8.24

8.24 A fluid flows through a horizontal 0.1-in.-diameter pipe. When the Reynolds number is 1500, the head loss over a 20-ft length of the pipe is 6.4 ft. Determine the fluid velocity.

$h_L = f \frac{\ell}{D} \frac{V^2}{2g}$, where since $Re = 1500 < 2100$ the flow is laminar.

Thus, $f = 64/Re = 64/1500 = 0.0427$ so that

$$6.4\,\text{ft} = 0.0427 \frac{20\,\text{ft}}{(0.1/12\,\text{ft})} \frac{V^2}{2(32.2\,\text{ft/s}^2)}$$

or

$$V = \underline{\underline{2.01\,\frac{\text{ft}}{\text{s}}}}$$