Solar Heater the principle and the design the extra corrected version—2011/3/1,

The aim of this topics is survey what type of SH is best performance from view of physics principle and of costs for materials. Many useful concrete topics were found, but the priciple for **design calculator** is difficult to find. Hereupon 2011/2/4 the first version was found to have many articles which should be corrected and supplemented. Here are summary for those problems.

—Note for correction and supplemetal for "red characters"—

❶[3]: Green House Effect Box without solar ray focusing。

This chapter has many doubtful points.

*Conductive and convection heat flow loss(≡ $Q_{C\&V}$) are almost neglegible.

But reality could not be so,

*(2) $Q_s = Q_L = S_L @ \sigma T^4$. → (3) $T_M = [Q_s/S_L @ \sigma]^{1/4}$. <equilibrium max temperature>>

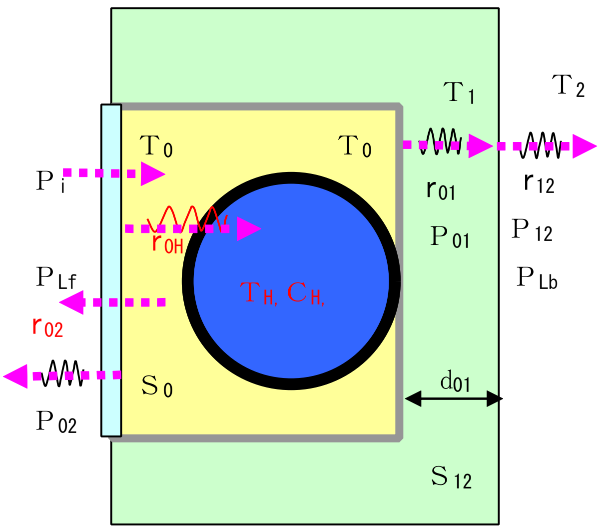
→ $Q_s = Q_L = Q_{C\&V} + S_L @ \sigma T^4$. → (3) $T_M = [\langle Q_s - Q_{C\&V}\rangle / S_L @ \sigma]^{1/4} = [\langle Q_s - Q_{C\&V}\rangle / S_L \sigma]^{1/4}$.

<<equilibrium max temperature, but is not pragmatical utility one>>

Note that half mirror @=1(blackbody) when top cover would become T_M❸.

Following is a heat box model of **heat input and outputs account**.

Heat Box Model.



heat resistor definition:

$P_{01} = (T_0 - T_1)\kappa_{01}/d_{01}$.

→ $r_{01} \equiv (T_0 - T_1)/P_{01} = d_{01}/\kappa_{01}$.

It's quite analogy of electrical circuit of current P and voltage T.

$P_i = S_0 P_0$. << P_0 = 956W/m²>>

$P_{Lf} = S_0 @_0 \sigma T_0^4 + S_{12} @_{12} \sigma T_1^4$.

$-(S_0 + S_{12})\sigma T_2^4$.

≡**radiation** outgoing—incoming.

$P_{Lb} = P_{02} + P_{01}(= P_{12}) = (T_0 - T_2)/r_{02}$

$+ (T_0 - T_2)/(r_{01} + r_{12})$.

$P_{01} = (T_0 - T_1)\kappa_{01}/d_{01}$. <<**conductive**>>

$r_{01} = d_{01}/\kappa_{01}$. << κ_{01} = 0. W/m℃>>.

$P_{12} = (T_1 - T_2)\kappa_{12} S_{12}$. <<**convective**>>

$r_{12} = 1/S_{12}\kappa_{12}$. << κ_{12}(air) ≒ 7W/m²℃>>.

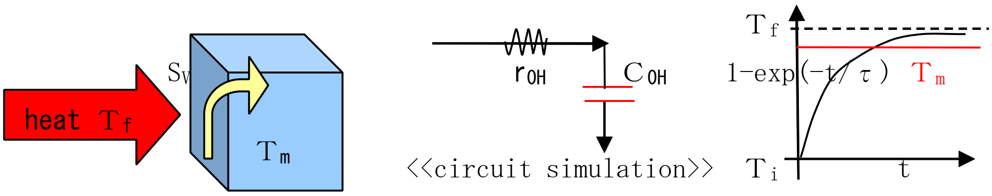
$P_{02} = (T_0 - T_2)\kappa_{02} S_{02}$. <<**convective**>>

$r_{02} = 1/S_{02}\kappa_{02}$. << κ_{02}(air) ≒ 7W/m²℃>>.

＊(7)t_H≒$E_H/(Q_s-\langle Q_L(T_0)+Q_L(T_M)\rangle/2)$.<<coarse estimation>>.

A coarse heating time could be estimated by heat flow time constant.

heating tiem constant(example):



$\tau = r_{OH}C_{OH}$=33946s=9.4hour.

C_{OH}=130Kgx4.178KJ/Kg℃, <<heat capacity of H_2O of 130Kg>>

heat input J area≡S_V=0.2mx4.0m. J=$\kappa_V S_V[T_f-T_m]$.→ $r_{OH}\equiv[T_f-T_m]/J=1/\kappa_V S_V$.

r_{OH}=1/20?W/m²℃x0.2mx4.0m=0.0625.<<convective heat resistor of water>>

http://www.engineeringtoolbox.com/convective-heat-transfer-d_430.html

T_i=10℃(initial)→T_f=60℃(final) T_m= 40℃→ln(<60−40>/<60−10>)=0.92τ.

10℃→50℃	10℃→60℃	10℃→70℃	10℃→80℃	10℃→100℃
ln(1/4)=1.39	ln(2/5)=0.92	ln(3/6)=0.69	ln(4/7)=0.56	ln(6/9)=0.41

Heating time is serious important, which should be improved by design change.

❷This article is abribated due to doubtful mesurement enviroments.

Example-5)

inner blackbody box size=0.46m×0.36m×0.18m;opening area S_s=0.46×0.36=0.16m².

input heat amount Q_s=900W/m²×0.16m²=150W.→80℃<observing 2011/2/3 in Japan>.

cooling radiation area S_L=2(0.46×0.36)+2(0.46×0.18)+2(0.18×0.36)=0.312m².

(1)covection heat flow into exterior air $Q_{LC}=S_L J$=0.312m²×7W/m²K.<neglegible>

(2)radiation rate of material surface @≒0.5?.

Max cooling radiation amount $Q_s=Q_L=S_L @\sigma T^4$.→ T≒87℃、observing=80℃、

＊reference site on heat calculation.

http://www.hakko.co.jp/qa/qakit/html/s01050.htm

❸[1]:Solar Heater the physics fundamental.

(b)green house method of @<heat(infrared ray)reflecting wall≡HW>.

This method seems good at a glance, however there might be a difficulty.

It's a blackbody radiation of semi-transparent HW(heat input window)-itself.

The window become no-green house function at saturated temperature.

☞:This short report is still insufficient to describe systematic design calculator. Please wait for a while.