// 2st solution: add 2 insulation layers of glass wool of L_2 meters thickness, the following calculations are done to find L_2 required to comply with the rules

//Knowns given:
A = 0.422 [m^2] // The total surface area on which we aim to insulate
L_1= 0.635/1000 // thickness of the main aluminum firewall base
k_6061 = 166 [W/K-m]
k_GW = 0.04 [W/K-m]

T_inf = 298.15 [K]
Ts_1= 402.59[K]
Ts_2 = 333.15 [K]
T_delta= Ts_1-T_inf

h_conv_air = 5 [W/m^2*K]

//Thermal Resistances connected in series:
R_cond_6061 = L_1/(K_6061*A)
R_conv_air = 1/(h_conv_air *A)
R_cond_GW = L_2/(A*k_GW)

// the sumation of the thermal resitsnaces in the wall
R_total_GW= R_cond_6061+ R_conv_air + (2*R_cond_GW)

// Thermal power:
Q_GW= T_delta/ R_total_GW

// Surfcae temperature 2:
Ts_2 =(- (2* R_cond_GW+R_cond_6061)*Q_GW) +Ts_1

$A = 0.422 \ [m^2]$

$L_1 = \frac{0.635}{1000}$

$k_{6061} = 166 \ [W/K\text{-}m]$

$k_{GW} = 0.04 \ [W/K\text{-}m]$

$T_{inf} = 298.15 \ [K]$

$Ts_1 = 402.59 \ [K]$

$Ts_2 = 333.15 \ [K]$

$T_\delta = Ts_1 - T_{inf}$

$h_{conv,air} = 5 \ [W/m^2*K]$

$R_{cond,6061} = \frac{L_1}{k_{6061} \cdot A}$

$R_{conv,air} = \frac{1}{h_{conv,air} \cdot A}$

$R_{cond,GW} = \frac{L_2}{A \cdot k_{GW}}$

$R_{total,GW} = R_{cond,6061} + R_{conv,air} + 2 \cdot R_{cond,GW}$

$Q_{GW} = \frac{T_\delta}{R_{total,GW}}$

$$Ts_2 = -(2 \cdot R_{cond,GW} + R_{cond,6061}) \cdot Q_{GW} + Ts_1$$

SOLUTION

Unit Settings: SI K Pa J mass rad

$A = 0.422$ [m^2]
$k_{6061} = 166$ [W/K-m]
$L_1 = 0.000635$ [m]
$Q_{GW} = 73.85$ [W]
$R_{cond,GW} = 0.4701$ [K/W]
$R_{total,GW} = 1.414$ [K/W]
$Ts_2 = 333.2$ [K]
$T_{inf} = 298.2$ [K]
$h_{conv,air} = 5$ [$W/m^{2*}K$]
$k_{GW} = 0.04$ [W/K-m]
$L_2 = 0.007936$ [m]
$R_{cond,6061} = 0.000009065$ [K/W]
$R_{conv,air} = 0.4739$ [K/W]
$Ts_1 = 402.6$ [K]
$T_\delta = 104.4$ [K]

No unit problems were detected.