3.3-2. $U = PV$, $P = BT^2$

U given so we are in entropy representation, want to express S in U, V.

In entropy rep. $\quad \frac{1}{T} = \frac{dS}{dU}, \qquad \frac{\partial P}{T} = \frac{dS}{dV}$

$\Rightarrow \quad \frac{U}{V} = BT^2, \qquad \frac{U}{VB} = T^2, \qquad T = \sqrt{\frac{U}{VB}}$

$P = \frac{U}{V},$

$\Rightarrow \quad \frac{dS}{dU} = \sqrt{\frac{V}{U}}\,\sqrt{B} \qquad , \qquad \frac{dS}{dV} = \frac{U}{V}\sqrt{\frac{VB}{U}}$

$\qquad\qquad = V^{1/2}\,U^{-1/2}\,B^{1/2} \qquad\qquad\qquad = \frac{\sqrt{U}}{\sqrt{V}}\,\sqrt{B}.$

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad = U^{1/2}\,V^{-1/2}\,B^{1/2}.$

$\Rightarrow \quad \boxed{S = V^{1/2}\,U^{1/2}\,B^{1/2}.}$