Guidelines for use of fibre-reinforced plastics (FRP) within ship structures

-Progressing the work at IMO-

2023 Tripartite

Paul Altena
Director Taxonomy and International Technical & Environmental Affairs

SEA Europe
Shipyards' & Maritime Equipment Association

Introduction and background (1/2)

In 2017, IMO MSC 98 adopted the **Interim guidelines for use of Fibre Reinforced Plastic (FRP) elements within ship structures**: Fire safety issues (MSC.1/Circ.1574) (Interim guidelines),

Paragraph 5 states that the Interim guidelines should be reviewed 4 years after their approval in order **to make any necessary amendments based on experience gained**.

In 2022, CESA made the submission “Experience gained with larger FRP structures in ship construction” (SDC 9/15/2) to SDC 9, **proposing the review of the Interim Guidelines with a view to the wider application of FRP beyond their current limitation as structures that may be removed without compromising the safety of the ship**.

Introduction and background (2/2)

SDC 9 agreed to invite MSC to move the output ‘Guidelines for use of fibre-reinforced plastics (FRP) within ship structures’ from its post-biennial agenda to the 2024-2025 biennial agenda of SDC, as well as to place it on the provisional agenda of SDC 10.

This was agreed by MSC 107 with a target completion year of 2025.

Furthermore, SDC 9 agreed that any work undertaken on the review of the Guidelines would need **to take into account and address the concerns raised** during the meeting regarding the potential challenges with using FRP, in particular concerning its recycling and its combustibility with respect to fire safety.

Review of the current Interim Guidelines

Application of the Interim guidelines is **currently limited to FRP elements, which are defined as a structure that may be removed without compromising the safety of the ship**.

The **Interim guidelines do not fully address the risks of progressive structural collapse or global loss of structural integrity due to fire**.

Potential conflict SOLAS vs updated FRP Guidelines

Importantly:

- **SDC should discuss whether requirements stemming from SOLAS, including the existing SOLAS regulation II-2/11 as well as class "A" steel requirements in SOLAS would conflict with the updated FRP Guidelines that would permit the use of FRP in structures.**

- **In such case, IMO MSC 108 should be informed accordingly and a corresponding proposal for a new output should be submitted.**

Goals follow-up process

CESA will submit a paper to IMO SDC 10 (22-26 January 2024)

In its submission, CESA brings forward experience with the application of FRP with a view to facilitating the review and potential amendment of the Interim guidelines and to improve the uptake of new technologies for greener shipping.

It will be imperative to facilitate technical discussions, also in between (sub)committee meetings, to progress the revision of the Interim Guidelines.

Importantly, the subcommittee is invited to discuss whether requirements stemming from SOLAS would conflict with the updated FRP Guidelines.

Considerations should include: (1/3)

A. Extent the scope of the Guidelines to ship structures, beyond “elements”

B. Definitions of (non-)combustible material in Chapter 1, Section 1.1 and SOLAS II-2

- Section 1.1 clarifies that “any element that can comply with the prescriptive requirements is outside the scope of these guidelines” and therefore that “in these guidelines combustible FRP elements are implied”.
- SOLAS II-2/Reg. 11.2 requires “The hull, superstructures, structural bulkheads, decks and deckhouses shall be constructed of steel or other equivalent material. For the purpose of applying the definition of steel or other equivalent material as given in regulation 3.43”.
- SOLAS II-2/Reg. 3.34 defines “Steel or other equivalent material means any non-combustible material […]” Since FRP is considered combustible, it cannot be used.

C. Acceptable safety level demonstrated for ships with FRP composites that go beyond the definition of an ‘element‘

D. Update Reference in SOLAS Ch.II-2, reg 17.3

E. Develop an allocation scheme for room types which translates the different nomenclatures used in IMO instruments

F. Allow use of combustible material for the fire divisions (A-/B-/C-) according to SOLAS, if proper insulation is provided (Establish separation of combustibility and load bearing capacity)

G. Structural Integrity Requirements for FRM bulkheads (E.G. FRD-10).

Considerations should include: (2/3)

H. Requirements for external surfaces: SOLAS does not specify any requirements for external spaces or voids.

I. The following suggestions regarding fire tests are made:

i. The FTP part 5 regulations are not well suited for composites. Therefore, a regulation between FTP part 5 and part 10 should be put in place, since currently there is a lack of suitable IMO tests if 'lower flame spread surfaces for composites' are to be applied, e.g. decks and outer surfaces.
ii. Add a structural performance requirement for FRM bulkheads (e.g. FRD-10). (See annex F).
iii. Add a separate requirement for fire reaction (time to fire reaction)
iv. Create a requirement and feasible test for the ignitability of exposed composites on outer surfaces
v. Add a risk based table for composite structures, or to add the possibility to create a risk based table such as in the naval ship code, solution 2.
vi. Consideration 'goal based testing' approach to fire test
Standard test set-up may not correspond to the loads in a realistic fire scenario, as the normally protected core materials would be directly exposed to flames and heat.

