DMA RO Circular no. 025

Guidelines for safe use of Fibre Reinforced Plastic – Fire Safety

1. General

Generally, the use of Fibre Reinforced Plastic (FRP) elements within ship structures on cargo ships of 500 gross tonnage and above and on passenger ships is not allowed internationally due to requirements for using non-combustible materials.

SOLAS I/5 regarding equivalents reads:
"(a) Where the present Regulations require that a particular fitting, material, appliance or apparatus, or type thereof, shall be fitted or carried in a ship, or that any particular provision shall be made, the Administration may allow any other fitting, material, appliance or apparatus, or type thereof, to be fitted or carried, or any other provision to be made in that ship, if it is satisfied by trial thereof or otherwise that such fitting, material, appliance or apparatus, or type thereof, or provision, is at least as effective as that required by the present Regulations.
(b) Any Administration which so allows, in substitution, a fitting, material, appliance or apparatus, or type thereof, or provision, shall communicate to the Organization particulars thereof together with a report on any trials made and the Organization shall circulate such particulars to other Contracting Governments for the information of their officers."

If a ship's design or arrangements deviate from the prescriptive requirements of SOLAS, it may be allowed as an equivalent in accordance with SOLAS I/5.

SOLAS II-2/17 provides a methodology for alternative design and arrangements in relation to fire safety.

Combustible FRP elements and related fire safety measures can thus be treated as alternative fire safety design and arrangements in accordance with SOLAS II-2/17, while safety issues not directly linked with fire must be approved as equivalents in accordance with SOLAS I/5.

Fully FRP composite ships and FRP composite structures contributing to global strength are not fully covered by the current international interim guidelines for use of FRP elements within ship structures (MSC.1/Circ.1574). However, the guidelines should be used as the foundation for risk assessments of fully FRP composite ships and FRP composite structures contributing to global strength, as long as deviations from the guidelines are identified and additional assessments are performed, as appropriate.

Section 2 in this circular outlines possibilities for safe use of FRP and approval of ships – irrespective of ship size.

2. Guidelines for safe use of FRP and approval of ship constructions

2.1 Cargo ships (< 24 metres in length) with no passengers on board

Notice F from the Danish Maritime Authority – *Technical regulation on the construction, equipment, etc. of small commercial vessels* – takes account of and permits vessels constructed of glassfibre reinforced polyester (GRP).

If the ship does not carry any passengers, there are no requirements in addition to the regulations stipulated in Notice F from the Danish Maritime Authority.

2.2 Cargo ships (< 24 metres in length and ≤ 12 passengers)

Notice F from the Danish Maritime Authority – *Technical regulation on the construction, equipment, etc. of small commercial vessels* – takes account of and permits vessels constructed of glassfibre reinforced polyester (GRP).

GRP or FRP can be used on cargo ships below 24 metres in length that carry up to 12 passengers if the construction meets the requirements of the said technical regulation and the following requirements are fulfilled:

- An assessment must be carried out in accordance with the *Guidelines for the approval of alternatives and equivalents as provided for in various IMO instruments* (MSC.1/Circ.1455), as a qualitative analysis, taking into account the information and regulations from the *Interim guidelines for use of Fibre Reinforced Plastic (FRP) elements within ship structures: Fire Safety issues* (MSC.1/Circ.1574).
- The qualitative analysis can be performed following the principles of the *Guidelines on alternative design and arrangements for fire safety* (MSC.1/Circ.1002, as amended by MSC.1/Circ.1552).
- The safety assessment must concern the vessel as a whole, i.e. the safety assessment must concern not only directly affected fire safety issues, but also other safety related issues that may be affected by the FRP application, including, but not limited to, loss of stability following a fire or a collision, grounding or contact, and appropriate training of crew regarding fast and specific emergency response.

