WEEK 3 SUBMISSION **PAOLA GOBBI - 926210**

1. **You should first definalize the composite wall question by finding the heat transfer rate, and then solve the same question while the thickness of the brick is increased to 32 cm and comment on the results.**

Heat transfer of the wall in EXEMPLE D:

$$\dot{Q} = \frac{T_{\infty 1} - T_{\infty 2}}{R_{TOT}} = \frac{20°\text{C} + 10°\text{C}}{6{,}81\ {}^{W}/_{°\text{C}}} = 4{,}41\ W$$

Heat loss throught a composite wall

$K_{Plaster} = 0{,}22\ W/m°C$

$K_{Brick} = 0{,}72\ W/m°C$

$K_{Foam} = 0{,}26\ W/m°C$

$T_{inside} = 20\ °C$

$T_{outside} = -10\ °C$

$h_1 = 10\ W/m^2\ °C$

$h_2 = 40\ W/m^2\ °C$

$$R_i = \frac{1}{h_1 \cdot A} = \frac{1}{10\ {}^{W}/_{m^2 \cdot °\text{C}} \cdot 0{,}25\ m^2} = 0{,}4\ {}^{°\text{C}}/_{W}$$

$$R_F = \frac{L_F}{k_F \cdot A_F} = \frac{0{,}03m}{0{,}026\ {}^{W}/_{m \cdot °\text{C}} \cdot 0{,}25m^2} = 4{,}615\ {}^{°\text{C}}/_{W}$$

Calculation of parallel resistance:

$$R_{Pup} = R_{Pdown} = \frac{L_{Pup}}{k_P \cdot A_{P\,up}} = \frac{0{,}32m}{0{,}22\,{}^{W}/_{m\,\cdot\,°\mathrm{C}} \cdot 0{,}015m^2} = 96{,}97\,{}^{°\mathrm{C}}/_{W}$$

$$R_B = \frac{L_B}{k_B \cdot A_B} = \frac{0{,}32m}{0{,}72\,{}^{W}/_{m\,\cdot\,°\mathrm{C}} \cdot 0{,}22m^2} = 2{,}02\,{}^{°\mathrm{C}}/_{W}$$

$$\frac{1}{R_{TOT\,parallel}} = \frac{1}{R_{P\,up}} + \frac{1}{R_B} + \frac{1}{R_{P\,down}}$$

$$= \frac{1}{96{,}97\,{}^{°\mathrm{C}}/_{W}} + \frac{1}{2{,}02\,{}^{°\mathrm{C}}/_{W}} + \frac{1}{96{,}97\,{}^{°\mathrm{C}}/_{W}} = \frac{1}{0{,}515\,{}^{°\mathrm{C}}/_{W}}$$

$$R_{TOT\,parallel} = \frac{1}{0{,}515\,{}^{°\mathrm{C}}/_{W}} = 1{,}94\,{}^{°\mathrm{C}}/_{W}$$

$$R_{P\,left} = R_{P\,right} = \frac{L_{P\,left}}{k_P \cdot A_{P\,left}} = \frac{0{,}02m}{0{,}22\,{}^{W}/_{m\,\cdot\,°\mathrm{C}} \cdot 0{,}25m^2} = 0{,}363\,{}^{°\mathrm{C}}/_{W}$$

$$R_o = \frac{1}{h_2 \cdot A} = \frac{1}{40\,{}^{W}/_{m^2\,\cdot\,°\mathrm{C}} \cdot 0{,}25\,m^2} = 0{,}1\,{}^{°\mathrm{C}}/_{W}$$

$$R_{TOT} = R_i + R_F + R_{P\,left} + R_{TOT\,parallel} + R_{P\,right} + R_o$$

$$= 0{,}4\,{}^{°\mathrm{C}}/_{W} + 4{,}615\,{}^{°\mathrm{C}}/_{W} + 0{,}363\,{}^{°\mathrm{C}}/_{W} + 1{,}94\,{}^{°\mathrm{C}}/_{W}$$

$$+ 0{,}363\,{}^{°\mathrm{C}}/_{W} + 0{,}1\,{}^{°\mathrm{C}}/_{W} = 7{,}781\,{}^{°\mathrm{C}}/_{W}$$

$$\dot{Q} = \frac{T_{\infty 1} - T_{\infty 2}}{R_{TOT}} = \frac{20°\mathrm{C} + 10°\mathrm{C}}{7{,}781\,{}^{W}/_{°\mathrm{C}}} = 3{,}856\,W$$

Conclusion:

$R_{TOT\ brick\ (16\ cm)} = 6{,}81\ ^{\circ C}/_{W}$

$R_{TOT\ brick\ (32\ cm)} = 7{,}781\ ^{\circ C}/_{W}$

double up the thickness of the brick, the result shows that this increase is not significant for the purpose of total wall resistance. The significant value is instead the resistance of the foam, which is the highest figure in total resistance.

$R_{TOT} = 7{,}781\ ^{\circ C}/_{W} \rightarrow\ R_{Foam} = 4{,}615\ ^{\circ C}/_{W}$

2. **You should solve again the simplified wall calculation procedure replacing the *glass* fiber one with *urethane* rigid foam andwhile replacing the fiberboard with *plywood* and find the two R_unit values.**

	A	B
OUTSIDE AIR	0,03	0,03
WOOD BEVEL L	0,14	0,14
PLYWOOD	0,11	0,11
URATHANE RIGID FOAM	–	0,98
WOOD STUDS	0,63	–
GYPSUN BOARD	0,079	0,079
INSIDE SURFACE	0,12	0,12

$R_{\text{URATHANE RIGID FOAM}} = 0{,}98 \cdot \frac{90}{25} = 3{,}528\ m^2 \cdot {}^{\circ C}/_{W}$

$R_{WITH\ WOOD} = 0{,}03 + 0{,}14 + 0{,}11 + 0{,}63 + 0{,}079 + 0{,}12$

$= 1{,}109\ m^2 \cdot {}^{\circ C}/_{W}$

$R_{INSULATION} = 0{,}03 + 0{,}14 + 0{,}11 + 3{,}528 + 0{,}079 + 0{,}12$

$= 4{,}007\ m^2 \cdot {}^{\circ C}/_{W}$