

## Problem 1.38

[Difficulty: 1]

**1.38** A parameter that is often used in describing pump performance is the specific speed,  $N_{\text{scu}}$ , given by

$$N_{\text{scu}} = \frac{N(\text{rpm})[Q(\text{gpm})]^{1/2}}{[H(\text{ft})]^{3/4}}$$

What are the units of specific speed? A particular pump has a specific speed of 2000. What will be the specific speed in SI units (angular velocity in rad/s)?

**Given:** Specific speed in customary units

**Find:** Units; Specific speed in SI units

**Solution:**

The units are  $\frac{\text{rpm} \cdot \text{gpm}^{\frac{1}{2}}}{\text{ft}^{\frac{3}{4}}}$  or  $\frac{\text{ft}^{\frac{3}{4}}}{\text{s}^{\frac{2}{2}}}$

Using data from tables (e.g. Table G.2)

$$N_{\text{Scu}} = 2000 \frac{\text{rpm} \cdot \text{gpm}^{\frac{1}{2}}}{\text{ft}^{\frac{3}{4}}}$$

$$N_{\text{Scu}} = 2000 \times \frac{\text{rpm} \cdot \text{gpm}^{\frac{1}{2}}}{\text{ft}^{\frac{3}{4}}} \times \frac{2 \cdot \pi \cdot \text{rad}}{1 \cdot \text{rev}} \times \frac{1 \cdot \text{min}}{60 \cdot \text{s}} \times \left( \frac{4 \times 0.000946 \cdot \text{m}^3}{1 \cdot \text{gal}} \cdot \frac{1 \cdot \text{min}}{60 \cdot \text{s}} \right)^{\frac{1}{2}} \times \left( \frac{\frac{1}{12} \cdot \text{ft}}{0.0254 \cdot \text{m}} \right)^{\frac{3}{4}}$$

$$N_{\text{Scu}} = 4.06 \cdot \frac{\frac{\text{rad}}{\text{s}} \cdot \left( \frac{\text{m}^3}{\text{s}} \right)^{\frac{1}{2}}}{\text{m}^{\frac{3}{4}}}$$