

UI SC253 “Fire resistance requirements for fibre-reinforced plastic (FRP) gratings used for safe access to tanker bows (IMO Res. MSC.62(67))”

Part A. Revision History

Version no.	Approval date	Implementation date when applicable
NEW (Dec 2011)	19 December 2011	1 January 2013

- **NEW (Dec 2011)**

.1 Origin for Change:

- ☒ Suggestion by IACS member

.2 Main Reason for Change:

Interpretation of a vague expression within an IMO instrument.

.3 List of non-IACS Member classification societies contributing through the TC Forum and/or participating in IACS Working Group:

None

.4 History of Decisions Made:

The issue was raised within the Statutory Panel. After some discussion it was agreed to draft an IACS UI and associated HF and TB.

.5 Other Resolutions Changes

None

.6 Dates:

Original proposal: 27 January 2011 made by: a Member

Panel Approval: July 2011 by: Statutory panel

GPG Approval: 19 December 2011 (Ref. 11167_IGc)

Part B. Technical Background

List of Technical Background (TB) documents for UI SC253:

Annex 1. **TB for New (December 2011)**

See separate TB document in Annex 1.



Technical Background for UI SC253 New, Dec 2011

1. Scope and objectives

The UI is intended to provide additional requirements to be considered for the use of FRP gratings in lieu of steel for safe access to tanker bows. This includes defining a common understanding for the term “fire resistant” as required by MSC.62(67) Safe access to tanker bows.

2. Engineering background for technical basis and rationale

FRP gratings are desirable for use in the marine environment because of their light weight, low thermal conductivity, and resistance to corrosion. However, these materials are typically combustible and exhibit mechanical properties different from steel and thus require careful consideration with respect to fire integrity, combustibility, and smoke generation.

3. Source / derivation of the proposed IACS Resolution

National standard of the USA: USCG Marine Safety Manual Vol. II, Para 5.C.6. Structural fire protection - Use of fibre-reinforced plastic gratings.

4. Summary of Changes intended for the revised Resolution:

Not applicable

5. Points of discussions or possible discussions

None

6. Attachments if any

1. National standard of the USA: USCG Marine Safety Manual Vol. II, Para 5.C.6. Structural fire protection - Use of fibre-reinforced plastic gratings.
2. MSC.62(67) - Guidelines for safe access to tanker bows.

POLICY FILE MEMORANDUM ON THE USE OF FIBER REINFORCED PLASTIC (FRP) GRATINGS AND CABLE TRAYS

1. **PURPOSE:** This Policy File Memorandum provides guidance on the fire test requirements for use of fiber reinforced plastic (FRP) gratings and cable trays and will be incorporated as a change to reference (a).

2. **APPLICABILITY:** This Policy File Memorandum addresses the fire performance of FRP grating and cable trays for use on inspected vessels, including mobile offshore drilling units (MODUs) and floating production platforms. It is not intended to eliminate any other design criteria or requirements pertaining to the material, construction, or performance of the grating in the non-fire condition, nor is it intended to apply retroactively to applications that have previously received approval on a case-by-case basis.

3. **BACKGROUND:** FRP gratings and cable trays are desirable for use in the marine environment because of their light weight, low thermal conductivity, and resistance to corrosion. However, these materials are typically combustible and exhibit mechanical properties different from steel and thus require careful consideration with respect to fire integrity, combustibility, and smoke generation. As a result of the development of this policy, the use of FRP grating can be expanded beyond the current guidance in reference (a) with confidence that the overall level of fire safety will be maintained.

4. **DISCUSSION:** This Policy File Memorandum addresses qualification and testing of FRP grating for structural fire integrity, and updates the requirements for flame spread, smoke, and toxicity testing of FRP gratings and cable trays. Enclosure (1) provides the fire testing requirements necessary for using FRP grating and cable trays in various locations and services.

5. **ACTION:** Enclosure (1) of this PFM shall be consulted in lieu of paragraph 5.C.6 on pages 5-4 and 5-5 of Volume II of the Marine Safety Manual. This PFM shall remain in effect until enclosure (1) is incorporated as a change to the Marine Safety Manual. Questions arising which pertain to specific issues not addressed in this policy should be referred to the Commandant (G-MSE-4), U.S. Coast Guard Headquarters, 2100 Second St., S.W., Washington, DC 20593-0001.

