Derive an expression for the Joule-Thomson coefficient of a gas if the state equation of the gas is $(P + a)(v - b) = RT$.

General expression Joule Thomson coefficient: $\mu_{JT} = \frac{v(T\beta - 1)}{c_P}$

$(P + a)(v - b) = RT \rightarrow v = \frac{RT}{P+a} + b \rightarrow \frac{R}{P+a} = \frac{v-b}{T}$

$\beta = \frac{1}{v}\left(\frac{\partial v}{\partial T}\right)_P = \frac{1}{v}\left(\frac{R}{P+a}\right) = \frac{1}{v}\left(\frac{v-b}{T}\right)$

$\mu_{JT} = \frac{v(T\beta - 1)}{c_P} = \frac{v\left(T\frac{1}{v}\left(\frac{v-b}{T}\right) - 1\right)}{c_P} = \frac{(v-b-v)}{c_P} = \frac{b}{c_P}$