functional requirements and expected performance criteria, as set out in appendix 5, should be taken into account.

6.3.4 Before evaluating the prescriptive design, the design team should agree on what specific performance criteria and safety margins should be established. Depending on the prescriptive requirements to which the approval of alternative design or arrangements is sought, these performance criteria could fall within one or more of the following areas:

.1 Life safety criteria – These criteria address the survivability of passengers and crew and may represent the effects of flooding, fire, etc.

.2 Criteria for damage to ship structure and related systems – These criteria address the impact that casualty might have on the ship structure, mechanical systems, electrical systems, fire protection systems, evacuation systems, propulsion and manoeuvrability, etc. These criteria may represent physical effects of the casualty.

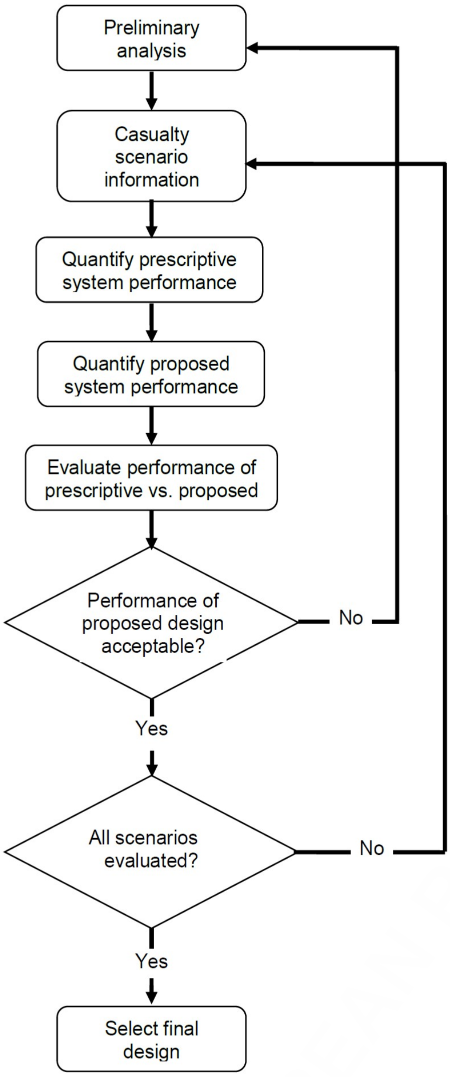
.3 Criteria for damage to the environment – These criteria address the impact of the casualty on the atmosphere and marine environment.

6.3.5 The design team should consider the impact that one particular performance criterion might have on other areas that might not be specifically part of the alternative design. For example, the failure of a particular safeguard may not only affect the life safety of passengers and crew in the adjacent space, but it may result in the failure of some system affecting the overall safety of the ship.

6.3.6 Once all of the performance criteria have been established, the design team can then proceed with the evaluation of the trial alternative designs (see section 6.4).

6.4 *Evaluation of trial alternative designs*

6.4.1 All of the data and information generated during the preliminary analysis and specification of design casualty should serve as input to the evaluation process. The evaluation process may differ depending on the level of evaluation necessary (based on the scope defined during the preliminary analysis), but should generally follow the process illustrated in figure 6.4.1.



6.4.2 Each selected trial alternative design should be analysed against the selected design casualty scenarios to demonstrate that it meets the performance criteria with the agreed safety margin, which in turn demonstrates equivalence to the prescriptive design.

6.4.3 The level of engineering rigor required in any particular analysis will depend on the level of analysis required to demonstrate equivalency of the proposed alternative design and arrangements to the prescriptive requirements. Obviously, the more components, systems, operations and parts of the ship that are affected by a particular alternative design, the larger the scope of the analysis.

6.4.4 The final alternative design and arrangements should be selected from the trial alternative designs that meet the selected performance criteria and safety margins.

