A shock tube initially contains a stationary piston and stationary air at $T_1 = 300\,\mathrm{K}$, $p_1 = 10^5\,\mathrm{Pa}$. The constant air properties are $c_p = 1004\,\mathrm{J/kg\,K}$, $R = 286.9\,\mathrm{J/kg\,K}$, $\gamma = 1.4$. A piston then impulsively starts moving at $5\,\mathrm{m/s}$ to the right. sending a shock down the tube traveling at $350\,\mathrm{m/s}$ to the right. These speeds are measured relative to the tube. The situation is sketched in the F13 notes, but the piston motion is the other way.

a) Sketch the velocity distributions $V(x)$ in the frame of the tube, and in the frame of the shock. V and x defined positive to the right as usual.

b) Determine the total enthalpies h_{o_1}, h_{o_2} on both sides of the shock, in the shock frame.

c) Determine the static enthalpy h_2 and static temperature T_2 between the shock and the piston.

d) Explain why this can be considered a weak shock.

e) For a weak shock, the isentropic relations are very nearly correct. Estimate the pressure difference $p_2 - p_1$ across the shock.