

**§ 154.407**

**46 CFR Ch. I (10-1-06 Edition)**

(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 (G-MSO).

[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:

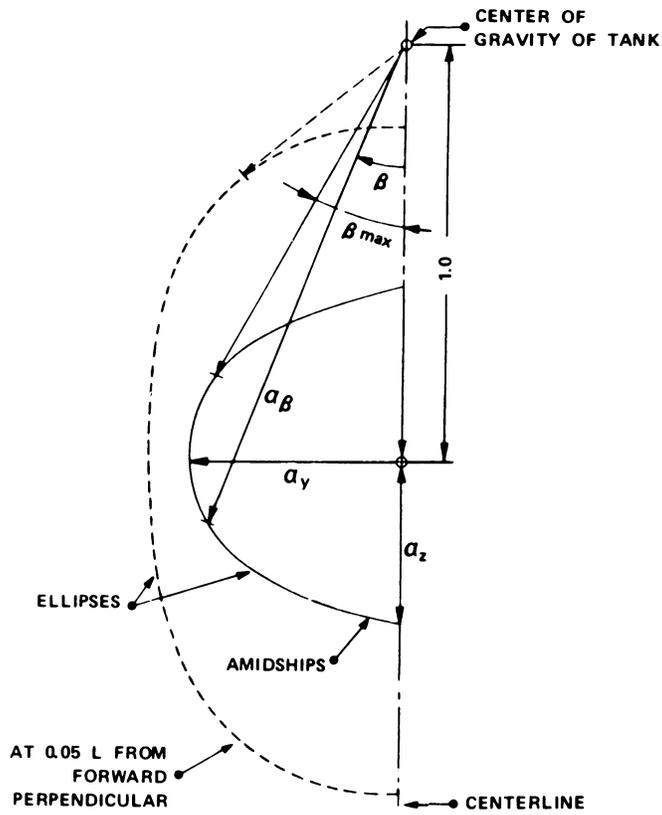
$h_{gd}$  (the value of internal pressure, in meters of fresh water, resulting from the combined effects of gravity and dynamic accelerations of a full tank) =  $a\beta Z\beta Y$ ;

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.

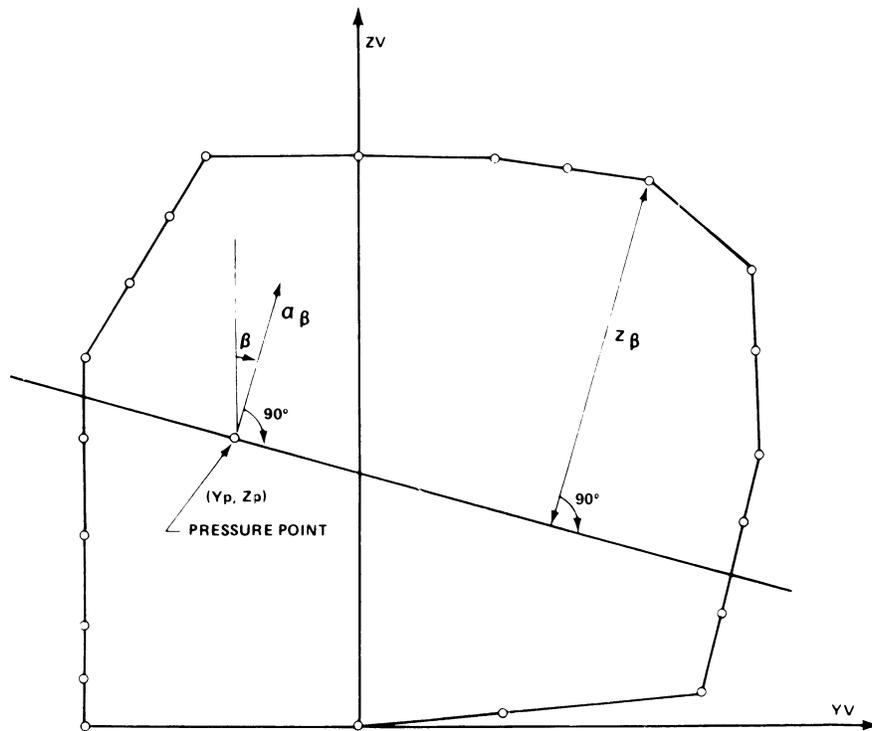


NOTE: RESULTING ACCELERATION (STATIC + DYNAMIC) =  $a_\beta$   
 IN ARBITRARY DIRECTION  $\beta$ .

$a_y$  = TRANSVERSE COMPONENT OF ACCELERATION.

$a_z$  = VERTICAL COMPONENT OF ACCELERATION.

Figure 1. Acceleration Ellipse



NOTE: LARGEST LIQUID HEIGHT ABOVE THE POINT WHERE THE PRESSURE IS DETERMINED =  $Z_{\beta}$

Figure 2. Determination of Internal Pressure Heads

(b) The  $(h_{gd})_{max}$  is determined for the  $\beta$  direction, on the ellipse in Figure 1, which gives the maximum value for  $h_{gd}$ .

(c) When the longitudinal acceleration is considered in addition to the vertical transverse acceleration, an ellipsoid must be used in the calculations instead of the ellipse contained in Figure 1.

**§ 154.408 Cargo tank external pressure load.**

For the calculation required under § 154.406 (a)(2) and (b), the external pressure load must be the difference between the minimum internal pressure (maximum vacuum), and the maximum

external pressure to which any portion of the cargo tank may be simultaneously subjected.

**§ 154.409 Dynamic loads from vessel motion.**

(a) For the calculation required under § 154.406 (a)(3) and (b), the dynamic loads must be determined from the long term distribution of vessel motions, including the effects of surge, sway, heave, roll, pitch, and yaw on irregular seas that the vessel may experience during  $10^8$  wave encounters. The speed used for this calculation may be reduced from the ship service speed if specially approved by the Commandant