7 Documentation

7.1 Because the alternative design process may involve substantial deviation from the regulatory prescribed requirements, the process should be thoroughly documented. This provides a record that will be required if future design changes to the ship are proposed or the ship transfers to the flag of another State and will also provide details and information that may be adapted for use in future designs. The following information should be provided for approval of the alternative design or arrangements:

.1 scope of the analysis or design;

.2 description of the alternative design(s) or arrangements(s), including drawings and specifications;

.3 results of the preliminary analysis, to include:

.3.1 members of the design team (including qualifications);

.3.2 description of the trial alternative design and arrangements being evaluated;

.3.3 discussion of affected SOLAS regulations and their requirements;

.3.4 hazard identification;

.3.5 enumeration of hazards;

.3.6 selection of hazards; and

.3.7 description of design casualty scenarios;

.4 results of quantitative analysis:

.4.1 design casualty scenarios:

.4.1.1 critical assumptions;

.4.1.2 initial conditions;

.4.1.3 engineering judgements;

.4.1.4 calculation procedures;

.4.1.5 test data;

.4.1.6 sensitivity analysis; and

.4.1.7 timelines;

.4.2 performance criteria;

.4.3 evaluation of trial alternative designs against performance criteria;

.4.4 description of final alternative design and arrangements;

.4.5 test, inspection and maintenance requirements; and

.4.6 references.

7.2 Documentation of approval by the Administration and the following information should be maintained onboard the ship at all times:

.1 scope of the analysis or design, including the critical design assumptions and critical design features;

.2 description of the alternative design and arrangements, including drawings and specifications;

.3 listing of affected SOLAS regulations;

.4 summary of the results of the engineering analysis and basis for approval; and

.5 test, inspection and maintenance requirements.

7.3 *Reporting and approval forms*

7.3.1 When the Administration approves alternative design and arrangements under these guidelines, pertinent technical information about the approval should be summarized on the reporting form given in appendixes 1 or 2, as appropriate, and should be submitted to the Organization for circulation to the Member Governments.

7.3.2 When the Administration approves alternative design and arrangements under these guidelines, documentation should be provided as indicated in appendixes 3 or 4, as appropriate. The documentation should be in the language or languages required by the Administration. If the language is neither English, French or Spanish, a translation into one of those languages should be included.

APPENDIX 1

REPORT ON THE APPROVAL OF ALTERNATIVE DESIGN AND ARRANGEMENTS FOR MACHINERY AND ELECTRICAL INSTALLATIONS

The Government of ……………………. has approved on …………….. an alternative design and arrangement in accordance with provisions of regulation II-1/55 of the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended, as described below:

Name of ship ....

Port of registry ....

Ship type ....

IMO Number ....

1. Scope of the analysis or design, including the critical design assumptions and critical design features:

2. Description of the alternative design and arrangements:

3. Conditions of approval, if any:

4. Listing of affected SOLAS chapter II-1 regulations in parts C, D and E:

5. Summary of the result of the engineering analysis and basis for approval, including performance criteria and design casualty scenarios:

6. Test, inspection and maintenance requirements:

APPENDIX 2

REPORT ON THE APPROVAL OF ALTERNATIVE DESIGN AND ARRANGEMENTS FOR LIFE-SAVING APPLIANCES AND ARRANGEMENTS

The Government of ……………………. has approved on ……………… an alternative design and arrangement in accordance with provisions of regulation III/38 of the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended, as described below:

Name of ship ....

Port of registry ....

Ship type ....

IMO Number ....

1. Scope of the analysis or design, including the critical design assumptions and critical design features:

2. Description of the alternative design and arrangements:

3. Conditions of approval, if any:

4. Listing of affected SOLAS chapter III regulations:

5. Summary of the result of the engineering analysis and basis for approval, including performance criteria and design casualty scenarios:

6. Test, inspection and maintenance requirements:

APPENDIX 3

DOCUMENT OF APPROVAL OF ALTERNATIVE DESIGN AND ARRANGEMENTS FOR MACHINERY AND ELECTRICAL INSTALLATIONS

Issued in accordance with provisions of regulation II-1/55.4 of the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended, under the authority of the Government of ....……………………………… by ……….…..………………………..

(Name of State) (Person or organization authorized)

Name of ship ....

Port of registry ....

Ship type ....

IMO Number ....

THIS IS TO CERTIFY that the following alternative design and arrangements applied to the above ship have been approved under the provisions of SOLAS regulation II-1/55:

1. Scope of the analysis or design, including the critical design assumptions and critical design features:

2. Description of the alternative design and arrangements:
3. Conditions of approval, if any:

4. Listing of affected SOLAS chapter II-1 regulations:

5. Summary of the result of the engineering analysis and basis for approval, including performance criteria and design casualty scenarios:

6. Test, inspection and maintenance requirements:

7. Drawings and specifications of the alternative design and arrangement:

Issued at .... on ....

