Politechnico di Milano

Week 8

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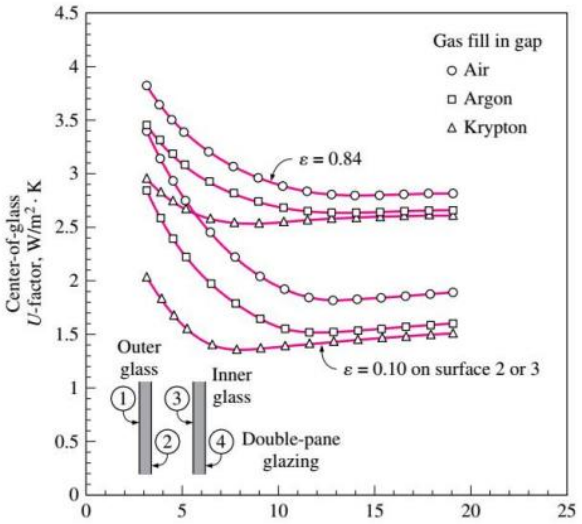
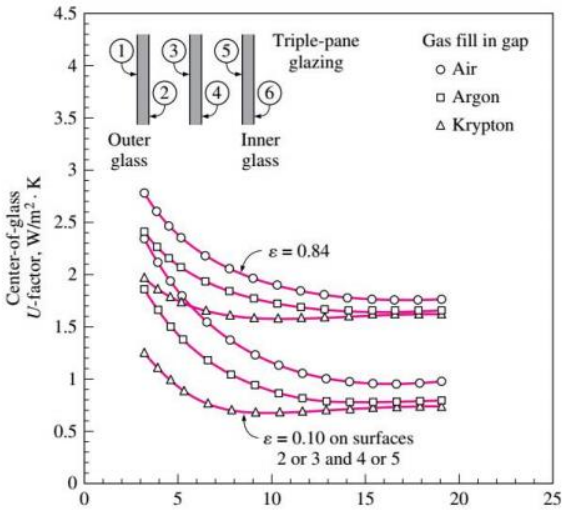
Task 1





By comparing two diagrams, they show when there are 2 panels and there are air in the gap the U factor is 2.8 w/m^2k and the final percentage is 100 and if we change the gas to krypton the U factor is 2.6 w/m^2 k and the percentage is 93 but when there is 13mm gap with e=0.10 and there are 2 panels with Air the U-factor is 1.8 w/m^2k and the percentage is 64.In the other hand If E=0.84 and the panels is 3 the U-factor 1.8 w/m^2 k and the percentage is 64 %.

Task2

Task 2.

CF = surface cooling Factor
HF = Heating Factor

East windows

① $A = 14.4\ m^2$

Heating: $U = 2.84\ w/m^2k$

$HF: U \cdot \Delta T = 2.84 \times 24.8 = 70.43$

$Q = HF \times A = 70.43 \times 14.4 = 1014.22$

Cooling

$CF = U \times (\Delta T_{cooling} - 0.46 \times DR) = 2.84(7.9 - 0.46 \times 11.9) = 6.9\ w/m^2$

$ED = 559$ = part for Irradiation Part

$Ed = 188$

$SHGG = 0.54$

$PXI = ED + Ed = 747$

$CF_W = PXI \times SHGC \times IAC \times FFS = 747 \times 0.54 \times 1 \times 0.31 = 125.1$

$CF_{fenestration} = U \times (\Delta T_{cooling} - 0.46 \times DR) + PXI \times SHGC \times IAC \times FFS$

$= 6.9 + 125.1 = 132\ w/m^2$

$Q = CF_{fenestration} \times A = 132 \times 14.4 = 1900.8\ w$

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② Heating

$U = 2.84\ w/m^2k$

$HF = U \times \Delta T_{cooling} = 2.84 \times 24.8 = 70.44\ w/m^2$

$Q = HF \times A = 70.44 \times 14.4 = 1014.2\ w$

Cooling

$CF = U \times (\Delta T_{cooling} - 0.46 \times DR) = 2.84(7.9 - 0.46 \times 11,9) = 6,9\ w/m^2$

$ED = 559$

$Ed = 188$

west windows of detached house - $FFS = 0.31$

$SHGC = 0.54$

PXI = Ed + Ed = 747

CF = PXI X SHGC X IAC X FFS = 747 X 0.54 X 1 X 0.56
= 225.9

$CF_{fenestration}$ = U($\Delta T_{cooling}$ - 0.46 X DR) + PXI X SHGC X IAC X FFS =
= 6.9 + 225.9 = 232.8 w/m^2

$Q_w = CF_{fenestration} X A = 232.8 X 14.4 = 3352.32 w$

③ A = 3.6 (south)

Heating

U = 2.84 w/m^2K

HF = U south X $\Delta T_{heating}$ = 2.84 X 24.8 = 70.44 w/m^2

Q = HF X A = 70.44 X 3.6 = 253.6

Cooling

CF = U($\Delta T_{cooling}$ - 0.46 X DR) = 2.84(7.9 - 0.46 X 11.9) = 6.9 w/m^2

ED = 348

Ed = 209

SHGC = 0.56

PXI = ED + Ed = 348 + 209 = 557

CF = PXI X SHGC X IAC X FF_S = 557 X 0.54 X 1 X 0.47 = 141.4

$CF_{fenestration}$ = U(ΔT - 0.46 X DR) + PXI X SHGC X IAC X FF_S =

6.9 + 141.4 = 148.3 w

$Q = CF_{fenestration} X A = 148.3 X 3.6 = 533.88 w$

④ A = 3.6

U = 2.87 w/m^2K

HF = U X $\Delta T_{heating}$ = 2.87 X 24.8 = 71.17 w/m^2

Q = HF X A = 71.17 X 3.6 = 256.2 w

Cooling

$CF = U(\Delta T_{cooling} - 0.46 \times DR) = 2.87(7.9 - 0.46 \cdot 11,9) =$

$CF = 6.96\ w/m^2$

Part a for Irradiation part:

