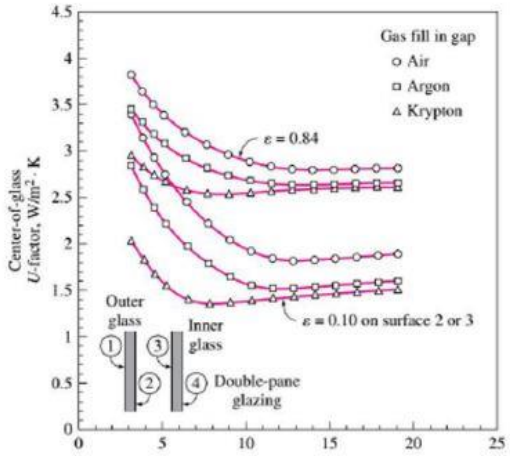
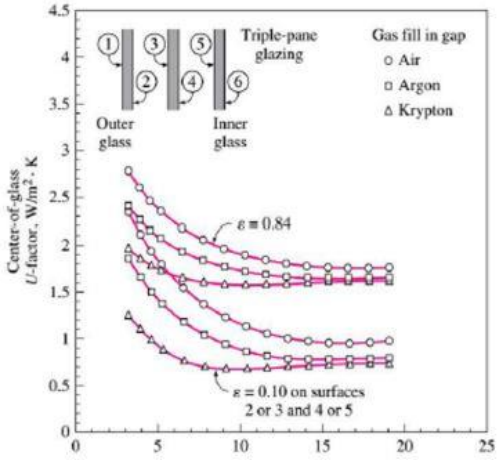
WEEK 8 – ASSIGNMENT

Task 1 Using the diagrams given in the presentation calculate how much (%) is the effect of applying different modifications (changing the gas, adding an extra pane, using a low emissivity coating) on the U value with respect to a benchmark case of double layer with air and no coating ? (keep the gap thickenss to be 13 mm)





PANEL WITH AIR GAP 13mm			U-VALUE	EFFECT %
D-PG	AIR BETWEEN	N-COATING	2.80	0%
D-P	ARGON	N-COATING	2.65	5%
D-P	KRYPTON	N-COATING	2.60	7%
D-P	AIR	COATING IP	1.80	36%
D-P	ARGON	COATING IP	1.55	45%
D-P	KRYPTON	COATING IP	1.40	50%
TP	AIR	NO-COATING	1.80	36%
TP	ARGON	NO-COATING	1.65	41%
TP	KRYPTON	NO-COATING	1.55	45%
TP	AIR	COATING IP	1.00	64%
TP	ARGON	COATING IP	0.8	71%
TP	KRYPTON	COATING IP	0.70	75%

Task 2 Consider the house that we analysed in the alst two examples, calculate the heating and cooling load of the other windows which are fixed 14.4 m2 on the west, fixed 3.6 m2 on the south and an operable 3.6 m2 on the south (the same window and frame type). How much does the total value change if I change the frame of the window from wooden one to aluminium ?

CASE 1 : FIXED WINDOW ON WEST :

Cooling load :

Frame : wood

$q_{windowW} = A*CF_{windowW}$; A= 14,4 m²

$Cf_{windowWheattransfer} = U_{windowW} (\Delta T_{cooling}-0,46\ DR) = 2,84*(7,9-0,46*11,9)$

$Cf_{windowWheattransfer}$ =6,89 w/m²

$PXI_{windowW} = E_D+E_d = 559+188=747$; SHGC =0,54 ; IAC = 1 ; F_{fs} = 0,56

$Cf_{windowWirradiation} = PXI*SHGC*IAC*FF_s = 747*0,54*1*0,56$

$Cf_{windowWirradiation}$ =225,9

$q_{windowW} = A*CF_{windowW} = A*(CF_{windowWheattransfer} + CF_{windowWirradiation})= 14,4 * (6,89+225,9)$

$q_{windowW}$ = 3352,17 W

Heating load :

Frame : aluminium

$q_{windowW} = A*HF_{windowW} = A*U_{windowW}\ \Delta T_{heating} = 14,4*2,84*24,8$