Encl: (1) Future Change to the Marine Safety Manual, Volume II, paragraph 5.C.6, Fiber Reinforced Plastic (FRP) Gratings

FUTURE CHANGE TO THE MARINE SAFETY MANUAL, VOLUME II, PARAGRAPH 5.C.6, FIBER REINFORCED PLASTIC (FRP) GRATINGS

5.C.6. Fiber Reinforced Plastic (FRP) Gratings.

a. General.

(1) FRP gratings are not specifically addressed in the individual vessel regulations. However, the resins typically used in the manufacture of these gratings are combustible and heat sensitive; therefore, FRP gratings use must be limited based on the requirements discussed below.

(2) These requirements are not intended to eliminate any other design criteria or requirement pertaining to the material, construction, or performance of the FRP gratings in the non-fire condition.

b. FRP Grating Material Systems.

(1) All fire integrity, flame spread, smoke, and toxicity testing, where required, shall be conducted on each material system.

(2) Changes in either the type, amount, and/or architecture, of either the reinforcement materials, resin matrix, coatings, or manufacturing processes shall require separate testing in accordance with the procedures below. Manufacturers should provide evidence, such as enrollment in a follow-up program, that the FRP gratings being installed are the same as those which were tested and approved.

c. Testing Laboratories and Approval.

(1) The testing laboratory conducting the fire testing described below shall:

(a) be engaged, as a regular part of its business, in performing inspections and tests that are the same or similar to the tests described below;

(b) have or have access to the apparatus, facilities, personnel, and calibrated instruments that are necessary to inspect and test the FRP gratings; and

(c) not be owned or controlled by the manufacturer of the FRP gratings.

(2) Requests for approval shall be submitted to the Commandant (G-MSE-4) 2100 Second St., S.W., Washington DC, 20593-0001 and shall include the following:

(a) a test report containing the information required by 46 CFR 159.005-11; and

(b) a list of the FRP gratings and grating systems for which approval is requested.

d. Fire Test Requirements.

(1) Structural Fire Integrity* – The structural fire integrity matrix in paragraph 5.C.6.f establishes the structural fire integrity characteristics that FRP gratings should possess, based on location and service. Where a specific application satisfies more than one block in the matrix, the highest level of fire integrity shall be required. The test procedures required to qualify FRP gratings to one of three levels are described in paragraph 5.C.6.e. The Marine Safety Center (MSC) and/or the OCMI shall determine the location and service of the FRP gratings keeping in mind the following considerations for each of the three performance levels:

(a) Level 1 (L1): FRP gratings meeting the L1 performance criteria are intended to be satisfactory for use in escape routes or access for firefighting, emergency operation or rescue, after having been exposed to a significant hydrocarbon or cellulosic fire incident. In addition they are also acceptable for the services and functions described for levels L2 and L3.

(b) Level 2 (L2): FRP gratings meeting the L2 performance criteria are intended to be satisfactory for use in open deck areas where groups of people are likely to assemble such as temporary safe refuge or lifeboat embarkation areas. In addition they are also acceptable for the services and functions described for level L3.

(c) Level 3 (L3): FRP gratings meeting the L3 performance criteria are intended to be satisfactory for use in egress routes and any areas that may require access for firefighting, rescue or emergency operations during exposure to or shortly after exposure to a transitory hydrocarbon or cellulosic fire.

* The structural fire integrity requirements are intended for self-supporting personnel platforms or walkways and are not intended for grating overlaid on steel decking or used in other applications such as pipe guards, seachest screenings, safety guards, etc.

(2) Fire Retardance – All FRP gratings should be fire retardant; this can be demonstrated by testing to ASTM E-84, Standard Test Method for the Surface Burning Characteristics of Building Materials with a flame spread rating not to exceed 25 or by meeting the requirements in paragraph 5.C.6.d(3)(a) or (b) below.

