



1 → 2 isentrop

2 → 3 isobar

3 → 4 isentrop

4 → 1 isobar

Diesels - Prozess

Wirkungsgrad beim Joule-Prozess

$$\eta_R = \frac{-W_R}{Q_{zu}} = \frac{Q_{zu} + Q_{ab}}{Q_{zu}} = 1 + \frac{Q_{ab}}{Q_{zu}} = 1 + \frac{T_1 - T_4}{T_3 - T_2} = 1 - \frac{T_4 - T_1}{T_3 - T_2}$$

$$Q_{zu} = Q_{23} = m c_p (T_3 - T_2)$$

$$Q_{ab} = Q_{41} = m c_p (T_1 - T_4)$$

→ Zustandsgleichungen:

$$\frac{T_1}{T_2} = \left(\frac{p_1}{p_2}\right)^{\frac{\kappa-1}{\kappa}} = \left(\frac{p_4}{p_3}\right)^{\frac{\kappa-1}{\kappa}} = \frac{T_4}{T_3} \Rightarrow T_4 = \frac{T_1}{T_2} T_3$$

$$\Rightarrow \eta_R = 1 - \frac{\frac{T_1}{T_2} \cdot T_3 - T_1}{T_3 - T_2} = 1 - \frac{T_1 T_3 - T_1 T_2}{T_2 (T_3 - T_2)} = 1 - \frac{T_1 (T_3 - T_2)}{T_2 (T_3 - T_2)} = 1 - \frac{T_1}{T_2}$$

$$\eta_R = 1 - \left(\frac{p_1}{p_2}\right)^{\frac{\kappa-1}{\kappa}}$$
