

**Committee of Experts on the Transport of Dangerous Goods
and on the Globally Harmonized System of Classification
and Labelling of Chemicals**

4 July 2019

**Sub-Committee of Experts on the Transport of Dangerous Goods
Fifty-fifth session**

Geneva, 1-5 July 2019

Item 6 (c) of the provisional agenda

**Miscellaneous proposals for amendments to the Model Regulations
on the Transport of Dangerous Goods:
fibre-reinforced plastics (FRP) portable tanks**

**Report of the informal working group on fibre-reinforced
plastics (FRP) portable tanks**

Transmitted by Chairman of the informal working group

1. The informal working group on FRP portable tanks met from 1-3 July 2019. Twenty-five representatives from 10 different member governments and numerous industry representatives were in attendance. The group discussed the papers referred by the Sub-Committee, reviewed work completed through correspondence prior to the session on application and general provisions, and specific FRP portable tank design criteria.

Issues referred by Sub-Committee

2. INF.39 & INF.43 – The group discussed the idea of ensuring an equivalent level of safety is maintained between metal and FRP portable tanks and the various other issues raised by these two informal papers (e.g., unique modal concerns, heating and cooling elements, and service life).

3. The differences in materials of construction between metallic and FRP portable tanks requires the use of multiple elements to ensure an equivalent level of safety is achieved. Elements currently being considered when making this determination include scientific and historical understanding of FRP construction materials and processes, analysis of the current transport use and incident history of FRP portable tanks, safety factors built into design criteria, and physical testing.

4. Noting the different levels of experience with FRP portable tanks and FRP materials in general, the consensus of the working group was that data concerning the number of different design types, approximate numbers of FRP portable tanks in transportation, and accident/incident data would be useful to inform general understanding of FRP portable tanks. A further solicitation from members of the working group with this type of data will be made and distributed to the group.

5. It was noted that in many respects, the tests required for metal portable tanks are suitable for FRP portable tanks (e.g., CSC testing and hydrostatic testing) but that in other cases the intrinsic properties of FRP portable tanks may require additional testing (e.g., fire engulfment, impact resistance, and protection from UV radiation).

6. The group brainstormed and discussed the different requirements that individual member states and experts had concerns including those contained in the informal documents submitted to the Sub-Committee. This discussion lead to an open discussion resulting in a gap analysis to identify issues currently incorporated in the draft provisions and those that are not currently addressed. A table found in the Annex follows. The first column of the table is the concept or concern raised. The 2nd column identifies if the concern is currently addressed in some manner in the draft requirements as of the start of this meeting; the 3rd column cross referenced the concern to metal tanks to understand if this is a unique criteria for FRP tanks; the 4th column contains further discussion and notes; and the last column

identifies if the group discussed the concern in some manner during this meeting of the informal working group and may have taken action to include it within the draft requirements. A “Yes” in the last column does not indicate that the matter is completely closed and provisions are in place, or even determined to be appropriate, but simply indicates the issue was discussed. This gap analysis is being utilized during the development of the standard to ensure members concerns are addressed. The analysis may also inform potential research projects on specific tests or material properties of FRP portable tanks and FRP materials of construction.

Discussions in working group

7. The working group continued discussion on the general provisions, definitions, and design criteria to address comments received through informal correspondence. Additional work is still necessary based on the outcome of further sections (e.g., inspection and testing requirements and approval provisions), but a large portion of these sections have provisional agreement within the group. Sections that still need work have been identified.

8. Some items of work concerning design criteria were identified that would benefit from smaller breakout groups to address (e.g., safety factors for buckling and ensuring proper usage of definitions for design and test pressure consistent with Chapter 6.7 of the Model Regulations). These smaller groups have been assigned to review these provisions and report back to the working group their recommendations.

Actions requested

9. The Sub-Committee is invited to consider the report of the working group and provide comments to the working group chair.