(3) Flame Spread – All FRP gratings, except those fitted on open decks and within tanks, cofferdams, void spaces, pipe tunnels and ducts, should have low flame spread characteristics as determined by one of the following test procedures:

(a) tested to ASTM E-84 with a flame spread rating not to exceed 20; or

(b) tested to IMO Resolution A.653(16), Recommendation on Improved Fire Test Procedures for Surface Flammability of Bulkhead, Ceiling and Deck Finish Materials and meeting the criteria for bulkheads, linings, or ceilings.

(4) Smoke Generation – FRP gratings within accommodation, service and control spaces, should have low smoke characteristics as determined by one of the following test procedures:

(a) tested to ASTM E-84 with a smoke developed rating not to exceed 10; or

(b) tested in accordance with the IMO Fire Test Procedures Code (FTPC), Resolution MSC.61(67), Part 2 – Smoke and Toxicity Test, and meeting the criteria established for materials used as bulkheads, linings, or ceilings.

e. Structural Fire Integrity Test Procedures.

(1) Level 1 – To be qualified as level 1 (L1), the FRP gratings shall meet the requirements for qualification as level 3 and level 2, and in addition shall be subjected to the following test procedures:

(a) Three (3) FRP grating specimens, after being subjected to the level 2 testing, shall be unloaded and prepared for impact testing in the manner specified for horizontal specimens in ASTM E-695, Standard Method of Measuring Resistance of Wall, Floor, and Roof Construction to Impact Loading. The test specimens shall be secured as required in section 8.3 of ASTM E-695 except that the span shall be 200 mm less than the specimen length. A lead shot bag of 40 kg mass shall be dropped once from a height of 2 m such that the point of impact is in the center of the span. The specimens shall then be uniformly loaded as required by the level 2 test procedures.

(b) The test will be considered successful if all three (3) specimens remain intact after being subjected to the impact test and the level 2 loading test. Failure will be indicated by collapse of one or more of the gratings.

(2) Level 2 – To be qualified as level 2 (L2), the FRP gratings shall meet the requirements for qualification as level 3, and in addition shall be subjected to the following test procedures:

(a) On the FRP grating specimen and the steel grating specimen subjected to the level 3 post-loaded testing, the specimen shall be gradually loaded in increments not to exceed 20 kg, placed in such a manner as to represent a uniformly distributed load across the span.

(b) The test will be considered successful if the FRP grating remains intact at a load greater than or equal to a uniform 4.5kN/m² (94 lbf/ft²) or greater than or equal to the steel grating failure loading, whichever is less. Failure will be indicated by collapse of the grate.

(3) Level 3 – To be qualified as level 3 (L3), the FRP gratings should be subjected to the following fire test procedures for both the post-loaded and pre-loaded tests and conditions:

(a) A fire test will be conducted in accordance with ASTM E-119, Standard Test Method for Tests of Building Construction and Materials. Two tests shall be conducted in the ASTM E-119 furnace for each FRP grating design. The first fire test shall be conducted with the specimens under the specified load (pre-loaded) and the second fire test will be conducted on unloaded specimens (post-loaded). The time-temperature curve shall be the standard for E-119 or the ISO equivalent. The duration of the tests shall be as specified below.

(b) Each test specimen shall be 300-350 mm wide to allow for the differences in the spacing of longitudinal supporting members. The length of each test specimen shall be the length of the maximum span to be seen in service plus 200 mm. Four test specimens shall be prepared as described above; two of the proposed FRP gratings and two of a similar steel gratings that would be used in the same location constructed to the applicable regulations and standards (steel

gratings rated at a minimum of 4.5 kN/m² (94 lbf/ft²) uniform loading with a 1.67 factor of safety are acceptable).

(c) The pre-loaded test shall consist of the following:

(i) one steel grating specimen and one FRP grating specimen shall be placed adjacent to one another in the furnace simply supported on two I-beams with a minimum flange width of 100 mm at an elevation of at least one half of the furnace height or a minimum of 300 mm above the burners;

(ii) the specimens shall be placed on the I-beams such that 100 mm of each side of the specimen rests on each of the two I-beams;

(iii) a static load represented by a 40 kg mass shall be placed in the center span of the test specimens;

(iv) the 40 kg mass load shall consist of a steel container filled with sand, the base of which shall be square with an area of 0.9 m²;

(v) arrangements shall be made to measure the deflection at the center of the span of each of the loaded specimens during the test with a degree of accuracy of ± 5 mm.