....
(Signature of authorized official issuing the certificate)

(Seal or stamp of issuing authority, as appropriate)

APPENDIX 4

DOCUMENT OF APPROVAL OF ALTERNATIVE DESIGN AND ARRANGEMENTS FOR LIFE-SAVING APPLIANCES AND ARRANGEMENTS

Issued in accordance with provisions of regulation III/38.4 of the International

Convention for the Safety of Life at Sea (SOLAS), 1974, as amended, under the authority of the Government of ....……………………………….. by ………..…..………………………..
(Name of State) (Person or organization authorized)

Name of ship ....

Port of registry ....

Ship type ....

IMO Number ....

THIS IS TO CERTIFY that the following alternative design and arrangements applied to the above ship have been approved under the provisions of SOLAS regulation III/38.

1. Scope of the analysis or design, including the critical design assumptions and critical design features:

2. Description of the alternative design and arrangements:

3. Conditions of approval, if any:

4. Listing of affected SOLAS chapter III regulations:

5. Summary of the result of the engineering analysis and basis for approval, including performance criteria and design casualty scenarios:

6. Test, inspection and maintenance requirements:

7. Drawings and specifications of the alternative design and arrangement:

Issued at .... on ....

....
(Signature of authorized official issuing the certificate)

(Seal or stamp of issuing authority, as appropriate)

APPENDIX 5

GOALS, FUNCTIONAL REQUIREMENTS AND EXPECTED PERFORMANCE CRITERIA FOR SOLAS CHAPTER III

Goal: To save and maintain human life during and after an emergency situation

FR 1: All life-saving appliances should be in a state of readiness for immediate use. This will be accomplished by ensuring:

EP 1: All life-saving appliances should be easily accessible (e.g. not obstructed and not locked).

EP 2: All life-saving appliances should be stowed securely in a sheltered position and protected from damage by fire and explosion.

EP 3: All life-saving appliances should be maintainable to ensure reliability for the specified service cycle.

EP 4: All life-saving appliances should be designed considering uncertainty in material properties, loads, deterioration and consequences of failure in operating environment.

EP 5: Descriptions and instructions for operation, inspection, maintenance and functional testing should be provided for all life-saving appliances.

EP 6: All life-saving appliances should be able to withstand environmental exposure of the ship including sunlight, ozone, seawater (wash, heavy seas), icing, wind, humidity, oil, air temperature (-30°C to +65°C), water temperature (at least -1°C to +30°C if it is likely to be immersed in seawater), fungus and marine atmosphere.

EP 7: All life-saving appliances should be usable and operational under adverse vessel conditions, i.e. list and trim.

EP 8: Deployment of life-saving appliances should be possible without depending upon any means other than gravity or stored power which is independent of the ship's power supplies to launch the survival craft.

EP 9: The number of crew members on board should be sufficient for operating the life-saving appliance and launching arrangements required for abandonment by the total number of persons on board. This should include substitutes for key persons and crew members on board operating survival craft and launching arrangements are assigned and trained appropriately.

FR 2: Training and drills should be sufficient to ensure that all passengers and crew are familiar with their responsibilities in an emergency. This will be accomplished by ensuring:

EP 1: All life-saving appliances and arrangements should be designed and installed to facilitate training and drills.

EP 2: Training and drills should be routinely conducted to ensure crew are in a state of readiness and are competent with the operation of life-saving appliances and their assigned emergency duties.

EP 3: Every crew member should participate in drills. These should be conducted, as far as practicable, as if there were an actual emergency.

EP 4: Drills should be planned and conducted in a safe manner.

EP 5: Drills should be planned in such a way that due consideration is given to regular practice in the various emergencies that may occur depending on the type of ship and cargo.

FR 3: Before proceeding to sea, all crew and passengers should be provided with information and instructions of the actions to be taken in an emergency. This will be accomplished by ensuring:

EP 1: Safety information and instructions should be presented in a manner that is easily understood by passengers, in language, illustration and/or demonstration.

EP 2: Information should be distributed and displayed in appropriate conspicuous places accessible under all conditions, e.g. emergency lighting.

EP 3: All ships should clearly indicate and highlight the stowage location of all life-saving appliances, display directions to places designated for assembling all persons in the event of an emergency, display assignment to life-saving appliances and display how to operate life-saving appliances.

EP 4: The number and type of life-saving appliances should be marked at each stowage location.

