

SUB-COMMITTEE ON SHIP DESIGN AND
CONSTRUCTION
11th session
Agenda item 11

SDC 11/11
11 October 2024
Original: ENGLISH
Pre-session public release: ☒

**GUIDELINES FOR THE USE OF FIBRE-REINFORCED PLASTICS (FRP)
WITHIN SHIP STRUCTURES**

Report of the Correspondence Group

Submitted by Sweden

SUMMARY

<i>Executive summary:</i>	This document provides the report of the Correspondence Group on the Revision of the Interim Guidelines for Use of Fibre-Reinforced Plastic (FRP) (MSC.1/Circ.1574).
<i>Strategic direction, if applicable:</i>	2
<i>Output:</i>	2.6
<i>Action to be taken:</i>	Paragraph 47
<i>Related documents:</i>	SDC 9/15/2, SDC 9/16; SDC 10/12, SDC 10/12/2, SDC 10/17; MSC.1/Circ.1002, MSC.1/Circ.1455, MSC.1/Circ.1552 and MSC.1/Circ.1574

Background

1 The Sub-Committee on Ship Design and Construction, at its tenth session, agreed to establish the Correspondence Group (the Group) on the Revision of the Interim Guidelines for Use of Fibre-Reinforced Plastic (FRP) (FRP Interim Guidelines) (MSC.1/Circ.1574¹) under the coordination of Sweden (SDC 10/17, paragraph 12.9).

List of participants

2 Representatives from the following Member States participated in the Group:

CHINA
FINLAND
LIBERIA
MARSHALL ISLANDS
NORWAY

REPUBLIC OF KOREA
RUSSIAN FEDERATION
SINGAPORE
TÜRKİYE
UNITED STATES

¹ *Interim Guidelines for use of Fibre Reinforced Plastic (FRP) elements within ship structures: Fire safety issues (MSC.1/Circ.1574).*

and observers from the following non-governmental organizations in consultative status:

INTERNATIONAL ASSOCIATION OF CLASSIFICATION SOCIETIES (IACS)
INTERNATIONAL COUNCIL OF MARINE INDUSTRY ASSOCIATIONS (ICOMIA)
CESA
SUPERYACHT BUILDERS ASSOCIATION (SYBAss)

Terms of reference

3 Taking into account the comments made and decisions taken at SDC 10, as well as documents SDC 10/12 (Germany and CESA) and SDC 10/12/2 (IACS), the Group was instructed to:

- .1 review the FRP Interim Guidelines;
- .2 invite for and consider input concerning experience gained in the use of the FRP Interim Guidelines;
- .3 address concerns raised during SDC 9 regarding recycling and fire safety (SDC 9/16, paragraph 15.10);
- .4 consider and advise whether other IMO instruments (e.g. SOLAS and FTP Code) should be amended in order to enable and to support the use of FRP;
- .5 convene virtual meetings using a suitable platform in order to consider any of the terms of reference, as necessary; and
- .6 submit a written report to SDC 11.

Method of work

4 Since SDC 10, the Group has progressed its work through correspondence via email and, when considered necessary, by "virtual meetings" as authorized by SDC 10.

5 Intersessional work included three rounds of correspondence. Further details are presented below for each point of the terms of reference (ToR):

- .1 with reference to ToRs 1, 2 and 3, round 1 focused on gathering information and experience gained;
- .2 round 2 focused on consideration and evaluation of information, experience gained and comments received in round 1, in order to decide what should be brought forward in the process;
- .3 based on consideration and conclusions from round 2, round 3 focused on the review of the FRP Interim Guidelines with reference to ToR 1, and was concluded with advice to the Sub-Committee on whether IMO instruments should be amended with reference to ToR 4; and
- .4 any need for editorial corrections was considered with reference to ToRs 1 and 2.