(vi) the two specimens shall be subjected to the time-temperature curve specified in the ASTM E-119;

(vii) deflection of the two loaded test specimens shall be measured throughout the duration of the fire test and the average furnace temperature shall be recorded when each of the two specimens has deflected a distance of $L/10$ (failure point) from the horizontal where L is equal to the maximum unsupported span of the specimens; and

(viii) the test will be considered successful if the difference between the average furnace temperature at the time of failure of the steel grating and the average furnace temperature at the time of failure of the FRP grating is less than 100 °C (180 °F).

(e) The post-loaded test shall consist of the following:

(i) one steel grating specimen and one FRP grating specimen shall be placed adjacent to one another in the furnace simply supported on two I-beams with a minimum flange width of 100 mm at an elevation of at least one half of the furnace height;

(ii) the specimens shall be placed on the I-beams such that 100 mm of each side of the specimen rests on each of the two I-beams;

(iii) the two specimens shall be subjected to the time-temperature curve specified in the ASTM E-119 for a duration of 60 minutes;

(iv) at the end of the 60 minutes the specimens will be allowed to cool and shall then be subjected to a static load represented by the 40 kg mass specified in the pre-loaded test above, placed in the center span of the test specimens; and

(v) the test will be considered successful if the FRP grating specimen is intact at the end of the test and does not collapse under the 40 kg mass load.

f. Structural Fire Integrity Matrix.

Location	Service	Fire Integrity
Machinery Spaces	Walkways or areas which may be used for escape, or access for firefighting, emergency operation or rescue	L1 See note 1
Machinery Spaces	Personnel walkways, catwalks, ladders, platforms or access areas other than those described above	L3
Cargo Pump Rooms	All personnel walkways, catwalks, ladders, platforms or access areas	L1
Cargo Holds	Walkways or areas which may be used for escape, or access for firefighting, emergency operation or rescue	L1
Cargo Holds	Personnel walkways, catwalks, ladders, platforms or access areas other than those described above	None required
Cargo Tanks	All personnel walkways, catwalks, ladders, platforms or access areas	None required See note 2
Fuel Oil Tanks	All personnel walkways, catwalks, ladders, platforms or access areas	None required See note 2
Ballast Water Tanks	All personnel walkways, catwalks, ladders, platforms or access areas	None required See note 3
Cofferdams, void spaces, double bottoms, pipe tunnels, etc.	All personnel walkways, catwalks, ladders, platforms or access areas	None required See note 3
Accommodation, service, and control spaces	All personnel walkways, catwalks, ladders, platforms or access areas	L1
Lifeboat embarkation or temporary safe refuge stations in open deck areas	All personnel walkways, catwalks, ladders, platforms or access areas	L2
Open Decks or semi-enclosed areas	Walkways or areas which may be used for escape, or access for firefighting, emergency operation or rescue	L3 See note 4
Open Decks or semi-enclosed areas	Personnel walkways, catwalks, ladders, platforms or access areas other than those described above	None required

Notes:

1. If the machinery space does not contain any internal combustion machinery, other oil burning, oil heating, or oil pumping units, fuel oil filling stations, or other potential hydrocarbon fire sources and has not more than 2.5 kg/m² of combustible storage, gratings of L3 integrity may be used in lieu of L1.
2. If these spaces are normally entered when underway, gratings of L1 integrity shall be required.
3. If these spaces are normally entered when underway, gratings of L3 integrity shall be required.
4. Vessels fitted with deck foam firefighting systems require gratings of L1 integrity for foam system operational areas and access routes.

g. Other Authorized Uses.

