



SUB-COMMITTEE ON SHIP DESIGN AND  
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## PERFORMANCE TESTING AND APPROVAL STANDARDS FOR SOLAS PERSONAL LIFE-SAVING APPLIANCES

### Functional requirements reflecting risk and end user needs

Submitted by Norway

#### SUMMARY

**Executive summary:** This document includes proposals on improved functional requirements for personal life saving appliances. All proposals are based on risk analyses of realistic scenarios and end user needs. The intention is to lay the foundations for relevant product testing.

It has been shown that existing requirements for lifejackets provide insufficient protection of the wearer when exposed to moderate waves and when using seasonal clothing.

**Action to be taken:** Paragraph 9

**Related documents:** LSA Code, resolution MSC.81(70); MSC/Circ.980; DE 44/19, annex 4; MSC 74/21/8; DE 45/19/3

### 1 Challenge

Existing SOLAS requirements for personal life-saving appliances as in the LSA Code, chapter II, and the resolution MSC.81(70) reflect the end user needs before the introduction of dry-shod evacuation. Requirements for effective performance under realistic environmental conditions are mentioned in the LSA Code but not reflected in any prototype tests. The link between the end user needs during emergency and crisis scenarios and product requirements has to be drawn much clearer.

In co-operation with other Member States, Norway investigated the effect of waves and clothing on approved personal life-saving appliances in the summer of 2002 in Rotterdam. It was demonstrated in a wave-pool that the LSA Code test requirements for lifejackets do not provide adequate protection for a person depending on such appliance in a seaway. The indications were especially alarming for infants and children. The full test report is available through the Norwegian administration.

For reasons of economy, this document is printed in a limited number. Delegates are kindly asked to bring their copies to meetings and not to request additional copies.

## 2 Objective

Functional requirements for personal life-saving appliances in the LSA Code should be adapted to the development of dry-shod evacuation and evacuation as a process. We also hope to set functional requirements capable of communicating realistic expectations to the user. In addition clear functional requirements will encourage manufacturers to develop new solutions focusing on innovation and development.

## 3 Risk analysis

One relevant frame for analysing functions of personal life-saving appliances in real life situations is to look at evacuation plans on different types of ship. All such plans share some principles regarding personal life-saving appliances.

- .1 Personal life-saving appliances are donned before any action towards evacuation is taken. All persons are wearing it throughout the subsequent evacuation and rescue process.
- .2 Evacuation procedures require a time consuming static situation where personal life-saving appliances are donned and checked.
- .3 Evacuation plans are designed to evacuate all persons dry shod. The personal life-saving appliance seems to be more of a piece of personal safety equipment.
- .4 There are seldom instructions on how the individual who enters the water should act to increase the chances of survival.

Consequently a risk analysis has to reflect evacuation plans. Additionally, one or more scenarios have to be added where persons actually enter the water. A logic risk analysis frame will consist of the following scenarios:

- Training
- Dry-shod evacuation performed as planned
- A crisis situation where all or groups of individuals have to evacuate by means of personal life-saving appliances

## 4 Critical processes

A risk analysis performed within the described frame identified five critical processes. The list is presented in order of priority.

1	Availability	Availability for all persons on board with regard to location, fit and donning.
2	Dry-shod evacuation	Not delaying the crew in performing an effective and safe planned evacuation of passengers and themselves.
3	Drowning	Contribute to avoid drowning and delay exhaustion under expected weather and wave conditions.
4	Cooling	Contribute to decrease the initial cold shock. Contribute to reduce body cooling to a level where a vulnerable person can produce enough heat to stabilise the body temperature at intended seawater temperature.
5	Rescue	Contribute to rescue out of the water. Enable persons to help themselves or assist others out of the water.

## 5 Threats

In analysing a scenario where an individual is depending on a personal life-saving appliance to survive in the water, the following factors can be identified.

