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**Week 3**

**Question 1:**

A 3m high and 5m wide wall consists of long 32 cm 22 cm cross section horizontal bricks (k = 0.72 W/m. C) separated by 3 cm thick plaster layers ( k = 0.22 W/m.C).

There are also 2 cm thick plaster layers on each side of the brick and a 3 cm thick grid foam (k = 0.026 W/m.C) on the inner side of the wall. The indoor and the outdoor temperatures are 20 C and -10 C, the convection heat transfer coefficients on the inner and the outer sides are h1 = 10 W/m2 . C and h2 = 40 W/m2 . C, respectively. Assuming one dimensional heat transfer and disregarding radiation, determine the rate of heat transfer through the wall.

Answer:

R1=

Rfoam =

Rbrick =

Rbrick =

1/Rtotal-parallel =

R2=

RPlaster3 = RPlaster4 =

Rwall,total =R1.conv + Rfoam +Rplaster1 + Rparallel + Rplaster2 + R2.conv

=0.4 + 4.615 + 0.363 + 1.94 + 0.363 +0.1 = 7.781 C/W

Q.=

Rwall is already calculated then

Rwall total(thickness of the brick 16mm) =6.81 C/W

Q.=

Comments: Comparison of both walls is that increasing the thickness of the brick inside the wall doesn’t increase the thermal resistance and therefore the rate of heat transfer doesn’t change a lot.

**Question 2:**

Determine the overall unit thermal resistance (the *R*-value) and the overall heat transfer coefficient (the *U*-factor) of a wood frame wall that is built around 38-mm 90-mm wood studs with a center-to-center distance of 400 mm. The 90-mm-wide cavity between the studs is filled with  
glass fiber insulation. The inside is finished with 13-mm gypsum wallboard and the outside with 13 mm wood fiberboard and 13-mm 200-mm wood bevel lapped siding. The insulated cavity constitutes 75 percent of the heat transmission area while the studs, plates, and sills constitute 21 percent. The headers constitute 4 percent of the area, and they can be treated as studs.

Answer:

|  |  |  |
| --- | --- | --- |
|  | Wood | Insulation |
| Outside Air | 0.03 | 0.03 |
| Wood bevel | 0.14 | 0.14 |
| Polywood | 0.11 | 0.11 |
| Urethane rigif foam ins. | No | 3.528 |
| Wood studs | 0.63 | No |
| Gypsum board | 0.079 | 0.079 |
| Inside surface | 0.12 | 0.12 |

Urethane rigif foam ins.---> = 3.528

R’with wood = (0.12+0.079+0.63+0.11+0.14+0.03) m2  = 1.11

R’with insulation = (0.12+0.079+3.528+0.11+0.14+0.03) m2  = 4.007