Procedure: Find all the states involved in the problem. They will be used to solve for the collection of gases at the turbine exit (P_5) and the velocity of gases at the nozzle exit (V_6). Finally, thrust can be found using the formula $F = (V_1/v_1)(\pi/4)(D^2)(V_6 - V_1)$.

Calculations:

$V_6 = \sqrt{2(1.005 \cdot 10^3)(1187.78 - 955.63)} = \boxed{683.1 \text{ m/s}}$

$(T_6/1187.78) = (40/85.63)^{\frac{1.4-1}{1.4}} \Rightarrow T_6 = 955.63\text{K}$

$F = (250/1.71)(\pi/4)(1.6)^2(683.1 - 250)$

$\boxed{= 127,309.83 \text{ N}}$

$P_5/94.89 = (1187.78/1223.15)^{\left(\frac{1.4}{1.4-1}\right)} \Rightarrow \boxed{P_5 = 85.63 \text{ kPa}}$

$T_5 = 1223.15 - (304.81 - 269.44) = 1187.78\text{K}$

$T_3/269.44 = (94.89/61.62)^{\frac{1.4-1}{1.4}} \Rightarrow T_3 = 304.81\text{K}$

$P_3 = (1.54)(61.62) = 94.89 \text{ kPa}$

$r_p = 61.62/40 = 1.54$

$(61.62)(v_2) = (0.287)(269.44) \Rightarrow v_2 = 1.25 \text{ m}^3/\text{kg}$

$T_2 = (238.15 \cdot 10^3) + (250)^2/2 = 269.44 \text{ K}$

$P_2/40\text{kPa} = (269.44/238.15)^{\frac{1.4}{1.4-1}} = 61.62 \text{ kPa} = P_2$

$(40)(v_1) = (0.287)(238.15)$

$v_1 = 1.71$