M69 Qualitative Failure Analysis for Propulsion and Steering on Passenger Ships

(June 2008)

1. Scope

Detailing a qualitative failure analysis for propulsion and steering for new passenger ships including those having a length of 120 m or more or having three or more main vertical zones.

2. Note

This may be considered as the first step for demonstrating compliance with the revised SOLAS Chapter II-2, Regulation 21 – SOLAS 2006 Amendments, Resolution MSC.216(82), annex 3.

3. Objectives

3.1 For ships having at least two independent means of propulsion and steering to comply with SOLAS requirements for a safe return to port, items (a) and (b) below are applicable:

(a) Provide knowledge of the effects of failure in all the equipment and systems due to fire in any space, or flooding of any watertight compartment that could affect the availability of the propulsion and steering.

(b) Provide solutions to ensure the availability of propulsion and steering upon such failures in item (a).

3.2 Ships not required to satisfy the safe return to port concept will require the analysis of failure in single equipment and fire in any space to provide knowledge and possible solutions for enhancing availability of propulsion and steering.

4. Systems to be considered

4.1 The qualitative failure analysis is to consider the propulsion and steering equipment and all its associated systems which might impair the availability of propulsion and steering.

4.2 The qualitative failure analysis should include:

(a) Propulsion and electrical power prime movers, e.g.,
- Diesel engines
- Electric motors

Note:

1. This UR is to be uniformly implemented by IACS Societies for Passenger Ships contracted for construction on or after 1 January 2010.

2. The “contracted for construction” date means the date on which the contract to build the vessel is signed between the prospective owner and the shipbuilder. For further details regarding the date of “contract for construction”, refer to IACS Procedural Requirement (PR) No. 29.

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(b) Power transmission systems, e.g.,
- Shafting
- Bearings
- Power converters
- Transformers
- Slip ring systems

(c) Steering gear
- Rudder actuator or equivalent for azimuthing propulsor
- Rudder stock with bearings and seals
- Rudder
- Power unit and control gear
- Local control systems and indicators
- Remote control systems and indicators
- Communication equipment

(d) Propulsors, e.g.,
- Propeller
- Azimuthing thruster
- Water jet

(e) Main power supply systems, e.g.,
- Electrical generators and distribution systems
- Cable runs
- Hydraulic
- Pneumatic

(f) Essential auxiliary systems, e.g.,
- Compressed air
- Oil fuel
- Lubricating oil
- Cooling water
- Ventilation
- Fuel storage and supply systems

(g) Control and monitoring systems, e.g.,
- Electrical auxiliary circuits
- Power supplies
- Protective safety systems
- Power management systems
- Automation and control systems

(h) Support systems, e.g.,
- Lighting
- Ventilation

To consider the effects of fire or flooding in a single compartment, the analysis is to address the location and layout of equipment and systems.

5. Failure Criteria

5.1 Failures are deviations from normal operating conditions such as loss or malfunction of a component or system such that it cannot perform an intended or required function.

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5.2 The qualitative failure analysis should be based on single failure criteria, (not two independent failures occurring simultaneously).

5.3 Where a single failure cause results in failure of more than one component in a system (common cause failure), all the resulting failures are to be considered together.

5.4 Where the occurrence of a failure leads directly to further failures, all those failures are to be considered together.

6. Verification of Solutions

6.1 The shipyard is to submit a report to class societies that identifies how the objectives have been addressed. The report is to include the following information:

(a) Identify the standards used for analysis of the design.

(b) Identify the objectives of the analysis.

(c) Identify any assumptions made in the analysis.

(d) Identify the equipment, system or sub-system, mode of operation of the equipment.

(e) Identify probable failure modes and acceptable deviations from the intended or required function.

(f) Evaluate the local effects (e.g. fuel injection failure) and the effects on the system as a whole (e.g. loss of propulsion power) of each failure mode as applicable.

(g) Identify trials and testing necessary to prove conclusions.

Note: All stakeholders (e.g., class, owners, shipyard and manufacturers) should as far as possible be involved in the development of the report.

6.2 The report is to be submitted prior to approval of detail design plans. The report may be submitted in two parts:

(a) A preliminary analysis as soon as the initial arrangements of different compartments and propulsion plant are known which can form the basis of discussion. This is to include a structured assessment of all essential systems supporting the propulsion plant after a failure in equipment, fire or flooding in any compartment casualty.

(b) A final report detailing the final design with a detailed assessment of any critical system identified in the preliminary report.

6.3 Verification of the report findings are to be agreed between the class society and the shipyard.

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