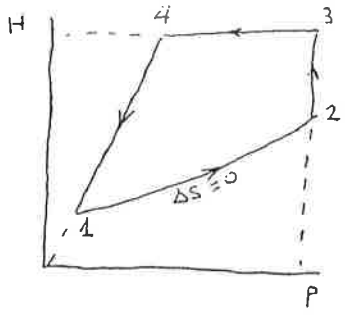

Evol 1,2 - Adiabática

$$Q_{12} = 0 \qquad \Delta S_{12} = 0$$

Evol 2-3 - P cte

$$Q_{23} = \Delta H_{23} = \frac{\gamma}{\gamma-1} nR(T_3 - T_2) > 0 \; ; \quad \Delta S_{23} = \frac{\gamma nR}{\gamma-1} \ln \frac{T_3}{T_2}$$

Evol. 3-4 : T cte

$$Q_{34} = T_3 nR \ln \frac{V_4}{V_3} > 0 \qquad \Delta S_{34} = nR \ln \frac{V_4}{V_3}$$

Evol 4,1 $\quad \frac{H}{P} = cte \; , \; \frac{T}{P} = cte = v$

$$Q_{41} = \Delta E_{i41} = \frac{nR}{\gamma-1}(T_1 - T_4) < 0 \qquad \Delta S_{41} = \frac{nR}{\gamma-1} \ln \frac{T_1}{T_4}$$

Así que $\quad \eta = 1 - \frac{|Q_{41}|}{Q_{23} + Q_{34}} = 1 - \frac{\frac{nR}{\gamma-1}(T_4 - T_1)}{\frac{\gamma}{\gamma-1} nR(T_3 - T_2) + T_3 nR \ln \frac{V_4}{V_3}}$

$$\rightarrow \sum \Delta S = 0 \rightarrow \frac{\gamma nR}{\gamma-1} \ln \frac{T_3}{T_2} + nR \ln \frac{V_4}{V_3} + \frac{nR}{\gamma-1} \ln \frac{T_1}{T_4} = 0 \qquad (1)$$

$$\frac{E_{i3}}{E_{i2}} = \frac{\frac{nR}{\gamma-1} T_3}{\frac{nR}{\gamma-1} T_2} = \frac{T_3}{T_2} = \beta \qquad (2)$$

En la evol. 1, 2 : $\quad \frac{T_1}{T_2} = \left(\frac{V_2}{V_1}\right)^{\gamma-1} = \alpha^{\gamma-1}$

$$\frac{T_1}{T_4} = \frac{T_1}{T_3} = \frac{T_1}{T_2} \frac{T_2}{T_3} = \frac{\alpha^{\gamma-1}}{\beta} \qquad (3)$$

De (1) $\quad \ln \frac{V_4}{V_3} = -\frac{1}{\gamma-1} \left[\ln \left(\frac{T_3}{T_2}\right)^{\gamma} + \ln \frac{T_1}{T_4} \right] \; , \quad \frac{V_4}{V_3} = \frac{1}{\left(\frac{T_3}{T_2}\right)^{\gamma/\gamma-1} \left(\frac{T_1}{T_4}\right)^{1/\gamma-1}}$

De (2) y (3) : $\quad \frac{V_4}{V_3} = \frac{1}{\beta^{\gamma/\gamma-1} \frac{\alpha^{\gamma-1/\gamma-1}}{\beta^{1/\gamma-1}}} = \frac{1}{\alpha\beta}$

Sustituyendo en la expresión del rendimiento

$$\eta = 1 - \frac{1 - T_1/T_4}{\gamma\left(1 - \frac{T_2}{T_3}\right) + (\gamma-1) \ln \frac{V_4}{V_3}} = 1 - \frac{1 - \frac{\alpha^{\gamma-1}}{\beta}}{\gamma\left(1 - \frac{1}{\beta}\right) - (\gamma-1) \ln(\alpha\beta)}$$