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A 3 m high 5 m wide wall consist of long 32 cm 22 cm cross section horizontal bricks (k=0.72 W/m C) separeted by 3 cm thick plaster (k=0.22 w/m C). There are also 2 cm thick plaster layers on each side of the brick 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 are 20 C and – 10 C and the convection heat transfer coefficients on the inner and the outer sides are h1=10W/m2 C. and h2=40 W/m2 C respectivley. Assuming one dimensional heat transfer and disregarding radiation, determine the rate of heat transfer throught the wall.

$R_i=1/10x0.25=0.4$ C/w

$R_f=0.03/0.026x0.25=4.615$ C/w

$R_{Plaster\ upper}=R_{Plasterdown}=L_{Pc1}/K_PxA_{Pc1}=0.32/0.22x0.015=96.97$ C/W

$R_{brick}=L_b/K_bxA_b=0.32/0.72x0.22=2.02$C/W

$1/R_{totparallel}=1/R_{brick}+1/R_{Plaster\ upper}+1/R_{Plasterdown}=1/2.02+2x(1/96.97)=0.516$C/W

$1/R_{totparallel}=0.516C/W_{totparallel}=1/0.516=0.97$C/W

$R_{P1}=R_{P2n}=L_{P1}/K_PxA_{P1}=0.02/0.22x0.25=0.363$C/W

$R_{P2}=1/h_0xA=1/40x\ 0.25=0.1$C/W

$R_{total}=R_i+R_0+2xR_{totparallel}+R_{foam}$

$R_{total}=7.781$C/W

$Q=\Delta\ T/R_{toT}=30/7.781=3.855$W