note that $M_q$ with aft burning boost on is same as $(M_q)_0$ with aft burning boost off

and

$$\frac{M_q}{M_0} = \sqrt{\frac{T_f}{T_0}} \times \left( \frac{M_q}{M_0} \right)_0 \sqrt{\frac{T_f}{T_0}}$$

$$\frac{M_q}{M_0} = \left[ \frac{T_{ab}}{T_{a} T_{b}} \right] \frac{T_{a b}}{T_{a} T_{b}}$$

the problem has the aft fan decoupled from the first turbine and compressor

i.e. the power balance is:

$$\dot{W}_1 - \dot{W}_2 = \dot{W}_1 - \dot{W}_2$$

$$\tau_{ta} = 1 - \frac{\tau_{f}}{\tau_{f}} (\tau_{c} - 1)$$