Page 45, equation (2.37)

From the definition of production of entropy, (2.27), we have:

$$\hat{\Sigma}(V, \lambda\dot{V}, T) = -(1/T)\left(\frac{\partial \hat{F}}{\partial V}(V,T) + \hat{P}(V,\lambda\dot{V},T)\right)\lambda\dot{V}. \tag{1}$$

From (1) we can calculate derivatives with respect to parameter λ.

$$\begin{aligned}\frac{\mathrm{d}\hat{\Sigma}}{\mathrm{d}\lambda}(V,\lambda\dot{V},T) = &-(1/T)\left(\frac{\partial \hat{F}}{\partial V}(V,T) + \hat{P}(V,\lambda\dot{V},T)\right)\dot{V} - \\ &\lambda(1/T)\frac{\mathrm{d}}{\mathrm{d}\lambda}\left(\frac{\partial \hat{F}}{\partial V}(V,T) + \hat{P}(V,\lambda\dot{V},T)\right)\dot{V}\end{aligned}$$

and

$$\begin{aligned}&\frac{\mathrm{d}^2\hat{\Sigma}}{\mathrm{d}\lambda^2}(V,\lambda\dot{V},T) = \\ &-(1/T)\frac{\mathrm{d}\hat{P}(V,\lambda\dot{V},T)}{\mathrm{d}\lambda}\dot{V} - (1/T)\frac{\mathrm{d}}{\mathrm{d}\lambda}\left(\frac{\partial \hat{F}}{\partial V}(V,T) + \hat{P}(V,\lambda\dot{V},T)\right)\dot{V} - \\ &\lambda(1/T)\frac{\mathrm{d}^2}{\mathrm{d}\lambda^2}\left(\frac{\partial \hat{F}}{\partial V}(V,T) + \hat{P}(V,\lambda\dot{V},T)\right)\dot{V} = -(1/T)\frac{\mathrm{d}\hat{P}(V,\lambda\dot{V},T)}{\mathrm{d}\lambda}\dot{V} - \\ &(1/T)\frac{\mathrm{d}\hat{P}(V,\lambda\dot{V},T)}{\mathrm{d}\lambda}\dot{V} - \lambda(1/T)\frac{\mathrm{d}^2}{\mathrm{d}\lambda^2}\left(\frac{\partial \hat{F}}{\partial V}(V,T) + \hat{P}(V,\lambda\dot{V},T)\right)\dot{V} \equiv \\ &-(2/T)\dot{V}\frac{\mathrm{d}\hat{P}(V,\lambda\dot{V},T)}{\mathrm{d}\lambda} - \lambda(1/T)\frac{\mathrm{d}^2}{\mathrm{d}\lambda^2}\left(\frac{\partial \hat{F}}{\partial V}(V,T) + \hat{P}(V,\lambda\dot{V},T)\right)\dot{V} = \\ &-(2/T)\dot{V}\frac{\partial\hat{P}(V,\lambda\dot{V},T)}{\partial\dot{V}}\frac{\mathrm{d}(\lambda\dot{V})}{\mathrm{d}\lambda} - \lambda(1/T)\frac{\mathrm{d}^2}{\mathrm{d}\lambda^2}\left(\frac{\partial \hat{F}}{\partial V}(V,T) + \hat{P}(V,\lambda\dot{V},T)\right)\dot{V} = \\ &-(2/T)\dot{V}^2\frac{\partial\hat{P}(V,\lambda\dot{V},T)}{\partial\dot{V}} - \lambda(1/T)\frac{\mathrm{d}^2}{\mathrm{d}\lambda^2}\left(\frac{\partial \hat{F}}{\partial V}(V,T) + \hat{P}(V,\lambda\dot{V},T)\right)\dot{V}.\end{aligned}$$

Then, using (2.34),

$$
\begin{aligned}
&\frac{\mathrm{d}^2\hat{\Sigma}}{\mathrm{d}\lambda^2}(V,\lambda\dot{V},T)\mid_{\lambda=0} = \\
&-(2/T)\dot{V}^2\frac{\partial\hat{P}(V,0,T)}{\partial\dot{V}} = -(2/T)\dot{V}^2\frac{\partial}{\partial\dot{V}}\left(\hat{P}_N(V,0,T)+\hat{P}^o(V,T)\right) = \\
&-(2/T)\dot{V}^2\frac{\partial\hat{P}_N(V,0,T)}{\partial\dot{V}}.
\end{aligned}
\tag{2}
$$

From (2) and (2.30) non-equality (2.37) follows immediately.