$q_{windowW}$ = 1014,22 W

$U_{windowW}$ = 3,61 ; HSGC=0,56

$CF'_{windowWheattransfer} = U'_{windowW} *((\Delta T_{cooling}-0,46\ DR) =3,61*(7,9-0,46*11,9)$

$CF'_{windowWheattransfer}$ =

8,76 Cooling load :

$q'_{windowW} = A*CF'_{windowW} = A*(CF'_{windowWheattransfer} + CF'_{windowWirradiation})$

$=14,4* (8,76+234,26)$

$q'_{windowW}$ =3499,49 W

Heating load :

q'windowW = A*HF'windowW = A*U'windowW* ΔTheating = 14,4*3,61*24,8

q'windowW = 1289,2 W

CASE 2: FIXED WINDOW ON SOUTH:

Cooling load :

Frame : wood

qwindowS = A*CFwindowS ; A= 3,6 m²

CfwindowSheattransfer = UwindowS (ΔTcooling-0,46 DR) = 2,84*(7,9-0,46*11,9)

CfwindowSheattransfer =6,89 w/m²

PXIwindowS = ED+Ed = 348+209=557 ; SHGC =0,56 ; IAC = 1 ; Ffs = 0,47

CfwindowSirradiation = PXI*SHGC*IAC*FFs = 557*0,56*1*0,47

CfwindowSirradiation = 146,60

qwindowS = A*CFwindowS = A*(CFwindowSheattransfer + CFwindowSirradiation)= 3,6 * (6,89+146,60)

qwindowW = 552,56 W

Heating load :

Frame : aluminium

qwindowS = A*HFwindowS= A*UwindowS ΔTheating = 3,6*2,84*24,8

qwindowW = 253,56 W

UwindowS = 3,61 ; HSGC=0,56

CF'windowSheattransfer = $U'_{windowS}$ *((ΔTcooling-0,46 DR) =3,61*(7,9-0,46*11,9)

CF'windowWheattransfer = 8,76 W/m²

Cooling load :

q'windowS = A*CF'windowS = A*(CF'windowSheattransfer + CF'windowSirradiation) =3,6* (8,76+146,60)

q'windowS=559,3 W

Heating load :

q'windowS = A*HF'windowS = A*U'windowS* ΔTheating = 3,6*3,61*24,8

q'windowW = 322,3 W

CASE 3: OPERABLE WINDOW ON SOUTH:

COOLING LOAD FOR THE OPERABLE:

qwindowS = A*CFwindowS ; A= 3,6 m²

CfwindowSheattransfer = UwindowS (ΔTcooling-0,46 DR) = 2,87*(7,9-0,46*11,9)

CfwindowSheattransfer =6,96 w/m²

PXIwindowS = ED+Ed = 348+209=557 ; SHGC =0,46 ; IAC = 1 ; Ffs = 0,47

CfwindowSirradiation = PXI*SHGC*IAC*FFs = 557*0,46*1*0,47

CfwindowSirradiation = 120,42

qwindowS = A*CFwindowS = A*(CFwindowSheattransfer + CFwindowSirradiation)= 3,6 * (6,96+141,36)

qwindowS = 533,97 W

HEATING LOAD **(fixed window):**

qwindowS = A*HFwindowS= A*UwindowS ΔTheating = 3,6*2,87*24,8

qwindowW = 256,23 W

with aluminium frame :

UwindowS = 3,61 ; HSGC=0,56

CF'windowSheattransfer = $U'_{windowS}$ *((ΔTcooling-0,46 DR) =4,62*(7,9-0,46*11,9)

CF'windowWheattransfer = 11,21 W/m²

Cooling load :

q'windowS = A*CF'windowS = A*(CF'windowSheattransfer + CF'windowSirradiation) =3,6* (11,21+143,98)

q'windowS=558,7 W

Heating load :

$q'_{windowS} = A*HF'_{windowS} = A*U'_{windowS}* \Delta T_{heating} = 3,6*4,62*24,8$

$q'_{windowS}$= 412,47 W