Outcome of rounds of correspondence

Round 1 – Gathering information and collection of experience gained (ToRs 1 to 3)

6 Replies were received from six members of the Group. The replies contained proposals to introduce, or to revise, the FRP Interim Guidelines on various topics, such as:

- .1 smoke and toxicity;
- .2 load-bearing divisions and elements that contribute to global strength;
- .3 joints connecting FRP with the ship structure;
- .4 the content of documents SDC 9/15/2 (CESA) and SDC 10/12/2;
- .5 recycling; and
- .6 Life Cycle Assessment (LCA).

7 From the six replies received to the call for experience gained in the use of the FRP Interim Guidelines, three members expressed that they have experience of their application. Two members expressed that they do not have experience of their application. One member did not specify if they had experience of their application.

8 One member emphasized that, currently, Administrations may approve alternative design arrangements of composite structures without making use of the FRP Interim Guidelines, which may be a principle to bear in mind during this work. The consequence is that when applying SOLAS regulations II-2/17 (Alternative design and arrangements) or I/5 (Equivalents), it would be possible to go beyond "elements"² in the use of FRP, with or without, applying the FRP Interim Guidelines.

9 In particular, during round 1:

- .1 views were expressed and comments received indicating broad support to include additional guidelines for load-bearing divisions and elements that contribute to global strength;
- .2 there were also several proposals that would involve proposed amendments to IMO instruments (e.g. SOLAS and the 2010 FTP Code); and
- .3 comments and proposals for editorial corrections were received.

Round 2 – Consideration and evaluation of information, experience gained and comments received in round 1; and further consideration of topics to bring forward

10 Replies were received from seven members of the Group reflecting, for example, different opinions regarding the inclusion of load-bearing fire divisions and elements contributing to global strength as part of the Group's ToR.

² As defined in MSC.1/Circ.1574, chapter 1.3.

11 One member expressed concerns and the view that introducing in the FRP Interim Guidelines load-bearing fire divisions and elements contributing to global strength would be outside the scope of MSC.1/Circ.1574. In addition to this, other members expressed that such proposal could be out of scope from the ToR defined for the Group's work by SDC 10.

12 Taking into account the importance of the discussion on the scope of the Group's work, it was important to take stock and recall SDC 10's deliberations in document SDC 10/17, and the audio recording of the discussion. It was concluded by the Coordinator that the issues listed in paragraph 11 could be considered within the scope of the ToR for the Group, leaving it to the Group itself to advise whether these topics should be included or not in the revision of the FRP Interim Guidelines.

The following to be noted in particular, from document SDC 10/17:

- .1 Paragraph 12.9, indicating that documents SDC 10/12 and SDC 10/12/2 should be taken into account by the Group. These documents contain proposals on these issues to be further considered.
- .2 Paragraph 12.7, stating that the issues in paragraph 12.6 should be taken into account intersessionally, for further review and development of appropriate amendments to the FRP Interim Guidelines. In paragraph 12.6.3 of the report, it is expressed that "compared to steel structures, the structural core of FRP structures collapses quicker under pressure, and consideration should also be given to the level and rate of thermal deformation".

13 Despite the different views expressed in the Group, it was concluded that the following issues should be brought forward, as part of the scope of the revision of the FRP Interim Guidelines:

- .1 load-bearing divisions;
- .2 elements contributing to global strength;
- .3 fire testing with regard to, for example, fire growth, smoke, toxicity and load-bearing capacity; and
- .4 recycling.

14 There were a number of proposals that would involve amendment proposals to IMO instruments (e.g. SOLAS and the 2010 FTP Code). Based on document SDC 10/17, paragraphs 12.9.4 (ToR 4), 12.7 and 12.6.4, and the views expressed, the Group supported the referral of proposals related to the 2010 FTP Code to the SSE Sub-Committee, to be considered under the ongoing output on the revision of the 2010 FTP Code to allow for new fire protection systems and materials. The Group also agreed that any proposals involving amendments to SOLAS chapter II-2 would need to be considered under a new output.