FR 4: All ships should have an effective emergency management system. A copy of the emergency management system should be readily available to crew. This will be accomplished by ensuring:

EP 1: The emergency management system should clearly identify roles and responsibilities during an emergency.

EP 2: Assembly locations, muster stations and escape routes should be identified on all ships.

EP 3: All passenger ships should establish a decision support system.

EP 4: The emergency management system should include the consideration of physical characteristics and capabilities of embarked persons.

EP 5: All ships should have the means to account for all persons on board.

EP 6: The emergency management system should have a uniform structure, be easy to use and be provided on board in an appropriate conspicuous location.

FR 5: All ships should be provided with means of external communications with shore, ships and aircraft. This will be accomplished by ensuring:

EP 1: All ships should have the means to indicate their position visually in an emergency, which makes it possible to detect and locate the ship from an altitude of at least 3,000 m at a range of at least 10 miles under clear daytime and night-time conditions for a period of at least 40 s.

EP 2: All ships should be provided with means for two-way on-scene communication between survival craft, between survival craft and ship, and between survival craft and rescue craft.

EP 3: All ships should carry search and rescue locating devices that are designed to automatically activate and operate continuously and can be rapidly placed into any survival craft from their place of storage on the ship.

FR 6: All ships should be able to internally communicate emergency messages and instructions to all crew and passengers. This will be accomplished by ensuring:

EP 1: Emergency alerts, messages and instructions to all crew and passengers should be received regardless of an individual's location on the ship.

EP 2: Emergency alerts, messages and instructions should be communicated in appropriate languages expected to be understood by all those on board.

EP 3: Two-way communications should be possible between emergency control stations, places designated for assembling and/or embarkation to survival craft and strategic positions on board.

FR 7: All ships should provide means for a safe abandonment for all persons. This will be accomplished by ensuring:

EP 1: Means should be available to embark survival craft from both the embarkation deck and the waterline in the lightest seagoing condition and under adverse conditions of list and trim.

EP 2: Means of evacuation should be distributed on the ship considering access of persons and areas where persons may become isolated.

EP 3: Each davit-launched, self-propelled survival craft boarded from the embarkation deck should be capable of being launched from two positions by one crew member: from a position in the survival craft and from a position on deck.

EP 4: All survival and rescue craft should be stowed as near the water surface as is safe and practicable.

EP 5: All ships should provide for safe unobstructed launching of each survival craft, for example, by avoiding interference with fixed structures, fixtures, fittings, equipment and other life-saving appliances.

EP 6: Embarkation platforms should provide for protection from the seaway and the effects of hazardous cargo, if carried.

EP 7: Relative movement and gaps between the survival craft and ship during embarkation should be minimized.

EP 8: All life-saving appliances should enable safe abandonment of all persons on board regardless of their physical condition, age and mobility, including those needing evacuation by stretcher or other means.

EP 9: All ships should provide for safe launching of survival craft both in a seaway and when the ship is adrift.

EP 10: Passenger ships should provide float free survival craft capacity for at least 25% of the total number of persons on board and cargo ships should provide 100% float free survival craft capacity for the total number of persons on board.

EP 11: All ships should provide adequate space to muster and provide instructions for all persons on board.

EP 12: Abandonment of all persons on board should take no more than 30 minutes after mustering on passenger ships, and 10 minutes on cargo ships.

EP 13: Each survival craft should be prepared for boarding and launching by no more than two crew members in less than 5 minutes.

EP 14 Life-saving appliances and the craft they launch should operate as a system.

FR 8: All ships should provide means for the safety and survivability of all persons after abandonment for the time until expected rescue. This will be accomplished by ensuring:

EP 1: Survival craft should provide a habitable environment for all persons on board.

EP 2: Survival craft should provide adequate ventilation and protection for its complement against wind, rain and spray at all ambient temperatures between -15 and 30 degrees C.

EP 3: Each survival craft shall have sufficient buoyancy when loaded with its full complement of persons and when punctured in any one location.

EP 4: All passenger ships must have sufficient self-propelled craft capable of marshalling all non-self-propelled survival craft sufficient for the total number of persons on board.

EP 5: Self-propelled survival and rescue craft should be capable of proceeding ahead in calm water at least at 2 knots when towing the largest passive survival craft carried on the ship loaded with its full complement of persons and equipment.

EP 6: Survival craft should be able to reach a safe distance from the ship in a timely manner, either by its own propulsion or by assistance from other survival craft or rescue craft.

