§ 154.410 Cargo tank sloshing loads.

(a) For the calculation required under §154.406(a)(5) and (b), the determined sloshing loads resulting from the accelerations under §154.409(f) must be specially approved by the Commandant (CG–522).

(b) If the sloshing loads affect the cargo tank scantlings, an analysis of the effects of the sloshing loads in addition to the calculation under paragraph (a) of this section must be specially approved by the Commandant (CG–522).

§ 154.411 Cargo tank thermal loads.

For the calculations required under §154.406(a)(4), the following determined loads must be specially approved by the Commandant (CG–522):

(a) Transient thermal loads for the cooling down periods of cargo tanks for design temperatures lower than −55 °C (−67 °F).

(b) Stationary thermal loads for cargo tanks for design temperatures lower than −55 °C (−67 °F) that cause high thermal stress.
§ 154.425 General.
The design of the hull structure and the design of the membrane tank system, that includes the membrane tank, secondary barrier, including welds, the supporting insulation, and pressure control equipment, must be specially approved by the Commandant (CG–522).

§ 154.426 Design vapor pressure.
The $P_o$ of a membrane tank must not exceed 24.5 kPa gauge (3.55 psig) unless special approval by the Commandant (CG–522) allows a $P_o$ between 24.5 kPa gauge (3.55 psig) and 69 kPa gauge (10 psig).

§ 154.427 Membrane tank system design.
A membrane tank system must be designed for:
(a) Any static and dynamic loads with respect to plastic deformation and fatigue;
(b) Combined strains from static, dynamic, and thermal loads;
(c) Preventing collapse of the membrane from:
(1) Over-pressure in the interbarrier space;
(2) Vacuum in the cargo tank;
(3) Sloshing in a partially filled cargo tank; and
(d) Hull vibrations; and
(e) The deflections of the vessel’s hull.

§ 154.428 Allowable stress.
The membrane tank and the supporting insulation must have allowable stresses that are specially approved by the Commandant (CG–522).

§ 154.429 Calculations.
The tank design load calculations for a membrane tank must include the following:
(a) Plastic deformation and fatigue life resulting from static and dynamic loads in the membrane and the supporting insulation.
(b) The response of the membrane and its supporting insulation to vessel motion and acceleration under the worst weather conditions. Calculations from a similar vessel may be submitted to meet this paragraph.
(c) The combined strains from static, dynamic, and thermal loads.

§ 154.430 Material test.
(a) The membrane and the membrane supporting insulation must be made of materials that withstand the combined strains calculated under § 154.429(c).
(b) Analyzed data of a material test for the membrane and the membrane supporting insulation must be submitted to the Commandant (CG–522).

§ 154.431 Model test.
(a) The primary and secondary barrier of a membrane tank, including the corners and joints, must withstand the combined strains from static, dynamic, and thermal load calculated under § 154.429(c).
(b) Analyzed data of a model test for the primary and secondary barrier of the membrane tank must be submitted to the Commandant (CG–522).

§ 154.432 Expansion and contraction.
The support system of a membrane tank must allow for thermal and physical expansion and contraction of the tank.