Procedure: The first step would be to find all the necessary. Use those found variables to find the thermal efficiency and the mass flow rate.

Calculations:

$$① \rightarrow ② \rightarrow ③ \rightarrow ④$$

$T_1 = 310K$ $P_2 = 5\ bar$ $T_3 = 760K$ $T_4 = 1140K$

$P_1 = 1\ bar$ $T_2 = 490.98K$ $P_3 = 23.07\ bar$ $P_4 = 95.36\ bar$

$$\frac{T_2}{310K} = \left(\frac{5bar}{1bar}\right)^{\frac{(1.4-1)}{1.4}} = 490.98K \qquad \frac{760K}{490.98K} = \left(\frac{x}{5\ bar}\right)^{\frac{(1.4-1)}{1.4}} = 23.07\ bar$$

$$\frac{1140K}{760K} = \left(\frac{x}{23.07}\right)^{\frac{(1.4-1)}{1.4}} = 95.36K$$

$$h_2 = 492.74 + (490.98 - 490)\left(\frac{503.02 - 492.74}{500 - 490}\right) = 493.75\ kJ/kg$$

$q_{in} = 778.18 - 493.75 = 284.43\ kJ/kg$ $\quad r_p = 5\ bar$

$q_{out} = 1207.57 - 310.24 = 897.33\ kJ/kg$

$$\boxed{\eta_{th} = 1 - \frac{1}{5^{\frac{1.4-1}{1.4}}} = 0.37 = 37\%} \qquad \boxed{\epsilon = \frac{490.98 - 310}{1140 - 760} = 0.476 = 47.6\%}$$

$$W_{net} = (1.005)(1140 - 760) - (1.005)(490.98 - 310) = 470.38\ kJ/kg$$

$$\dot{m} = \frac{500kW}{470.38\ kJ/kg} = \boxed{1.06\ kg/s}$$

$$1 = \frac{760 - 490.98}{T_5 - 490.98} = T_5 = 760K$$

$$\boxed{\eta_{th} = \frac{(1140 - 760) - (490.98 - 310)}{1140 - 760} = \frac{380 - 180}{380} = 0.526 = 52.6\%}$$