Question 1:

Heat loss through a composite wall:

A 3m high and 5m wide wall consist of long 32 cm, 22 cm cross section horizontal Briks ($k = 0.72$ W/m °C) separated by 3cm thick plaster layers ($k = 0.22$ W/m °C).
There are also 2cm thick plaster layers on each side of the brike and a 3cm thick rigid foam ($k = 0.026$ W/m °C) on the inner side of the wall the indoor and the outdoor temperatures 20 °C and -10 °C and the convection heat transfer coefficients on the inner and the outer sides are $h_1 = 10$ W/m² °C and $h_2 = 40$ W/m² °C respectively. Assuming one dimensional heat transfer and disregarding radiation determine the rate of heat transfer through the wall.

answer:

$$R_{R\,foam} = \frac{L_{foam}}{K_{foam} \times A_{1-dimen}} = \frac{0{,}03\,m}{0{,}026\,\frac{w}{m°c} \times \underbrace{(0{,}015 + 0{,}22 + 0{,}015)}_{0{,}25}\,m \times 1m} = \boxed{4{,}615\ °c/w}$$

$$R_{1conv} = \frac{1}{h_1 \times A_{1-dimen}} = \frac{1}{10\,\frac{w}{m^2°c} \times (0{,}015 + 0{,}22 + 0{,}015)\,m \times 1m} = \boxed{0{,}4\ °c/w}$$

$$R_{Brik} = \frac{L_B}{K_B \times A_{B(1-dimen)}} = \frac{0{,}32}{0{,}72\,\frac{w}{m°c} \times 0{,}22m \times 1m} = \boxed{2{,}02\ °c/w}$$

$$R_{plaster\ up\ or\ down} = \frac{L_P}{K_P + A_{P(1-dimen)}} = \frac{0{,}32}{0{,}22\,\frac{w}{m°c} \times 0{,}015 \times 1m} = \boxed{96{,}97\ °c/w}$$

$$\Rightarrow \frac{1}{R_{total}} = \frac{1}{R_{p.up}} + \frac{1}{R_B} + \frac{1}{R_{p.down}} = \frac{1}{96{,}97} + \frac{1}{2{,}02} + \frac{1}{96{,}97} = \boxed{0{,}5156\ w/c}$$

$$0{,}0103 + 0{,}495 \quad 0{,}0103$$

$$\text{ie } R_{total-parellel} = \frac{1}{0{,}5156} = 1{,}9394\ °c/w$$

$$R_{p.left\ or\ right} = \frac{L_{P.Lorr}}{K_P \times A_{P\,righ\ or\ left\,(1-dimen)}} = \frac{0{,}02m}{0{,}22 \times (0{,}015 + 0{,}22 + 0{,}015) \times 1} = 0{,}3636\ °c/w$$

$$R_{2conv} = \frac{1}{h_2 \times A_{1-dmin}} = \frac{1}{40 \times (0{,}015 + 0{,}22 + 0{,}015) \times 1m} = \boxed{0{,}1\ °c/w}$$

$$R_{wall\ total\ (1-dmen)} = R_{1conv} + R_{plaster\,left} + R_{foam} + R_{total\,parellel} + R_{plaster\,right} + R_{2conv} =$$

$$0{,}4\ °c/w + 4{,}615\ °c/w + 0{,}3636\ °c/w + 1{,}9394\ °c/w + 0{,}3636\ °c/w + 0{,}1\ °c/w =$$

$$\boxed{R_{wall\ totall} = 7{,}7816\ °c/w}$$

$$\dot{Q} = \frac{T_1 - T_\infty}{R_{wall,total}} = \frac{20 - (-10)}{7,7816} = 3,855 \text{ w}$$

comments: In the last question the thickness of wall was 16cm and then the R_{total} was around 6,81 °C/w . In conclusion with increasing the thickness, R_{total} is increased and the heat transfer is decreased. Also, I should mentioned that we doubled the thickness of brick in a composit wall but the thermal ressistance doesnot significantly increase and the rate of heat transfering does not decrease significantly.

Question 2:

answer:

	wood	Insulation
outside air	0,03	0,03
wood Bevel (13mm×200)	0,14	0,14
Polywood (13mm)	0,11	0,11
Urethane Rigif Foam (90)	No	0,98×90/25 = 3,528
wood Studs (90mm)	0,63	No
Gypsum Board (13mm)	0,079	0,079
Inside surface	0,12	0,12

$R_{with\,wood} = (0,03 + 0,14 + 0,11 + 0,63 + 0,079 + 0,12) = 1,109 \; m^2 °C/w$

$R_{with\,insulation} = (0,03 + 0,14 + 0,11 + 3,528 + 0,079 + 0,12) = 4,007 \; m^2 °C/w$