

46.66 Water flows at 4fps through a 200ft pipe with inside diameter of 1.45in. The Moody friction factor is 0.028 . What is the pressure drop?

- A. 1.2psi
- B. 5.0psi
- C. 11.5psi
- D. 59.8psi

Use the **Darcy** equation for **Head Loss Due to Flow** to calculate the head loss based on the given information.

$$h_f = \frac{fLv^2}{2Dg} = \frac{(0.028)(200\text{ft})\left(4\frac{\text{ft}}{\text{s}}\right)^2}{2\left(\frac{1.45}{12}\text{ft}\right)\left(32.2\frac{\text{ft}}{\text{s}^2}\right)} = 11.51\text{ft}$$

Convert the head loss in ft to a pressure drop in psi . These terms are often used interchangeably. Converting between pressure units and length units is trivial provided the fluid is water.

$$\Delta p = 11.51\text{ft} \left(\frac{1\text{psi}}{2.31\text{ft}} \right) = 4.98\text{psi}$$

Answer B

46.67 An energy recovery device is used to pre-cool 5000cfm of outside air at $95^\circ\text{F db} / 75^\circ\text{F wb}$. An equivalent volume of return air enters the device at 76°F and 50% relative humidity. After passing through the device the exhaust air is discharged outside at $84^\circ\text{F db} / 70^\circ\text{F wb}$. What is the reduction in cooling demand provided by the energy recovery wheel?

- A. 4tons
- B. 8tons
- C. 10tons
- D. 18tons

Sketch the energy recovery device, considering the outside air as State 1, the supply air as State 2, the exhaust air as State 3, and the return air as State 4. Since the problem statement makes no reference to any losses or effectiveness, assume 100% of the heat absorbed by the exhaust stream from $4 \rightarrow 3$ is removed from the supply stream $1 \rightarrow 2$. For an energy recovery device, both sensible and latent heat are transferred, so it is appropriate to quantify the total heat gained by the exhaust path using the change in enthalpy which accounts for both sensible and latent energy. State 3 and State 4 are both fully defined, so use the **Psychrometric Chart** to obtain the enthalpies, h_3 and h_4 .