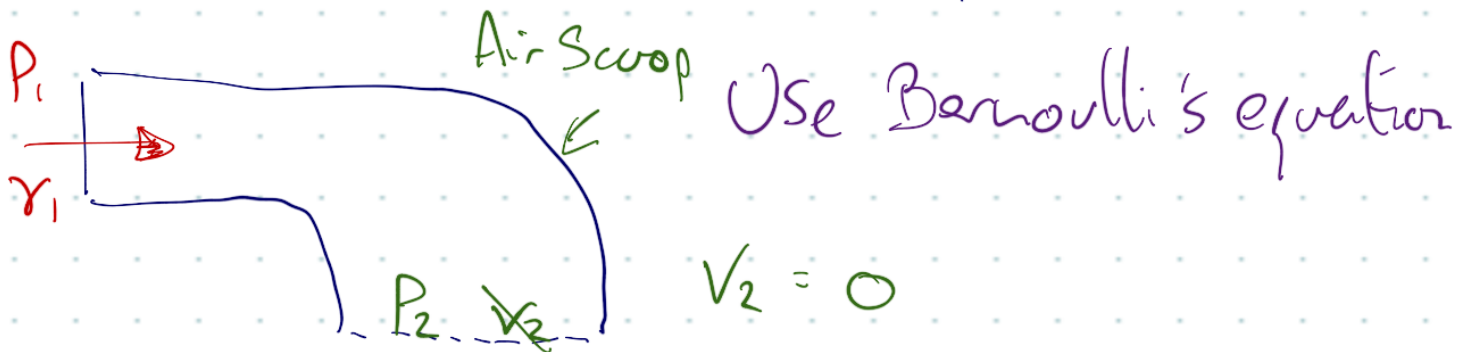


Final few things

You are required to calculate the effect of RAM - Air. Explaining your reasoning. Calculate the effect at 30 and 90 ms^{-1} compared to Dynamometer power in still air.



$$P_1 + \frac{1}{2} \rho v_1^2 = P_2 + \cancel{\frac{1}{2} \rho v_2^2}$$

So

$$P_2 = P_1 + \frac{1}{2} \rho v_1^2$$

So at a speed of 30 m/s

$$P_2 = 10^5 + \left(\frac{1}{2} \times 1.2 \times 30^2 \right)$$

so we get $P_2 = \underline{1.01 \text{ Bar}}$

This means a 1% increase

So looking again for 90 ms^{-1}

$$P_2 = 10^5 + \frac{1}{2} \times 1.2 \times 90^2$$

$$P_2 = 1.05 \text{ Bar}$$

This gives a 5% increase

Calculate the potential performance benefit
if the inlet could be moved to pull
cooler air (from 50°C to 20°C)

why?

So from $PV = nRT$

if we say $\rho = \frac{\text{mass}}{\text{Volume}}$

$$P = \rho RT$$

So

$$\rho = \frac{P}{RT} \rightarrow \rho \propto \frac{1}{T}$$

So in changing from 50°C to 20°C
Changes absolute temperature from 323K to 293K

$\therefore$ we can say

$$\frac{\text{Density at } 20^\circ\text{C}}{\text{Density at } 50^\circ\text{C}} = \frac{323}{293} = 1.1$$

Therefore we see a 10% increase
(Density Ratio)

Calculate the internal diameter for exhaust primary pipes for a 7.5L V8

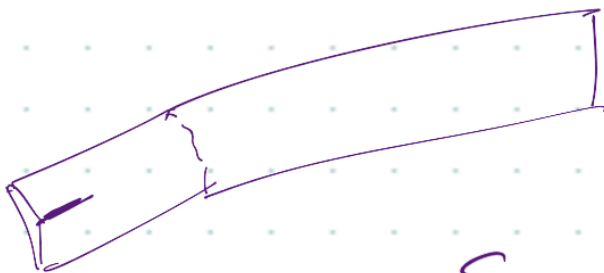
$$\text{Cylinder Capacity} = \frac{7500}{8} = \underline{937.5 \text{ cc}}$$

Air comes in at 20°C
if exhaust mean temp in primary = 600°C

Using Density Ratio

$$\frac{600 + 273}{20 + 273} = \underline{2.98}$$

for the primary pipe



if the length is 162.8 cm

The volume is the part + primary

$$\text{So} \sim 162.8 \times \frac{\pi D^2}{4} \text{ cc}$$

Length $\times$ Area

So $162.8 \times \frac{\pi D^2}{4} = 937.5 \times 2.98$

$$D^2 = \frac{4 \times 2.98 \times 937.5}{\pi \times 162.8}$$

$$D^2 = 68.64$$

$$D = \underline{8.28 \text{ cm}}$$

$$4.67$$

Other things :

$$\text{Fuel equivalence Ratio} = \frac{\text{Stoichiometric AFR}}{\text{Actual AFR}}$$

$$\text{Lambda} = (\text{FER})^{-1}$$

Other things to remember :

$$\text{Power} = 2\pi \times \text{Torque} \times \frac{\text{RPM}}{60}$$

Brake specific fuel consumption

$$\text{BSFC} = \frac{\text{Fuel mass used}}{\text{Power}}$$

Brake mean effective Pressure

$$\text{BMEP} = \frac{\text{Torque} \times 4\pi}{\text{Displacement}}$$

$$\text{Overall engine efficiency} = \frac{\text{Mech energy}}{\text{Fuel energy}}$$