15 The Group agreed to an editorial correction regarding the definition of "B" class divisions in paragraph 3.3 of the FRP Interim Guidelines (see [DRAFT PROPOSAL³](#)).

³ https://wwwcdn.imo.org/localresources/en/OurWork/Safety/Documents/DRAFT_PROPOSAL_2_-_MSC.1-CIRC.1574_proposal_CESA.docx

16 In round 1, proposals for a full LCA were received. From the comments received in round 2, it was concluded that it was necessary to differentiate between LCA and recycling. While "recycling" matter had support from the Group to be brought forward, LCA received only marginal support and it was decided not to continue with this proposal at that stage.

Round 3 – Review of the Interim Guidelines (ToR 1), and consideration and advice to the Sub-Committee on whether IMO instruments should be amended (ToR 4).

17 In round 3, the members of the Group were invited to submit draft text proposals in line with the conclusions from the work of the Group in rounds 1 and 2, as reported above. These proposals are intended to substantiate amendments to the FRP Interim Guidelines, and develop a new structure of the amended Guidelines, on topics such as:

- .1 load-bearing divisions;
- .2 elements contributing to global strength;
- .3 fire testing with regard to, for example, fire growth, smoke, toxicity and load-bearing capacity; and
- .4 recycling.

18 Some members of the Group indicated their intention to submit proposals in round 3 but for various reasons there were delays and the deadline for contributions was subsequently extended, resulting in lack of time and opportunity to receive and subsequently discuss the proposals in a timely manner.

19 Notwithstanding this, a proposal related to fire safety was received (See [DRAFT PROPOSAL](#)). The text, containing proposals to include "load-bearing elements", is a draft, meant as a basis for further discussion. The submitters of the proposal welcomed further comments from other members of the Group in order to reflect a common understanding. Due to a lack of time for discussion, this is submitted as an external link to this report, allowing for the Group members and the Sub-Committee to assess and prepare for further discussion. In addition to this proposal, a draft Table of Contents for the FRP Interim Guidelines is included in the annex.

Conducting virtual meetings (ToR 5)

20 The first virtual meeting was held on 13 May 2024. The purpose of this meeting was to further discuss the comments received in round 1 and the way forward during round 2 with the main focus on the Group's views on the inclusion of load-bearing divisions and elements contributing to global strength as part of the Group's work. There was also a discussion on recycling.

21 The meeting allowed mainly for information-sharing, giving the Group the opportunity to further elaborate on their proposals and to ask other members for clarifications of proposals before the deadline for submitting comments in round 2.

22 The second virtual meeting was held on 10 July 2024. The purpose of this meeting was to discuss the new structure proposed for the FRP Interim Guidelines, and how these new proposals should be incorporated.

23 In order to facilitate this discussion, the table of contents of the existing Interim Guidelines was used as a base document. The Group was invited to prepare proposals for changes to the table and submit them to the Coordinator.

24 The Group also discussed how to move forward in a constructive way, focusing on drafting text proposals and encouraged participants willing to take the lead in drafting text proposals on specific topics.

25 Furthermore, the participants also discussed the need to establish a working group at this session.

26 The outcome of the meeting resulted in proposals for new sections under appendix D.7 of the FRP Interim Guidelines:

- .1 "Load-bearing elements"; and
- .2 "Fire testing, with regard to, e.g. fire growth, smoke, toxicity and load-bearing capacity"

These proposals are presented as new section titles under appendix D.7, as indicated in the annex.

27 The majority of the Group also agreed that fire testing should be referred to in the 2010 FTP Code through revision. However, since such amendments may result in a more complex and long-term process, the Group agreed that the focus of the work should be on first revising the FRP Interim Guidelines and leave aside possible proposals for amending the 2010 FTP Code for future consideration.

28 One member stressed that some of the proposals in previous rounds would involve amendments to SOLAS and discussed how this could be handled.

