Class 39 T9 M10, 12, 14

10 -- we assum water initially at 20°C

Q (for 1g) $= 4.19 \cdot 80 + 333 = 417$ J

Watts of cooling $= 4.9 \cdot 250 = 1225$ W

$417 \cdot (15000) = 1225 \cdot t$

$5.1 \times 10^3 s = t$

12 we assum water started at 20°C before boiled away

Q (for 1g) $= 4.19 \times 80 + 2256 = 2591$ J

flow of water $= 4\text{m} \cdot .7\text{m} \cdot .7\text{m/s} = 1.96\ \text{m}^3/\text{s}$

density of water $= 1000\ \frac{\text{kg}}{\text{m}^3}$ $= 1.96 \times 10^3\ \text{kg/s}$

$= 1.96 \times 10^6\ \text{g/s}$

$Q_c = 1.96 \times 10^6\ \frac{\text{g}}{\text{s}}\ 2591\ \text{J/g} = 5.08 \times 10^6\ \text{J/s}$

$T_h = 550 + 273 = 823$ $\quad T_c = 100 + 273 = 373$

$\frac{W}{Q_c} = \frac{(T_h - T_c)\Delta S}{T_c \Delta S} = \frac{T_h}{T_c} - 1 = 1.206$ W

$W = 1.206 \cdot 5.08 \times 10^6\ \text{J/s} = 6.13 \times 10^6\ \text{J/s}$

14 $\frac{Q_c}{W} = \frac{T_c \Delta S}{(T_h - T_c)\Delta S}$ & $Q_c \propto (T_h - T_c)$

$W = Q_c\left(\frac{T_h - T_c}{T_c}\right) \propto \frac{(T_h - T_c)^2}{T_c}$