2.3 Passenger vessels exclusively engaged on voyages in port areas or on lakes, etc.

Order no. 916 of 3 July 2013 on *passenger vessels exclusively engaged on voyages in port areas or on lakes, etc.*, takes into account and permits vessels constructed in glassfibre reinforced polyester (GRP).

GRP or FRP can be used on vessels exclusively engaged on voyages in port areas or on lakes if the construction meets the requirements of the said order and the following requirements are fulfilled:

- An assessment must be carried out in accordance with the *Guidelines for the approval of alternatives and equivalents as provided for in various IMO instruments* (MSC.1/Circ.1455), as a qualitative analysis, taking into account the information and regulations from the *Interim guidelines for use of Fibre Reinforced Plastic (FRP) elements within ship structures: Fire Safety issues* (MSC.1/Circ.1574).

- The qualitative analysis can be performed following the principles of the *Guidelines on alternative design and arrangements for fire safety* (MSC.1/Circ.1002, as amended by MSC.1/Circ.1552).
- The safety assessment must concern the vessel as a whole, i.e. the safety assessment must concern not only directly affected fire safety issues, but also other safety related issues that may be affected by the FRP application, including, but not limited to, loss of stability following a fire or a collision, grounding or contact, and appropriate training of crew regarding fast and specific emergency response.

2.4 High-speed cargo craft (≤ 12 passengers)

The International Code of Safety for High-Speed Craft, 2000 (HSC Code) states in regulation 7.2.5 that: "*where the words "steel or other equivalent material" occur, "equivalent material" means any non-combustible material which, by itself or due to insulation provided, has structural and integrity properties equivalent to steel at the end of the applicable exposure to the standard fire test (e.g., aluminium alloy with appropriate insulation).*"

The HSC Code furthermore states in regulation 7.4.1.3 that: "*The hull, superstructure, structural bulkheads, decks, deckhouses and pillars shall be constructed of approved non-combustible materials having adequate structural properties. The use of other fire-restricting materials may be permitted provided the requirements of this chapter are complied with and the materials are in compliance with the Fire Test Procedures Code.*"

FRP may be used on high-speed cargo craft if the construction meets the requirements of the HSC Code, and the following requirements are fulfilled:

- An assessment must be carried out in accordance with the *Guidelines for the approval of alternatives and equivalents as provided for in various IMO instruments* (MSC.1/Circ.1455), as a qualitative analysis, taking into account the information and regulations from the *Interim guidelines for use of Fibre Reinforced Plastic (FRP) elements within ship structures: Fire Safety issues* (MSC.1/Circ.1574).
- The qualitative analysis can be performed following the principles of the *Guidelines on alternative design and arrangements for fire safety* (MSC.1/Circ.1002, as amended by MSC.1/Circ.1552).
- The safety assessment must concern the vessel as a whole, i.e. the safety assessment must concern not only directly affected fire safety issues, but also other safety related issues that may be affected by the FRP application, including, but not limited to, loss of stability following a fire or a collision, grounding or contact, and appropriate training of crew regarding fast and specific emergency response.

2.5 Cargo ships (≥ 24 metres in length)

FRP elements within ship structures can be considered as alternative designs and arrangements in accordance with SOLAS regulation II-2/17 if the following international guidelines are followed:

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

- *Guidelines for the approval of alternatives and equivalents as provided for in various IMO instruments* (MSC.1/Circ.1455).
- *Guidelines on alternative design and arrangements for fire safety* (MSC.1/Circ.1002, as amended by MSC.1/Circ.1552).

2.6 Passenger ships

FRP elements within ship structures can be considered as alternative designs and arrangements in accordance with SOLAS regulation II-2/17 if the following international guidelines are followed:

- *Interim guidelines for use of Fibre Reinforced Plastic (FRP) elements within ship structures: Fire Safety issues* (MSC.1/Circ.1574).
- *Guidelines for the approval of alternatives and equivalents as provided for in various IMO instruments* (MSC.1/Circ.1455).
- *Guidelines on alternative design and arrangements for fire safety* (MSC.1/Circ.1002, as amended by MSC.1/Circ.1552).

