$$\cancel{P_0}^{\,1}\left(1+\frac{\gamma-1}{2}M_9^2\right)^{\frac{\gamma}{\gamma-1}} = \cancel{\pi_n}^{\,1}\,\pi_t\,\cancel{\pi_b}^{\,1}\,\pi_c\,\cancel{\pi_d}^{\,1}\,\pi_r\,\cancel{P_0}^{\,1}$$

$$= \left(\tau_t\,\tau_c\,\tau_r\right)^{\frac{\gamma}{\gamma-1}}$$

$$1+\frac{\gamma-1}{2}M_9^2 = \tau_t\,\tau_c\,\tau_r$$

$$\boxed{M_9 = \sqrt{\frac{2}{\gamma-1}\left(\tau_t\,\tau_c\,\tau_r - 1\right)}}$$

total temperatures need to go to end of compressor instead of the end of burner

T_t across burner

limiting T_t in compress

$$T_{t9} = T_9\left(1+\frac{\gamma-1}{2}M_0^2\right) = \frac{T_{t9}}{T_{t5}}\,\frac{T_{t5}}{T_{t4}}\,\frac{T_{t4}}{T_{t3}}\,\frac{T_{t3}}{T_0}\,T_0$$

$$T_9\underbrace{\left(1+\frac{\gamma-1}{2}M_0^2\right)}_{\tau_t\,\tau_c\,\tau_r} = \cancel{\tau_n}^{\,1}\,\tau_t\,\tau_b\,\tau_{\lambda c}\,T_0$$

$$T_9\,\cancel{\tau_t}^{\,1}\,\tau_c\,\tau_r = \cancel{\tau_t}^{\,1}\,\tau_b\,\tau_{\lambda c}\,T_0$$

$$\boxed{\frac{T_9}{T_0} = \frac{\tau_b\,\tau_{\lambda c}}{\tau_c\,\tau_r}}$$