1.21 The pressure of the gas contained in the piston-cylinder assembly of Fig. 1.1 varies with its volume according to $p = A + (B/V)$, where A, B are constants. If pressure is in lbf/ft^2 and volume is in ft^3, what are the units of A and B?

KNOWN: Relationship between pressure and volume.

FIND: Determine units of A and B.

SCHEMATIC AND GIVEN DATA:

p $[lbf/ft^2]$
V $[ft^3]$
$p = A + (B/V)$, where A and B are constants

ENGINEERING MODEL:
1. The gas is a closed system.

ANALYSIS:

$$p = A + \frac{B}{V}$$

$$\left[\frac{lbf}{ft^2}\right] \quad \left[ft^3\right]$$

By inspection of this equation, **A has units of lbf/ft^2**.

Rearranging,

$$B = [p - A]\ V$$

$$\left[\frac{lbf}{ft^2}\right] \left[ft^3\right]$$

$\Rightarrow$ **B has units of ft·lbf.**