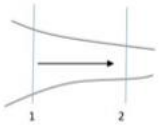
Question: 6. Air flows in a steady flow manner through a converging tub...

6. Air flows in a steady flow manner through a converging tube. At the inlet the pressure is 690kPaa and the density is 0.838 kg/m^3. If 125 m^3/min of air enters at the rate of 94 m/min and the exit section has a diameter of 350 mm, determine a) the mass flow rate (kg/min); b) the diameter of the entrance section (mm); c) the exit velocity(m/min). Assume that the density is constant.



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Expert Answer

Anonymous answered this
330 answers

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$\Rightarrow$ Discharge (Q) = (Area) x (velocity)

$$Q = A v$$

Discharge = Volumetric flow rate

$\Rightarrow$ mass flow rate = (density) x (volumetric flowrate)

$$\dot{m} = \rho Q$$

Problem:-

the density of air (ρ) = 0.838 kg/m^3

volumetric flow rate (Q) = 125 m^3/min

(a) So, mass flow rate ($\dot{m}$) = ρQ

$= 0.838 \times 125$

($\dot{m}$) = 104.75 kg/min

The mass flow rate ($\dot{m}$) 04.75 kg/min

(b) we know discharge (Q) = (Area) x (velocity)

Given, velocity of air at entrance (v) = 94

v = 94 m/min

The cross section of entrance is circular.

Let "d" is diameter of the entrance section.

So, Area of the entrance section is given by $A = \frac{\pi d^2}{4}$

We know, $Q = A \times V$

$$125 = \frac{\pi d^2}{4} \times 94$$

$$\frac{125 \times 4}{94 \times \pi} = d^2$$

$d = 1301.2\ mm$

Diameter of the entrance section (d) = 1301.2 mm

(c) Given, diameter of exit cross section is,

$d = 350\ mm$

$d = 0.35\ m$

Discharge (Q) = (Area) x (velocity)

$$125 = \left(\frac{\pi \times d^2}{4}\right) \times V$$

$$\frac{125 \times 4}{\pi \times (0.35)^2} = V$$

$$V = 1559.06\ m/min$$

So, exit velocity (V) = 1559.06 m/min

(a) Mass flow rate (kg/min) = 104.75

(b) Diameter of the entrance section (mm) = 1301.2

(c) exit velocity (m/min) = 1559.06

If you have any doubt leave comment.

If you like my explanation please give rating.Thank you.

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Q: undefined

A: See answer

Q: Consider a 40-L evacuated rigid bottle that is surrounded by atmospheric air at 101 kPa and 25°C. The bottle is now open and air flows into the bottle. At the final state, air in the bottle is in equilibrium with the atmospheric air. During this process, heat is transferred from the bottle to surrounding air. Please answer the following. Air a. Create a schematic representation of...

A: See answer