Maritime University of Szczecin

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Physics Laboratory

Laboratory Manual

Determination of cp/cv ratio

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Equipment:

1. Tank with tested gas.
2. Open liquid manometer.
3. Compressor.
4. Wall barometer.

Exercise:

1. From the wall barometer read the air pressure p_0 in the room.
2. Use a compressor to obtain an excess pressure in the tank corresponding to the 0.8 m difference of liquid levels in both manometer arms.
3. Wait for 3 minutes until the temperature of the gas in the tank reaches the ambient temperature.
4. From the left scale of the manometer read (with 1 mm accuracy) liquid levels h_{1MAX} and h_{1MIN}. Calculate their difference $h_1 = h_{1MAX} - h_{1MIN}$.
5. Open and close the tank valve for swiftly, so that due to the adiabatic expansion of the examined gas, the pressure equalizes with external pressure.
6. Wait until the difference in the level of the liquid in both manometer arms stops to increase.
7. From the left scale of the manometer read (with 1 mm accuracy) liquid levels h_{2MAX} and h_{2MIN}. Calculate their difference $h_2 = h_{2MAX} - h_{2MIN}$.
8. Four times repeat the steps 2-7.
9. Using equations: $p_1 = p_0 + \rho g h_1$ and $p_2 = p_0 + \rho g h_2$, where ρ is the liquid density and g is the gravitational acceleration, calculate pressures p_1 and p_2 of the air inside the tank, which correspond to liquid level differences h_1 and h_2.
10. For each set of measurements calculate the ratio:

$$\kappa = \frac{c_p}{c_v} = \frac{\Delta p_{ad}}{\Delta p_{izot}} = \frac{p_1 - p_0}{p_1 - p_2}$$

11. Calculate mean value of $\bar{\kappa}$ and its standard deviation. Compare the experimental value with the table value for air.

Table:

p_0=………hPa

h_{1MAX} [m]	h_{1MIN} [m]	h_1 [m]	p_1 [hPa]	h_{2MAX} [m]	h_{2MIN} [m]	h_2 [m]	p_2 [hPa]	κ

$\bar{\kappa}$ =…..±…….

κ_{tabl} =……