What is Pipe Flow Friction Loss?

Worksheet

Pipe friction loss (head loss) is h_f = f(L/D)(v/2g), where f is friction factor, L is pipe length, D is diameter, and v is flow velocity.

h_f = f(L/D)(v/2g)

Questions

1. Darcy-Weisbach shows head loss is
A) linear in velocity
B) proportional to v
C) independent of velocity
D) constant

2. Longer pipes cause
A) less loss
B) more loss
C) same loss
D) unpredictable

3. Larger diameter reduces loss because
A) less wall area
B) smaller velocity
C) lower friction factor
D) all above

4. Friction factor highest for
A) smooth pipes, high Re
B) smooth pipes, low Re
C) rough pipes, high Re
D) all same

5. Water through 100 m steel pipe (D = 0.1 m, v = 2 m/s, f = 0.025). Head loss?

6. 50 m pipeline (D = 0.05 m, v = 1 m/s, f = 0.03). Head loss?

7. Reducing velocity by half (2 m/s 1 m/s), head loss becomes?

8. Define: Darcy-Weisbach head loss equation?

9. Define: Why does head loss increase with velocity?

10. Define: Friction factor f depends on

Answer Key

1. B) proportional to v - h_f v - doubling velocity increases loss fourfold.
2. B) more loss - h_f L - longer length increases loss linearly.
3. C) lower friction factor - Large D reduces velocity, lowering loss (h_f 1/D and v).
4. C) rough pipes, high Re - Rough pipes at high Reynolds number show higher friction factor.
5. $h_f = f(L/D)(v/2g)$ $h_f = 0.025$ (100/0.1) (4/19.62) $h_f = 0.025$ 1000 0.204 = 5.1 m
6. $h_f = 0.03$ (50/0.05) (1/19.62) $h_f = 0.03$ 1000 0.051 = 1.53 m
7. h_f v, loss reduces by 1/(2) = 1/4 New h_f = 5.1/4 = 1.28 m
8. $h_f = f(L/D)(v/2g)$ - loss depends on friction factor, length, diameter, velocity.
9. Head loss v - doubling velocity increases loss fourfold.
10. Reynolds number and pipe roughness (from Moody diagram).