10. The working group will continue to correspond through email and teleconference in-between the sessions. We have tentatively scheduled a teleconference for the end of July to address remaining concerns over design criteria provisions. Noting, the value added to the group by having face-to-face discussions concerning important safety concerns in the development of these standards, the working group suggests having a three-day working group session running concurrently with the 56th TDG Sub-Committee session. If approved by the Sub-Committee, and noting the limited availability of meeting space at the Palace of Nations, the chairman requests the Secretariat inquire about the availability of meeting space for approximately 30 persons at their earliest convenience.

Annex

Concerns	Already a known test	Already a standard for metal tanks	Considerations	Addressed in session
Tensile strength	Yes, ISO currently in 6.9.2.3.4 of draft requirements	ASTM E8		Yes
In plane shear strength	No	N/A	ISO 14129: 1997 test. Not an element utilized in allowable calculation or factor of safety evaluation.	Yes
Interlaminar shear strength	Yes, ISO 14130 but related to the connected structure of parts 6.9.2.3.6	N/A		Yes
Fracture toughness	No		Difficult for competent authorities to implement ISO 15024.	Yes
Compression load	No	Yes		No
Heat distortion of resin (HDT)	Yes	N/A		Yes
Creep factor	Yes	N/A		Yes
Aging factor	Yes	N/A		Yes
Buckling	Yes	Yes	Needs further discussion	Yes
Solar radiation – Heat	No	N/A	Temperature range	Yes
UV	No	N/A	Is in ADR 6.9	Yes
Salt fog/spray	No	No	Significant effect on steel structure.	Yes
Fire engulfment	Yes	No. Design heat load, but no type test.	Significant effect on steel structure.	Yes
Puncture resistance (sharp impact tip)	No	No, addressed by minimum wall thickness.		No
Impact resistance (ball drop- blunt)	Yes	Yes		No
Drop from container stack	No	No, however 1M drop test for offshore tanks	Handling tests in CSC (e.g., stacking, racking).	No
Longitudinal impact	Yes	Yes	Need to ensure clear indication in draft. Discuss if tank is the target or the bullet (check Chapter 41 MOTC).	Yes
Roll over/Overturning	No	No	For FRP tanks double safety factors (K-factors) if there is not a full metallic skeleton surrounding the tank.	Yes
Frontal, rear, side impact	No	No	The factors of safety provided address. Loading conditions in 6.7.2.	Yes

Dynamic maneuvers testing	No	No	In ADR 6.9 spec	Yes
Sloshing	Yes	Yes	Must follow 4.2 general use requirements.	Yes
CSC requirements/ISO 1496-3	Yes	Yes	Align with requirements in UN 6.7	Yes
Service temperature	Yes	Yes	Testing at low and high range	Yes
Service pressure	Yes	Yes		Yes
Mechanism of failure (failure modes) – normal service	Yes	Yes	Resin cracks/delamination	Yes
Mechanism of failure accident	No	No	No design requirements for accidents	Yes
Fatigue testing- vibration	No	No	Safety factor (K3) takes fatigue into account.	No
Marking of tanks	Yes	Yes	Data plate present. Review.	Yes
Compatibility with cargo/Solvents	Yes	Yes		Yes
Interfaces/connections/openings/attachments-	Yes	Yes		No
Bonding	Yes	Yes, for steel tanks bonding is equivalent to welding		No
Electrical resistance	Yes	Yes		Yes
Static discharge	Yes	Yes		Yes
Heating and cooling elements	Yes	Yes	Measuring and control provisions needed to ensure that the tank wall doesn't exceed maximum design temperature.	Yes
Quality assurance for fibre orientation	Yes	N/A	Define elements	No
Quality assurance for manufacturing process	Yes	Yes	Define elements	No
Spill of substance onto shell	No	No	Further discussion	Yes
Repair methods	No	Yes	Further discussion	No
Insulation	No	Yes	Further discussion	No
Safety factor	Yes	Yes	Further discussion	Yes
Strength criteria	Yes	Yes	Further discussion	Yes
Elongation at fracture	Yes	Yes	Further discussion	Yes