

(b) The  $P_o$  of a cargo tank must be equal to or greater than the vapor pressure of the cargo at 45 °C (113 °F) if:

(1) The cargo tank has no temperature control for the cargo; and

(2) The vapor pressure of the cargo results solely from ambient temperature.

(c) The  $P_o$  of a cargo tank may be exceeded under harbor conditions if specially approved by the Commandant (CG-ENG).

[CGD 74-289, 44 FR 26009, May 3, 1979, as amended by CGD 82-063b, 48 FR 4782, Feb. 3, 1983]

**§ 154.406 Design loads for cargo tanks and fixtures: General.**

(a) Calculations must show that a cargo tank and its fixtures are designed for the following loads:

(1) Internal pressure head.

(2) External pressure load.

(3) Dynamic loads resulting from the motion of the vessel.

(4) Transient or stationary thermal loads if the design temperature is colder than -55 °C (-67 °F) or causes thermal stresses in cargo tank supports.

(5) Sloshing loads, if the cargo tank is designed for partial loads.

(6) Loads resulting from vessel's deflection.

(7) Tank weight, cargo weight, and corresponding support reaction.

(8) Insulation weight.

(9) Loads of a pipe tower and any other attachments to the cargo tank.

(10) Vapor pressure loads in harbor conditions allowed under § 154.405.

(11) Gas pressurization if the cargo tank is designed for gas pressurization as a means of cargo transfer.

(b) A cargo tank must be designed for the most unfavorable static heel angle within a 0° to 30° range without exceeding the allowable stress of the material.

(c) A hydrostatic or hydropneumatic test design load must be specially approved by the Commandant (CG-ENG).

[CGD 74-289, 44 FR 26009, May 3, 1979, as amended by CGD 82-063b, 48 FR 4782, Feb. 3, 1983]

**§ 154.407 Cargo tank internal pressure head.**

(a) For the calculation required under § 154.406(a)(1) and (b), the internal pressure head ( $h_{cq}$ ), must be determined from the following formula:

$$h_{cq} = 10 P_o + (h_{gd})_{max}$$

where:

$h_{gd}$  (the value of internal pressure, in meters of fresh water, resulting from the combined effects of gravity and dynamic accelerations of a full tank) =  $a\beta Z\beta Y$ ;

where:

$a\beta$  = dimensionless acceleration relative to the acceleration of gravity resulting from gravitational and dynamic loads in the  $\beta$  direction (see figure 1);

$Z\beta$  = largest liquid height (m) above the point where the pressure is to be determined in the  $\beta$  direction (see figure 2);

$Y$  = maximum specific weight of the cargo (t/m<sup>3</sup>) at the design temperature.