$$k\_{aerogel}=.03\frac{W}{mK}$$

$$k\_{coolant}=.06\frac{W}{mK}$$

Average velocity of gas:

$$U=U\_{piston}=2\*\frac{rpm}{60}\*stroke=2\*\frac{19250}{60}\*.03977=25.5\frac{m}{s}$$

$$\frac{h\left(x,t\right)b}{k}=10.4\left(\frac{Ub}{v}\right)^{\frac{3}{4}}$$

$$⇒h\left(x,t\right)=\frac{10.4\*k\*\left(\frac{Ub}{v}\right)^{\frac{3}{4}}}{b}$$

Where:

$$b=characteristic length=bore=.110m$$

$$v=gas thermal diffusivity=100\*10^{-6}\frac{m^{2}}{s}$$

Solving:

$$h\left(x,t\right)\_{aerogel}=5724\frac{W}{m^{2}K}$$

$$h\left(x,t\right)\_{coolant}=11447\frac{W}{m^{2}K}$$

Since the actual heat transfer is therefore $∝$ piston area

$$⇒50\% imporovement with Aerogel$$