29 It was discussed that the application of the FRP Interim Guidelines will involve alternative design in accordance with SOLAS regulations II-2/17 (MSC.1/Circ.1002, as amended by MSC.1/Circ.1552) or I/5 (MSC.1/Circ.1455). This principle is described in paragraph 2 of the cover note of MSC.1/Circ.1574. To this end, with reference to paragraphs 12.4 and 12.5 of document SDC 10/17, the consequence of this reasoning should be that the revised FRP Interim Guidelines, under development, would not contradict current SOLAS provisions. A non-compliance would only be concluded if, in the first place, the alternative design approval process, in accordance with SOLAS regulations II-2/17 or I/5, was not applied.

30 Despite the conclusion to address load-bearing elements as part of the FRP Interim Guidelines revision, as expressed in paragraphs 12 and 13 above, one member reiterated that they did not support to include them in the Interim Guidelines and that this would be out of scope for this work. Notwithstanding that, referring testing of FRP in the 2010 FTP Code was supported by this same member.

31 Two members announced their willingness to draft text proposals relevant to fire safety.

32 It was also agreed to advise the Sub-Committee on the need to establish a working group at this session where these matters can be further discussed.

33 The third virtual meeting was held on 19 August 2024. The objective of the meeting was to have a status update and a discussion of where the Group stood at this point, and how to proceed with the remaining work.

34 The Group agreed to invite interested Member States and international organizations to submit documents to this session, with a view to receiving input and further elements that can be taken into consideration by a working group, if established. The Group agreed to have this reflected in this report, together with necessary elements allowing for other documents to be handled at this session.

35 The outcome of this meeting was that a proposal for a draft table of content was received; however, no other proposals were submitted. Two members announced their intention to submit proposals after this meeting.

36 Since there had been delays in the process of developing text proposals, it was agreed to extend the deadline for round 3, with a view to allowing further input into the Group's work with tangible proposals materialized for discussion.

37 During the meeting, it was expressed that there were other IMO instruments better suited for recycling considerations and that the Group could advise the SDC Sub-Committee to refer the matter to the relevant Committee.

Summary in relation to terms of reference

Revision of the FRP Interim Guidelines (ToR 1)

38 The work of the Group resulted in concrete proposals for amendments of the FRP Interim Guidelines, including:

- .1 draft table of contents of FRP Interim Guidelines, including respective placeholders for new sections, as presented in paragraph 26 and included in the annex; and
- .2 [DRAFT PROPOSAL](#) containing draft amendments for the revision of the FRP Interim Guidelines with regard to fire safety (see paragraph 19).

39 The text in [DRAFT PROPOSAL](#) is intended as a basis for discussion. Despite not having had enough time to discuss the proposal with the Group, a link to the proposal is included in this report, with a view to allowing enough preparation and possible additional proposals in advance of this session. Due to time constraints, this work has not been finalized and needs further consideration.

Invite for and consider input concerning experience gained in the use of the FRP Guidelines (ToR 2)

40 Round 1 of correspondence initiated the work by inviting input concerning experience gained in the use of the FRP Interim Guidelines. This input was considered in rounds 2 and 3 of correspondence and during the virtual meetings held.

Address concerns raised during SDC 9 regarding recycling and fire safety (SDC 9/16, paragraph 15.10) (ToR 3)

41 Based on the outcome of round 2, related to recycling, the Group was invited to submit text proposals addressing recycling. However, due to time constraints, the Group decided to prioritize issues related to fire safety.

42 In relation to fire safety, the Group was invited to submit relevant text proposals to be considered in the revision of the FRP Interim Guidelines. As described in paragraphs 38 and 39, these are included in both the annex and [DRAFT PROPOSAL](#).

