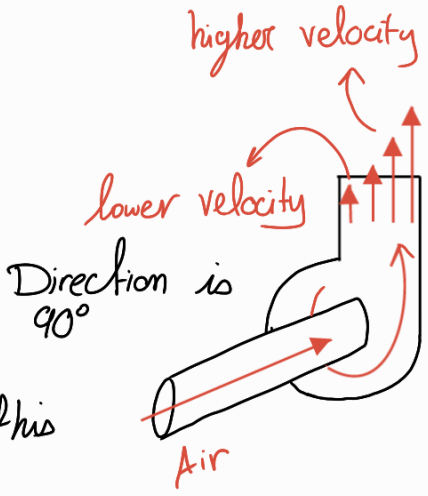
Exp 2 : Fan test

Power transmission

Electrical → Mechanical → Head increment
(Belt: Electrical → Mechanical; impellers: Mechanical → Head increment)

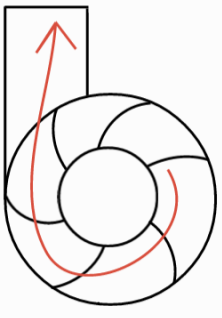


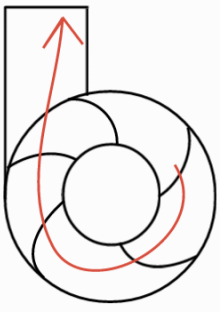
How does fans work ?

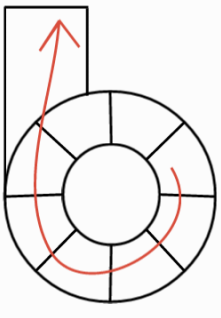
Impellers are rotated by an electrical motor, this generates centrifugal force
Air enters the fan and it is contained within the blade passage it is then pushed outwards due to F_{cent}. Lastly the air is directed to the exit. This leaves the middle region of the impellers with low pressure which causes air to be sucked

Types of impellers

1. Forward
Curves are in the same direction as the rotation
2. Backward
Curves are in the opposite direction of the rotation
3. Radial







Note
Constant volume device meaning that velocity is constant- but mass flow rate is not

Calculations

Total fan pressure

$$P_{fan} = (P_{fan})_{outlet} - (P_{fan})_{inlet}$$

$$= (P_{static} + P_{Dynamics}) - (P_{static} + P_{dynamic})$$

Area is constant so constant

$$= h_3 - h_2$$

h_2 negative since suction

$$Q = 1.006 \sqrt{\frac{\Delta P T}{P_a}}$$

$\Delta P = h_0 - h_1$ → gage pressure at the throat of the nozzle

h_0 ← atmospheric gage pressure

$$TAP_{fan} = P_{fan} Q$$

$$SP = \frac{2\pi r F N}{60}$$

$$\eta_{fan} = \frac{TAP_{Fan}}{IP}$$

Results

Backward fans are more efficient but more expensive due to construction cost