J. Cradle to cradle ship material circularity passport

CirclesOfLife is an EU funded project (duration Jan 2024 - Dec 2026) which will address issues of assessing the overall environmental footprint of ships, including non-operational processes. One goal is to develop a cradle to cradle ship material circularity passport to provide a transparent, understandable, comprehensive and trustworthy methodology to rate the sustainability of ships.

Considerations: Projects and case examples (3/3)

K. Potential basis for fire assessments

In August 2023, the EU funded project LASH FIRE was finalized. Within the project, **fire requirements of non-regulated materials were assessed, including composite materials and intumescent systems. 30 different material layouts were developed and fire tests according IMO FTP Code Part 2 and Part 5 were performed. Finally, a proposal for fire property requirements for surfaces in ro-ro spaces was developed**. More than 200 fire tests have been performed and the data, as well as RAMSSES results, are available in two databases, the RISE Fire database and at E-LASS Material database. The related report is public and available online . This data may be used as reference to the discussion and can be used as a basis for fire assessments, including assessments according SOLAS Chapter II-2 Reg 17.

L. Holistic FRP study regarding electric passenger ferries

M. Ships with FRP as a main building material (hull and structure) built according to other IMO instruments

The increasing number of ships with FRP as a main building material (hull and structure) built according to other IMO instruments, such as the HSC Code, provides a growing knowledge and experience base with structural parts built of FRP materials. The methods of design and approval of these ships can be adapted and used as a basis for new regulations under the SOLAS regime.

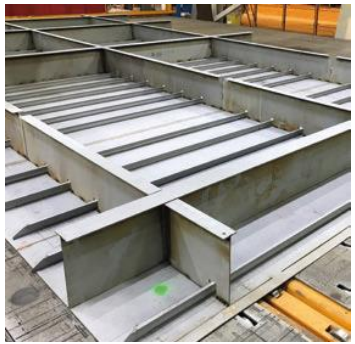
N. Military and authority vehicles with FRP

O. Inland vessels

Way forward (1/2)

For SDC 10 to:

- **Consider whether a consequential amendment of SOLAS is required** to enable the use of FRP in structures and advise IMO MSC 108 accordingly.
- Establish **a correspondence group** preparing the revision of the current Interim Guidelines taking into consideration information contained in this submission.
- Establish **an intersessional working group** between SDC 10 and SDC 11.
- Establish a **working group during SDC 11** to finalize the draft Guidelines for use of fibre-reinforced plastics (FRP) within ship structures in order to submit these to the following meeting of MSC for approval.
- **To encourage interested delegations to submit proposals** to the next IMO MSC and SDC meetings and work intersessionally.



Way forward: Roadmaps (2/2)

IMO Meeting	SDC 10 decides that SOLAS would not conflict	SDC 10 decides that SOLAS would conflict
IMO SDC 10 (2024)	Establish IMO CG on the FRP Guidelines to report to SDC 11.	
	Establish an intersessional Working Group meeting between SDC 10 and SDC 11 and after MSC 108.	
		Invite submissions to IMO MSC 108 for a new output amending SOLAS to allow the use of FRP structures in accordance with the reviewed FRP Guidelines and with SDC as its Associated Organ and target year 2025.
	SDC 10 to invite for submissions to MSC 108 and promote information exchange.	
Intersessional Working Group (2024)	Progress work on the FRP Guidelines, reporting to SDC.	Progress work on the FRP Guidelines and amendments to SOLAS, reporting to SDC.
IMO MSC 109 (2024)	SDC 10 to invite for submissions to MSC 109 and promote information exchange	
IMO SDC 11 (2025)	Dedicated WG for preparation of the FRP Guidelines	Dedicated WG for preparation of the FRP Guidelines and amendments to SOLAS.
IMO MSC 110 (2025)	Finalisation FRP Guidelines	

SEA Europe
Wetstraat 67
1000 Brussels
Belgium

www.linkedin.com/company/sea-europe
www.twitter.com/seaeurope

www.seaeurope.eu

Thank you for your attention

*Pictures taken from RAMSSES Report

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