

CENTRIFUGE

1. TECHNICAL DESCRIPTION, BACKGROUND

In a technical process, we need to investigate the safety of spinning a centrifuge at different angular velocities. It was therefore decided that it should be determined, that for the specific technical process, what the angular velocity is with which the liquid in the centrifuge reaches the lid. If this is less than the angular velocity at which the centrifuge is run ($\omega = 20 \left[\frac{1}{s} \right]$), then it should be determined how much force is acting on the lid of the container, and what is the pressure difference across the vessel wall at point A ($p_A - p_0$).

2. ENGINEERING CALCULATIONS

A) Calculate the angular velocity with which the liquid reaches the lid of the vessel.

B) Determine the amount of force acting on the lid of the container if $\omega = 20 \left[\frac{1}{s} \right]$.

C) Determine the pressure difference across the wall of the vessel at point A for $\omega = 20 \left[\frac{1}{s} \right]$.

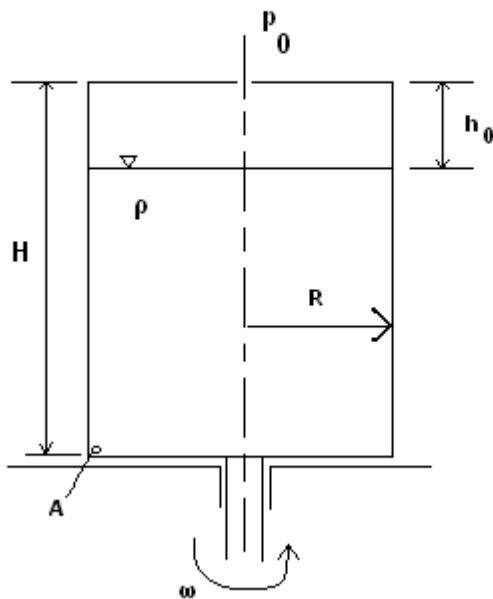


Figure 1.

Data:

Height of tank $H = 300[mm]$

Height of air column above the surface of the liquid $h_0 = 20[mm]$

Radius $R = 100[mm]$

Density of the liquid $\rho = 1000 \left[\frac{kg}{m^3} \right]$