

- $\sigma_m \leq f$
- $\sigma_L \leq 1.5 f$
- $\sigma_b \leq 1.5 F$
- $\sigma_L + \sigma_b \leq 1.5 F$
- $\sigma_m + \sigma_b \leq 1.5 F$

where:

- $\sigma_m$ =equivalent primary general membrane stress<sup>4</sup>
- $\sigma_L$ =equivalent primary local membrane stress<sup>4</sup>
- $\sigma_b$ =equivalent primary bending stress<sup>4</sup>
- f=the lesser of ( $\sigma_B/A$ ) or ( $\sigma_V/B$ )
- F=the lesser of ( $\sigma_B/C$ ) or ( $\sigma_V/D$ )
- A, B, C, and D=stress factors in Table 2.

TABLE 2—VALUES FOR STRESS FACTORS

	Nickel steel and carbon manganese steel values	Austenitic steel values	Aluminum alloy values
Stress factors:			
A .....	4.0	4.0	4.0
B .....	2.0	1.6	1.5
C .....	3.0	3.0	3.0
D .....	1.5	1.5	1.5

(b) An independent tank type B designed from plane surfaces must have allowable stresses 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]

**§ 154.448 Calculations.**

The following calculations for an independent tank type B must be specially approved by the Commandant (G-MSO):

- (a) Plastic deformation, fatigue life, buckling, and crack propagation resulting from static and dynamic loads on the tank and its support.
- (b) A three-dimensional analysis of the stress exerted by the hull on the tank, its support, and its keys.
- (c) The response of the tank and its support to the vessel's motion and acceleration in irregular waves or calculations from a similar vessel.
- (d) A tank buckling analysis considering the maximum construction tolerance.
- (e) A finite element analysis using the loads determined under §154.406.

<sup>4</sup>See Appendix A for equivalent stress.

(f) A fracture mechanics analysis using the loads determined under §154.406.

(g) The cumulative effects of the fatigue load from the following formula:

$$\sum \frac{n_i}{N_i} + \frac{10^3}{N_j} \leq C_w$$

where:

- $n_i$ =the number of stress cycles at each stress level during the life of the vessel;
- $N_i$ =the number of cycles to failure for corresponding stress levels from the Wohler (S-N) curve;
- $N_j$ =the number of cycles to failure from the fatigue load by loading and unloading the tank; and
- $C_w$ =0.5 or less. A  $C_w$  of greater than 0.5 but not exceeding 1.0 may be specially approved by the Commandant (G-MTH).

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

**§ 154.449 Model test.**

The following analyzed data of a model test of structural elements for independent tank type B must be submitted to the Commandant (G-MSO) for special approval:

- (a) Stress concentration factors.
- (b) Fatigue life.

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

INDEPENDENT TANK TYPE C AND PROCESS PRESSURE VESSELS

**§ 154.450 General.**

Independent tanks type C and process pressure vessels must be designed to meet the requirements under Part 54 of this chapter, except §54.01-40(b), and:

- (a) The calculation under §54.01-18
- (b)(1) must also include the design loads determined under §154.406;
- (b) The calculated tank plating thickness, including any corrosion allowance, must be the minimum thickness without a negative plate tolerance; and
- (c) The minimum tank plating thickness must not be less than:
  - (1) 5mm ( $\frac{3}{16}$  in.) for carbon-manganese steel and nickel steel;
  - (2) 3mm ( $\frac{1}{8}$  in.) for austenitic steels; or
  - (3) 7mm ( $\frac{9}{32}$  in.) for aluminum alloys.