FEMA Guidelines for calculating the net buoyancy force on a liquid propane tank

- F_b = the net buoyancy force of the tank, in lbs
- V_t = the volume of the tank in gallons (eg 250 gallons)
- 0.134 is a factor to convert gallons to ft^3
- y = the specific weight of flood water surrounding the tank (generally 62.4 lb/ft^3 for fresh water and 64.1 lb/ft^3 for salt water)
- FS = the factor of safety to be applied to the computation, typically 1.3 for tanks
- W_t = the weight of the tank = 670 lbs (empty – worst case scenario)
- V_c = the volume of concrete required, in ft^3
- S_c = the effective weight of concrete, typically 150 lbs/ft^3
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Find:

1. The net buoyancy force of the tank in pounds
2. The volume of concrete required to offset the buoyancy force

Solution for #1: The net buoyancy force of the liquid propane tank can be found as follows:

$F_b = [0.134V_t yFS] - W_t$

F_b = [0.134(250 gal)(62.4lbs/ft^3)(1.3) – 670lbs

F_b = [0.134(250 x 62.4 x 1.3) – 670

F_b = 2,048

Net buoyancy force of the tank = 2,048lbs

Solution for #2: The volume of concrete required to offset the buoyant force can be determined as follows:

$$V_c = \frac{F_b}{S_c - y}$$

$$V_c = \frac{2{,}048\text{lbs}}{(150\text{lbs/ft}^3 - 62.4\text{lbs/ft}^3)} \qquad V_c = \frac{2{,}048}{(150 - 62.4)}$$

V_c = 23.4

Thus, for a 250 gallon tank with a net bouyancy force of 2,048lbs, a slab of concrete with a volume 23.4ft^3 is usually strapped to the tank to resist the buoyant load.