From the expressions for the grand potential and the density of energy levels of an ideal Bose-Einstein gas in $D$ dimensions and confined to a box of volume $V = L^D$ with rigid walls,

$$\Omega(T, V, \mu) = k_B T \sum_k \ln(1 - z e^{-\beta \epsilon_k})$$

$$D(\epsilon) = \frac{V}{\Gamma(D/2)} \left( \frac{m}{2 \pi \hbar^2} \right)^{D/2} \epsilon^{D/2 - 1},$$

derive the fundamental thermodynamic relations at fugacity $z < 1$ in terms of the Bose-Einstein functions $g_n(z)$ and the thermal wavelength $\lambda_T = \sqrt{\hbar^2 / 2 \pi m k_B T}$ as follows:

$$\frac{pV}{k_B T} = \frac{V \lambda_T^{D/2} g_{D/2+1}(z)}{\lambda_T^{D/2}}$$

$$N = \frac{V \lambda_T^{D/2} g_{D/2}(z)}{\lambda_T^{D/2}}$$

$$U = \frac{D}{2} k_B T \frac{V \lambda_T^{D/2} g_{D/2+1}(z)}{\lambda_T^{D/2}}.$$