ED = 348

Ed = 209

south window of a detached house - FFS = 0.46

SHGC = 0.46 PXI = ED + Ed = 348 + 209 = 557

$CF = PXI \times SHGC \times IAC \times FFS = 557 \times 0.46 \times 1 \times 0.46 = 120.4$

$CF_{fenestration} = U(\Delta T_{cooling} - 0.46 \times DR) + PXI \times SHGC \times IAC \times FFS =$

$127.3\ w/m^2$

$Q = CF_{fenestration} \times A = 127.3 \times 3.6 = 458.28\ w$

$Q_{total\ cooling} = 1900.8 + 3352.32 + 533.88 + 458.28 =$

$6245.3\ w$

$Q_{Total\ Heating} = 1014.2 + 1014.2 + 253.6 + 256.2 =$

$2538.2\ w$

Aluminium Frame

①

$A = 14,4\ m^2$

Heating

$U = 3.67\ w/m^2K$

$HF = U \times \Delta T_{heating} = 3.67 \times 24.8 = 89.32\ w/m^2$

$Q = HF \times A = 89.52 \times 14.4 = 1289.1\ w$

$CF = U(\Delta T_{cooling} - 0.46 \times DR) = 3.61 \times (7.9 - 0.46 \times 11.9)$

$8.7\ w/m^2$ SHGC = 0.56

ED = 559 PX1 = ED + Ed = 559 + 188 = 747

Ed = 188 CF = PX1 × SHGC × IAC × FFS = 129.6

$CF_{fenestration} = U(\Delta T_{cooling} - 0.46\ DR) + PX1 \times SHGC \times IAC \times FFS$

$= 138.3\ w/m^2$

$Q = CF_{fenestration} \times A = 1991.5\ w$

② $U = 3.61\ w/m^2 K$

$HF = U \times \Delta T_{heating} = 3.61 \times 24.8 = 70.44$

$Q = HF \times A = 89.52 \times 14.4 = 1289.1\ w$

cooling

$CF = U(\Delta T_{cooling} - 0.46 \times DR) = 3.61(7.9 - 0.46 \times 11.9) = 8.7\ w/m^2$

ED = 559

Ed = 188 wes window of a detached house = 0.56

SHGC = 0.56

PX1 = ED + Ed = 559 + 188 = 747

CF = PX1 × SHGC × IAC × FFG = 747 × 0.56 × 1 × 0.56

$CF_{fenestra} = U(\Delta T_{cooling} - 0.46 \times DR) + PX1 * SHGC \times IAC \times FFS =$

$= 8.7 + 234.26 = 242.96\ w$

$Q = CF_{fenestration} \times A = 242.96 \times 14.4 = 3498.6\ w$

③ $A = 3.6\ m^2$

$U = 3.61\ W/m^2K$

$HF = U \times \Delta T_{cooling} = 3.61 \times 24.8 = 89.52\ W/m^2$

$Q = HF \times A = 89.52 \times 3.6 = 322.2\ W$

Cooling

$CF = U(\Delta T_{cooling} - 0.46 \times DR) = 3.61(7.9 - 0.46 \times 11.9) = 8.7\ W/m^2$

$ED = 348$

$Edd = 209$

South window of a detached house $- FFS = 0.47$

$SHGC = 0.56$

$PXI = ED + Ed = 348 + 209 = 557$

$CF = PXI \times SHGC \times IAC \times FFS = 557 \times 0.56 \times 1 \times 0.47 = 146.6$

$CF_{fenestration} = 155.3\ W/m^2$

$Q = CF \times A = 155.3 \times 3.6 = 559.08\ W$

④ $A = 3.6 m^2$

Heating

$U = 4.62\ W/m^2K$

$HF = U \times \Delta T_{cooling} = 4.62 \times 24.8 = 114.57\ W/m^2$

$Q = HF \times A = 114.57 \times 3.6 = 412.4\ W$

cooling

Heat transfer Part

$CF = U(\Delta T - 0.46 \times DR) = 4.62(7.9 - 0.46 \times 11.9) = 11.2\ W/m^2$

$ED = 348$ $SHGC = 0.55$

$Ed = 209$ $PXI = ED + Ed = 557$

$CF = PXL \times SHGC \times IAC \times FFS = 557 \times 0.55 \times 1 \times 0.47 = 143.95$

$CF_{fenestration} = U(\Delta T_{cooling} - 0.46 \Delta DR) + PXL \times SHGC \times IAC \times FFS$

$= 11.2 + 143.98 = 155.18$

$Q = CF_{fenestration} \times A = 155.18 \times 3.6 = 558.65$

Q Total windows Aluminum $\overset{\text{Max}}{\underset{\text{cooling}}{=}}$ 6607.8 w

" " " heating = 3312.8 w

Q_T Alumm is more than wood frame