Calculation task № 1.

In a vertical cylindrical tank with a diameter of 4.2 m 150 tons of oil are stored. Density of oil at 0 °C is 870 kg/m^3. Determine the level of fluctuations in the tank while changing oil temperature from 0 to 24 °C. The tank expansion is not taken into account. The coefficient of temperature expansion of oil is taken as 0.00072 ° C $^{-1}$.

d = 4.2 m

M = 150 tons

t_1 = 0 °C

t_2 = 24 °C

β_t = 0.00072 $^oC^{-1}$

$\rho = 870 \frac{kg}{m^3}$

Determine : Δh - ?

$$\Delta h = \frac{\Delta V}{S}$$

$$S = \frac{\pi d^2}{4} = \frac{3.14}{4} \cdot 4.2^2 = 13.85 \, m^2$$

$$V = \frac{M}{\rho}$$

$$V = \frac{150 \cdot 10^3}{870} =$$

$$= 172.4 \, m^3.$$

$$\Delta V = \beta_t \cdot V \cdot \Delta t.$$

$$\Delta t = t_2 - t_1 = 24 - 0 = 24 \, ^oC$$

$$\Delta V = 0.00072 \cdot 172.4 \cdot 24 = 2.979 \, m^3$$

$$S_o \; \Delta h = \frac{2.979}{13.85} = 0.215 \, m.$$

Answer : $\Delta h = 0.215 \, m$