### *Environmental threats:*

- Water
- Waves
- Temperature
- Wind
- Visibility
- Darkness

### *Individual characteristics influencing survival time:*

- Level of consciousness
- Clothing
- Physical fitness
- Vigour
- Specific weight or weight in water
- Mental condition and will to live
- Medical conditions

## 6 LSA Code, chapter II

The LSA Code, chapter II, does not reflect the end user needs of today.

The requirements of that chapter are a mix of functional requirements, design requirements and test procedures. A look at MSC/Circ.980 clearly reveals that describing test procedures and acceptance criteria on the basis of the LSA Code and resolution MSC.81(70) becomes unclear.

The LSA Code, chapter II, should be restructured and reformulated with close regard to resolution MSC.81(70), MSC/Circ.980 and the above risk-based aspects, taking the following proposals into consideration.

## 7 Proposals

The following proposals focus on the critical processes described in number 4.

### .1 Availability:

- Sizes are redefined to three groups:

<b>80</b>	<b>Infant</b>	- Infants up to 80 cm in height and 15 kg.
<b>150</b>	<b>Child / Adult Small</b>	- Persons up to 150 cm in height and 50 kg.
<b>215</b>	<b>Adult Medium / Large</b>	- Persons up to 215 cm in height and 200 kg.

The primary intention of this grouping is to facilitate logistics on-board. Additionally this grouping reflects demographic changes and changes in travelling patterns.

- **Donning in the water**

The appliance should allow the user to don the appliance correctly within two minutes in the water.

The need for this function has been illustrated in several accidents.

- **Dry donning in darkness**

The appliance should allow the user to don it correctly for effective use within one minute in darkness.

This requirement will reduce the complexity of the donning procedure.

- **Special requirements for infants**

Availability and function should reflect that an infant is totally dependent on a caretaker. Infants should be kept dry through the evacuation and rescue to obtain sufficient thermal protection.

.2 Dry-shod evacuation:

- **Ergonomic requirements**

Ergonomic requirements should reflect the evacuation process and the need of not delaying dry- shod evacuation. Verification of this function implies exposure to evacuation chutes, slides and entrances to lifeboats and rafts.

.3 Drowning:

- **Calm water**

An inactive, conscious and dressed person should obtain a stable face-up floating position after a vertical drop into the water.

- **Waves**

An inactive, conscious and dressed person when floating in the stable position in unfavourable waves should not have mouth immersions over a defined period of time.

Self-righting does not contribute to keeping an unconscious person alive for a significant period in a seaway. Stability and ability to float safely in waves contribute to the survival of any person that was initially conscious.

.4 Cooling:

- **Cold shock**

All personal life-saving appliances should protect against initial cold shock. Cold shock depends on the individual and the relative temperature difference between skin and water. Verification is possible e.g. by measuring the gasp reflex of a test subject being submerged in relatively cold water.

- **Body cooling**

Body cooling should be reduced by means of thermal protection with less than 15 degrees centigrade seawater temperature. In laboratory conditions it is shown that hypothermia might occur in less than 3 hours at 15 degrees centigrade water submersion.

.5 Rescue:

- **Rescue ergonomics**

The appliance should allow an unconscious wearer to be recovered into a liferaft or lifeboat.

All ergonomic rescue testing should be performed with a dummy with the characteristics of an unconscious person. Additionally such tests should take into consideration the loss of friction resulting from fuel that might float on the water surface.

- **Personal locator beacon**

Each personal life-saving appliance should be fitted with a PLB. The single strongest expectation from end users is to be localised and rescued within the available time the life-saving appliance offers.

## **8 User groups**

The end users of personal life-saving appliances can easily be divided into two main groups: passengers and crew. The main differences between these groups are level of training and tasks during evacuation. The LSA Code requirements should clearly differ between these users, and personal life-saving appliances intended for passengers should be easily identifiable.

## **9 Action requested of the Sub-Committee**

The Sub-committee is invited to note the foregoing and take action as appropriate.

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