(1) The OCMI may authorize the use of FRP gratings without Commandant approval in applications where structural fire integrity of the FRP gratings is not a concern, provided they meet the applicable fire retardance, flame spread and smoke generation requirements as set forth in paragraphs 5.C.6.d(2), (3), & (4). Applications where the use of FRP gratings have been authorized in the past, without any structural fire integrity requirements, include the following:

- (a) sea chest coverings;
- (b) small sundeck awnings and supports;
- (c) lifeboat bilge flooring;
- (d) electrical control flooring;
- (e) pipe guards on deck, in cargo holds, and in engine rooms;
- (f) removable guards over hawseholes, anchor hawsepipes, and scuppers;
- (g) personnel barriers, such as protection for electrical panels; and
- (h) ship staging and work platforms (Occupational Safety and Health Administration (OSHA) requirements may also apply).

5.C.7 Fiber Reinforced Plastic (FRP) Cable Trays.

a. General. Cables should be supported by metal hangers as required by section 20.5 of IEEE Standard 45, Recommended Practice for Electric Installations on Shipboard. FRP cable trays may be used anywhere provided:

- (1) they are fire-retardant as described in section 5.C.6.d(2) above;
- (2) they comply with the applicable flame spread requirements for FRP gratings specified in paragraph 5.C.6.d(3) above;
- (3) they comply with the applicable smoke generation requirements for FRP gratings specified in paragraph 5.C.6.d(4) above; and
- (4) their failure, will not cause the cables they are supporting to fall and hinder escape or access by firefighters.

ANNEX 7

RESOLUTION MSC.62(67)
(adopted on 5 December 1996)

GUIDELINES FOR SAFE ACCESS TO TANKER BOWS

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

NOTING that new regulation II-1/3-3 of the International Convention for the Safety of Life at Sea (SOLAS), 1974, as adopted by the Committee by resolution MSC.57(67), requires that all tankers, including gas carriers and chemical tankers, shall be provided with means, based on guidelines developed by the Organization, to enable the crew to gain safe access to the bow even in severe weather conditions,

HAVING CONSIDERED the recommendation made by the Sub-Committee on Ship Design and Equipment at its thirty-ninth session,

1. **ADOPTS** the Guidelines for Safe Access to Tanker Bows, set out in the Annex to the present resolution;
2. **RECOMMENDS** that all Governments concerned take appropriate steps to implement the said Guidelines.

ANNEX

GUIDELINES FOR SAFE ACCESS TO TANKER BOWS

Gangway and Access

1 Tankers, including oil tankers as defined in SOLAS regulation II-1/2.12, chemical tankers as defined in regulation VII/8.2 and gas carriers as defined in regulation VII/11.2, should be provided with means to enable the crew to gain safe access to the bow even in severe weather conditions. For tankers constructed on or after 1 July 1998, the access should be by means of either a walkway on the deck or a permanently constructed gangway of substantial strength at or above the level of the superstructure deck or the first tier of a deckhouse which should:

- .1 be not less than 1 m in width, situated on or as near as practicable to the centre line of the ship and located so as not to hinder easy access across working areas of the deck;
- .2 be fitted at each side throughout its length with a footstop and guard rails supported by stanchions. Such rails should consist of no less than 3 courses, the lowest being not more than 230 mm and the uppermost being at least 1 m above the gangway or walkway, and no intermediate opening should be more than 380 mm in height. Stanchions should be at intervals of not more than 1.5 m;
- .3 be constructed of fire resistant and non-slip material;
- .4 have openings, with ladders where appropriate, to and from the deck. Openings should not be more than 40 m apart;
- .5 if the length of exposed deck to be traversed exceeds 70 m, have shelters of substantial construction set in way of the gangways or walkways at intervals not exceeding 45 m. Every such shelter should be capable of accommodating at least one person and be so constructed as to afford weather protection on the forward, port and starboard sides; and
- .6 if obstructed by pipes or other fittings of a permanent nature, be provided with means of passage over such obstruction.

2 The Administration may accept alternative or modified arrangements for tankers with space constraint, such as small tankers, or tankers with large freeboard, such as gas carriers, provided that such alternative or modified arrangements achieve an equivalent level of safety for access to the bow.

3 Arrangements already approved by the Administration for the tankers constructed before 1 July 1998 may be accepted, provided that such existing arrangements achieve an equivalent level of safety for access to the bow.