2.7 High-speed passenger craft (> 12 passengers)

The International Code of Safety for High-Speed Craft, 2000 (HSC Code) states in regulation 7.2.5 that: "*where the words "steel or other equivalent material" occur, "equivalent material" means any non-combustible material which, by itself or due to insulation provided, has structural and integrity properties equivalent to steel at the end of the applicable exposure to the standard fire test (e.g., aluminium alloy with appropriate insulation).*"

The HSC Code furthermore states in regulation 7.4.1.3 that: "*The hull, superstructure, structural bulkheads, decks, deckhouses and pillars shall be constructed of approved non-combustible materials having adequate structural properties. The use of other fire-restricting materials may be permitted provided the requirements of this chapter are complied with and the materials are in compliance with the Fire Test Procedures Code.*"

FRP elements within ship structures can be considered on high-speed passenger craft if the construction meets the requirements of the HSC Code and the following international guidelines are followed:

- *Interim guidelines for use of Fibre Reinforced Plastic (FRP) elements within ship structures: Fire Safety issues* (MSC.1/Circ.1574).
- *Guidelines for the approval of alternatives and equivalents as provided for in various IMO instruments* (MSC.1/Circ.1455).
- *Guidelines on alternative design and arrangements for fire safety* (MSC.1/Circ.1002, as amended by MSC.1/Circ.1552).

2.8 Special purpose ships and offshore vessels

2.8.1 Special purpose ships carrying special personnel

The Code of safety for Special Purpose Ships, 2008 (SPS Code) consists of rules in addition to the provisions on cargo vessels stipulated in SOLAS. The SPS Code is equivalent to the SOLAS passenger rules, and vessels certified in accordance with the Code are permitted carry up to 240 persons on board. The Code is based on safety training requirements for special personnel as an equivalent to the passenger ship rules. Corresponding to SOLAS, the SPS Code is founded on ships constructed in steel and it does not mitigate the risks related to FRP elements within ship structures.

2.8.2 High-speed offshore vessels carrying industrial personnel

DMA RO Circular no. 024 – *Guidelines for approval of high-speed offshore vessels carrying more than 12 industrial personnel* – does not cover vessels constructed in FRP. This guideline consists of rules in addition to the cargo vessel requirements stipulated in the HSC Code. With an approach similar to that of the SPS Code, it offers an equivalent standard to the passenger vessel requirements of the HSC Code. Vessels approved in accordance with DMA RO Circular no. 024 are permitted to carry up to 60 persons on board. The RO Circular is based on safety training requirements for industrial personnel as an equivalent to the passenger ship rules. Corresponding to the 2000 HSC Code, the RO Circular is founded on a risk analysis for ships constructed of non-combustible material, and it does not mitigate the risks related to FRP elements within ship structures.

2.8.3 FRP elements within structures on vessels carrying special personnel or industrial personnel

The safety standards for both types of vessels (special purpose ships and high speed off-shore vessels) include reduction of structural safety compared to passenger ship safety standards and these vessels are consequently dependent on additional operational requirements and safety training requirements. It is therefore crucial that the possible use of FRP elements within ship structures does not reduce the time available for evacuation in case of a fire.

FRP elements within ship structures can be considered on ships carrying special personnel in accordance with SOLAS regulation II-2/17, or on ships carrying more than 12 industrial personnel if the following international guidelines are followed:

- *Interim guidelines for use of Fibre Reinforced Plastic (FRP) elements within ship structures: Fire Safety issues* (MSC.1/Circ.1574).
- *Guidelines for the approval of alternatives and equivalents as provided for in various IMO instruments* (MSC.1/Circ.1455).
- *Guidelines on alternative design and arrangements for fire safety* (MSC.1/Circ.1002, as amended by MSC.1/Circ.1552).