Consider and advise whether other IMO instruments (e.g. SOLAS and FTP Code) should be amended in order to enable and to support the use of FRP (ToR 4)

43 Several of the comments from round 1 would imply possible amendments to IMO instruments (e.g. SOLAS and the FTP Code). The Group agreed to advise the Sub-Committee to:

- .1 consider any proposals involving amendments of SOLAS chapter II-2 under a new output, in case and when such proposals are drafted; and
- .2 refer any possible proposals for amending the 2010 FTP Code to the SSE Sub-Committee under the ongoing output on "Revision of the 2010 FTP Code to allow for new fire protection systems and materials", with reference to paragraphs 12.6.4 and 12.7 of document SDC 10/17.

Despite the agreed way forward in relation to any possible amendments to SOLAS and the 2010 FTP Code, the Group concentrated the efforts in discussing, commenting and elaborating draft proposals for amendments to the FRP Interim Guidelines.

44 Discussion under ToR 4 was not finalized due to time constraints. Notwithstanding that, the following views were noted:

- .1 Application of MSC.1/Circ.1574 presupposes alternative design in accordance with SOLAS regulations I/5 (MSC.1/Circ.1455) or II-2/17 (MSC.1/Circ.1002, as amended by MSC.1/Circ.1552). In this case, as long as the FRP Interim Guidelines are used as a supplement in the alternative design process, no further amendments are needed (see paragraphs 28 and 29).
- .2 Use of the FRP Interim Guidelines outside the scope of alternative design, would contradict current SOLAS provisions. Should the possibility to use FRP without the Alternative Design process be intended, there would be a need to amend other IMO instruments in order to enable and to support the safe use of FRP in ship structures (see paragraphs 28 and 29).
- .3 In particular for "recycling", there might be other IMO instruments better suited for handling specific recycling considerations and that the Group could advise the SDC Sub-Committee to refer this matter to the relevant Committee (see paragraph 37).

Convene virtual meetings using a suitable platform in order to consider any of the terms of reference, as necessary (ToR 5)

- 45 The conclusions from those virtual meetings were:
- .1 to introduce two new placeholders for new sections as presented in the new table of contents (see the annex);
 - .2 that the process for fire testing should preferably be referred to in the 2010 FTP Code; however, since this would result in a longer process, addressing the subject matter as amendments to the FRP Interim Guidelines could be acceptable;
 - .3 to advise the Sub-Committee on the need to establish a working group at this session where the outcome of the Group can be discussed and further development of amendments to the FRP Interim Guidelines could be discussed and finalized, as appropriate; and
 - .4 to invite interested Member States and international organizations to submit documents to this session, so as to further contribute to the development and conclusion of the work at that session.

Establishment of a working group

46 As the Group was unable to finalize the work on all of the terms of reference, the Group agreed on the need for a working group to be established at this session under the following draft terms of reference:

- .1 finalize the revision of the Interim Guidelines for use of Fibre-Reinforced Plastic (FRP) (MSC.1/Circ.1574), based on document SDC 11/11 and taking into account [DRAFT PROPOSAL](#), as well as other documents to be submitted, as appropriate; and
- .2 further consider and advise the Sub-Committee whether other IMO instruments (e.g. SOLAS and FTP Code) should be amended in order to enable and to support the use of FRP.

Action requested of the Sub-Committee

- 47 The Sub-Committee is invited to approve the report in general and in particular to:
- .1 note the progress made on the revision of the FRP Interim Guidelines (MSC.1/Circ.1574) (paragraphs 38 and 39, and annex);
 - .2 consider the conclusion of the Group regarding inclusion of load-bearing divisions and elements contributing to global strength, as part of the scope of the revision of the FRP Interim Guidelines (paragraphs 12 and 13);
 - .3 consider the Group's agreement that (paragraphs 14 and 43):
 - .1 any relevant draft amendment proposals to the 2010 FTP Code should be made to the SSE Sub-Committee for consideration under the ongoing output on "Revision of the 2010 FTP Code to allow for new fire protection systems and materials"; and
 - .2 any future draft amendments to other IMO instruments, such as SOLAS, should be considered under a new output, as appropriate (paragraphs 14 and 43);

- .4 note the view of the Group that the "recycling" matter could be better addressed under other IMO instruments and refer the matter of recycling to MEPC for handling such considerations (paragraphs 37 and 44.3); and
- .5 establish the Working Group on the Revision of the Interim Guidelines for use of Fibre-Reinforced Plastic (FRP) (MSC.1/Circ.1574) with the draft terms of reference (paragraph 46).

