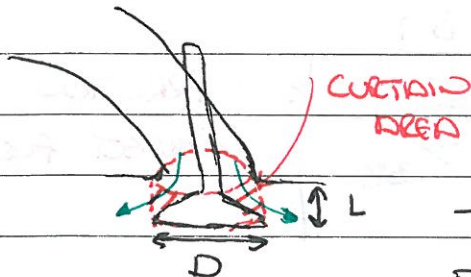


COMPETITION ENGINE PERFORMANCE

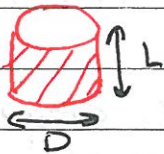
12/11/15

AIR FLOW -



$$\text{SIDEWAYS AREA} = \pi \cdot D \cdot L$$

THE AIR MUST CHANGE ITS FLOW DIRECTION TO GO PAST THE VALVE. THE AIR LEAVES THE INLET PORT SIDEWAYS THROUGH A CYLINDRICAL CURTAIN OF DIAMETER D + LENGTH L .



THE CURTAIN INCREASES WITH VALVE LIFT. AT SMALL VALVE LIFTS THE CURTAIN AREA IS THE RESTRICTION BECAUSE CURTAIN AREA $<$ PORT AREA. HOWEVER AT HIGH LIFTS THE CURTAIN AREA $>$ PORT AREA AND THEREFORE THE PORT AREA BECOMES THE RESTRICTION.

$$\text{PORT AREA} \approx \frac{\pi \cdot D^2}{4}$$

CURTAIN AREA

PORT AREA

SO WHEN $\pi \cdot D \cdot L > \frac{\pi \cdot D^2}{4}$ THE PORT IS RESTRICTING THE FLOW

$\therefore$ WHEN $L > \frac{D}{4}$ THE FLOW BEGINS TO SATURATE BECAUSE THE RESTRICTION IS IN THE PORT. THEREFORE, FOR AN EXAMPLE, 30mm OF VALVE FLOW SATURATES @ AROUND 7mm VALVE LIFT. NO NEED TO OPEN VALVES FURTHER AND RISK CONTACT WITH THE PISTON.

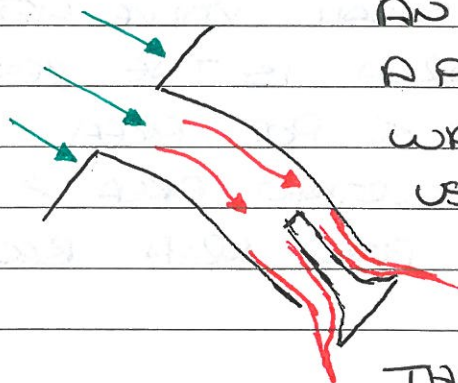
AT 25" H₂O PERFECT FLOW = 138 CFM/IN² VALVE

IN EXCEL

A	B	C	D
LIFT	CFM	CFM/IN ²	C _F
			$= \frac{C}{138}$

← FRACTION OF PERFECT FLOW

WHEN AIR FLOWS THROUGH A TUBE OR A PORT THERE IS A BOUNDARY LAYER, THIS IS WHERE THE AIR STICKS TO THE PORT SURFACE. THIS EFFECTIVELY MAKES THE AREA OF THE PORT SMALLER.



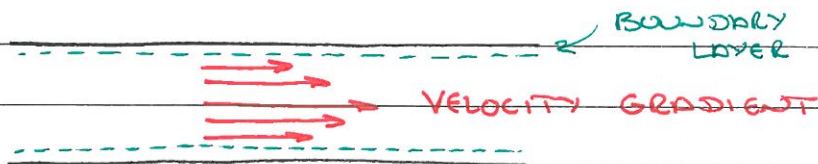
AN EDGE AT THE OPENING OF A PORT CREATES TURBULENCE. A WAY TO MINIMISE THIS IS TO USE A TRUMPET WITH A ROUNDED OPENING.

THE EFFECTIVE AREA AT LOW LIFT IS MUCH SMALLER.

$$\text{EFFECTIVE VALVE AREA AT FULL LIFT} = \frac{\pi \cdot D^2}{4} \times C_f \times \text{W. OF VALVES}$$

THROTTLE BODIES CAN BE A RESTRICTION IF THEIR DIAMETER IS SMALLER THAN THE EFFECTIVE VALVE AREA. THEREFORE ANY THROTTLE BODY MUST HAVE A GREATER AREA THAN THE EFFECTIVE VALVE AREA TO NOT BE A RESTRICTION.

$$\text{EFFECTIVE AREA OF THROTTLE} = C_f \times \frac{\pi \cdot D^2}{4}$$



TO CALCULATE MIN DIA FOR THROTTLE BODIES -

$$C_{f_1} \times \frac{\pi \cdot D_1^2}{4} \geq C_{f_2} \times \text{NO. OF VALVES} \times \frac{\pi \cdot D_2^2}{4}$$

WHERE -

C_{f_1} = FLOW COEFFICIENT OF THROTTLE BODY = 0.8

C_{f_2} = " " OF VALVES = 0.6

D_1 = THROTTLE BODY DIAMETER = ?

D_2 = VALVE DIAMETER

SO IF -

$$C_{f_1} \times \frac{\pi \cdot D_1^2}{4} = C_{f_2} \times \text{NO. OF VALVES} \times \frac{\pi \cdot D_2^2}{4}$$

$$C_{f_1} \times D_1^2 = C_{f_2} \times \text{NO OF VALVES} \times D_2^2$$

$$\therefore D_1^2 = \frac{C_{f_2} \times \text{NO. OF VALVES} \times D_2^2}{C_{f_1}}$$

$$\therefore D_1 = \sqrt{\frac{C_{f_2} \times \text{NO. OF VALVES} \times D_2^2}{C_{f_1}}}$$

$$D_1 = \sqrt{\frac{0.6 \times 2 \times 33^2}{0.8}} = 40.42 \text{ mm}$$