EP 7: Each survival craft should have sufficient first aid supplies, anti-seasickness medication, and supply of food and water for the number of persons on board.

EP 8: Survival craft should be approved for the maximum number of persons it is permitted to accommodate, as decided by practical seating tests afloat and based upon the number of adult persons wearing individual buoyancy equipment who can be seated without, in any way, interfering with the normal operation of its equipment or means of propulsion.

EP 9: All life-saving appliances and arrangements should be designed to reflect the expected capabilities and characteristics of persons on board.

EP 10: All survival craft should provide means for persons in the water to cling to the survival craft, and permit persons to board the survival craft from the water when wearing individual buoyancy equipment.

FR 9: Each person should be provided with means to facilitate survival in the water until rescued into a survival craft or rescue unit. This will be accomplished by ensuring:

EP 1: Each person on a cargo ship and each crew member assigned to operate the life-saving appliances on any ship should be provided with individual garments for protection against hypothermia.

EP 2: Each person on board should have ready access to a physically suitable personal life-saving appliance, regardless of their location on the vessel.

EP 3: All ships must ensure individual wearable buoyancy equipment are available for persons on watch and at remote locations on the ship so that they are readily accessible in an emergency.

EP 4: All ships shall ensure that each adult on board has a suitable individual wearable buoyancy equipment considering their weight and girth.

EP 5: Passenger ships shall ensure that each infant and child on board has a suitable individual wearable buoyancy equipment, as appropriate, for the duration of the voyage and the type of service.

EP 6: Throwable personal flotation devices are distributed so that they are readily available on both sides of the ship and as far as practicable on all open decks extending to the ship's side or to the stern.

EP 7: Throwable personal flotation devices are stowed so as to be capable of being rapidly cast loose and not permanently secured in any way.

EP 8: Personal life-saving appliances should be provided with adequate spare capacity.

FR 10: Each survival craft should provide active and passive means of detection by other survival and rescue craft. This will be accomplished by ensuring:

EP 1: Survival craft should have active and passive means of detection which makes it possible to visually locate or detect the survival craft in a seaway from a ship or an aircraft.

EP 2: Visual means of detection for survival craft should make it possible for an aircraft at an altitude of up to 3,000 meters to detect the survival craft at a range of at least 10 miles; and for a ship to detect the survival craft in a seaway in clear conditions at a range of at least 2 miles.

FR 11: All ships should provide active and passive means for detection of persons in the water by survival units and by rescue craft.

EP 1: Visual means of detection for persons in the water should make it possible for a ship to detect the person in a seaway in clear daytime conditions at a range of at least 0.2 miles; and in clear night-time conditions at a range of at least 0.5 miles for a duration of at least 8 hours.

EP 2: Individual wearable buoyancy equipment should have a manually controlled active means of detection which makes it possible to detect a person in a seaway audibly at a range of at least 0.2 miles in calm weather.

EP 3: Buoyancy equipment intended to support and enable the detection of persons in the water should be provided on board. The buoyancy equipment should have passive means of detection, which makes it possible to detect the buoyancy equipment in a seaway visually and, have active means of detection attached which is automatically activated when the buoyancy equipment is deployed.

FR 12: All ships should provide for the search, rescue and retrieval of persons in the water. This will be accomplished by ensuring:

EP 1: Rescue craft should be stowed in such a way that they are kept in a state of continuous readiness and can be launched within 5 minutes and neither the rescue craft nor its stowage arrangements interfere with the operation of any survival craft at any other launching station.

EP 2: Launching arrangements for rescue craft should provide safe launching from the ship in a seaway with the ship making way at speeds of up to 5 knots.

EP 3: Rescue craft should be capable of maintaining a speed of at least 6 knots for at least 4 hours in a seaway.

EP 4: Rescue craft should be capable of being towed at speeds of up to 5 knots and be capable of towing other survival craft.

EP 5: Rescue craft should have sufficient mobility and manoeuvrability in a seaway to enable retrieval of persons from the water. Ro-ro passenger ships should be equipped with effective means for rapidly recovering survivors from the water and transferring survivors from rescue or survival craft to the ship.

EP 6: The full complement of occupants for which the rescue craft is approved to carry must be recovered to a position where they can disembark to the deck of the ship.

EP 7: Rescue craft should be capable of carrying at least five persons seated and at least one person lying down.