ANNEX*

**DRAFT TABLE OF CONTENTS, INTRODUCING NEW SECTIONS INTO THE
STRUCTURE OF THE DRAFT REVISION OF
THE INTERIM GUIDELINES FOR USE OF FIBRE REINFORCED PLASTIC (FRP)
ELEMENTS WITHIN SHIP STRUCTURES:
FIRE SAFETY ISSUES (MSC.1/CIRC.1574)**

Chapter 1 General

Chapter 2 Assessing fire safety of FRP composite structures

Chapter 3 Important factors to consider when evaluating FRP elements with starting point
in the regulations of SOLAS chapter II-2

- 3.1 Regulation 1 – Application
- 3.2 Regulation 2 – Fire safety objectives and functional requirements
- 3.3 Regulation 3 – Definitions
- 3.4 Regulation 4 – Probability of ignition
- 3.5 Regulation 5 – Fire growth potential
- 3.6 Regulation 6 – Smoke generation potential and toxicity
- 3.7 Regulation 7 – Detection and alarm
- 3.8 Regulation 8 – Control of smoke spread
- 3.9 Regulation 9 – Containment of fire
- 3.10 Regulation 10 – Fire fighting
- 3.11 Regulation 11 – Structural integrity
- 3.12 Regulation 12 – Notification of crew and passengers
- 3.13 Regulation 13 – Means of escape
- 3.14 Regulation 14 – Operational readiness and maintenance
- 3.15 Regulation 15 – Instructions, onboard training and drills
- 3.16 Regulation 16 – Operations
- 3.17 Regulation 17 – Alternative design and arrangements
- 3.18 Regulation 18 – Helicopter facilities
- 3.19 Regulation 19 – Carriage of dangerous goods
- 3.20 Regulation 20 – Protection of vehicle, special category and ro-ro spaces
- 3.21 Regulation 21 – Casualty threshold, safe return to port and safe areas
- 3.22 Regulation 22 – Design criteria for systems to remain operational after a fire casualty
- 3.23 Regulation 23 – Safety centre on passenger ships

* The annex is provided in the English language only and suggested new sections are indicated in grey.

APPENDIX A ISSUES OTHER THAN FIRE SAFETY

APPENDIX B FRP COMPOSITE MATERIALS AND COMPOSITIONS USED IN SHIPBUILDING

Introduction

- B.1 FRP composite compositions
 - B.2.1 Polymers
 - B.2.2 Fibres and reinforcements
 - B.2.3 Core materials
- B.3 Fire performance of FRP composite, key issues and means for improvement
 - B.3.1 Structural fire performance of FRP composite structures
 - B.3.2 Fire fighting of FRP composite structures
 - B.3.3 Exterior surfaces in FRP composite
 - B.3.4 Steel-FRP joints

APPENDIX C RECOMMENDATIONS REGARDING THE ASSESSMENT

Introduction

- C.1 Uncertainty treatment
- C.2 Required method
- C.3 Establishment of approval basis
- C.4 Approval process

APPENDIX D FIRE TESTING OF FRP COMPOSITE

Introduction

- D.1 Uncertainties when using tests to validate FRP composite
- D.2 Low flame-spread characteristics
- D.3 Generated effect and smoke in small scale
- D.4 Generated effect and smoke on a large scale
- D.5 Non-combustibility
- D.6 Smoke generation and toxicity
- D.7 Structural resistance
 - [Load-bearing elements
 - Fire Testing of FRP composite structures]
- D.8 Additional testing

APPENDIX E EXAMPLE OF ASSESSMENT PROCEDURE
