Week 8

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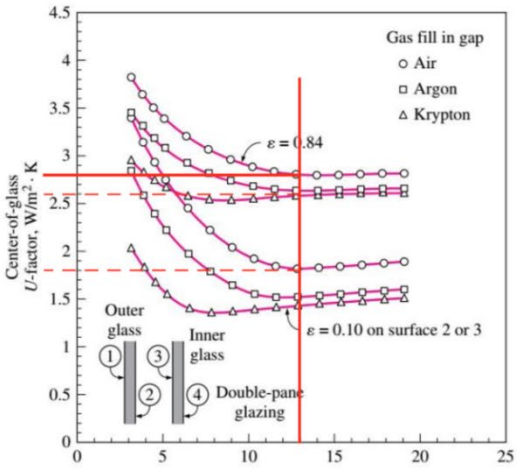
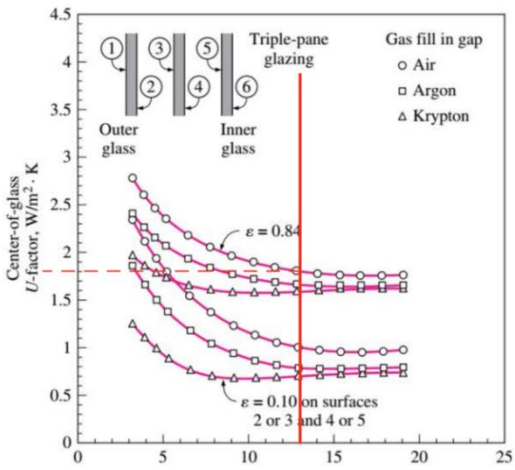
Task 1 Using the given diagrams and calculate how much (%) is the effect of applying different modifications on the U value with respect to a benchmark case of double layer with air and no coating (gap thickness = 13 mm)





2 parallel planes	U- value	Difference	percentage
w/air	2.8 W/m^2	0	0%
w/argon	2.65 W/m^2	0.15 W/m^2	5.36%
w/krypton	2.6 W/m^2	0.20 W/m^2	7.14%

3 parallel planes	U- value	Difference	percentage
w/air	1.8 W/m^2	1 W/m^2	35.7%
w/argon	1.7 W/m^2	1.1 W/m^2	39.2%
w/krypton	1.6 W/m^2	1.20 W/m^2	42.8

Task 2　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. How much does the total value change if I change the frame of the window from wooden one to aluminum?

PIACENZA, Italy　　WMO#: **160840**

Lat: **44.92N**　Long: **9.73E**　Elev: **138**　StdP: **99.68**　Time Zone: **1.00 (EUW)**　Period: **89-10**　WBAN: **99999**

Annual Heating and Humidification Design Conditions

Coldest Month	Heating DB		Humidification DP/MCDB and HR						Coldest month WS/MCDB				MCWS/PCWD to 99.6% DB	
	99.6%	99%	99.6%			99%			0.4%		1%			
			DP	HR	MCDB	DP	HR	MCDB	WS	MCDB	WS	MCDB	MCWS	PCWD
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)
1	-6.2	-4.8	-11.6	1.4	3.1	-8.8	1.8	1.8	8.8	5.6	7.7	6.2	2.1	250

(1)

Annual Cooling, Dehumidification, and Enthalpy Design Conditions

Hottest Month	Hottest Month DB Range	Cooling DB/MCWB						Evaporation WB/MCDB						MCWS/PCWD to 0.4% DB	
		0.4%		1%		2%		0.4%		1%		2%			
		DB	MCWB	DB	MCWB	DB	MCWB	WB	MCDB	WB	MCDB	WB	MCDB	MCWS	PCWD
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)
8	11.9	33.1	22.7	31.9	22.4	30.3	21.8	24.6	30.2	23.7	29.2	22.9	28.3	2.4	90

(2)

$DT_{cooling}$=31.9-24=7.9℃;　$DT_{heating}$ = 20 +4.8 =24.8℃;　DR=11.9℃

West window: fixed 14.4 m²

Wood frame:　Cooling Load: $Q_{w\text{-}window}$= A*$CF_{w\text{-}window}$

$CF_{w\text{-}window}$= $CF_{w\text{-}window\text{-}con}$ +$CF_{w\text{-}window\text{-}rad}$

$CF_{w\text{-}window}$= U(DT – 0.46DR)+ PXI*SHGC*IAC*FFs

$CF_{w\text{-}window\text{-}con}$= 2.84(7.9-(0.46*11.9)=6.89 w/m²

$CF_{w\text{-}window\text{-}rad}$ = PXI*SHGC*IAC*FFs

PXI = ED- Ed = 559+188 = 747

$CF_{w\text{-}window\text{-}rad}$= 747*0.54*1*0.56= 225.89w/m²

$CF_{w\text{-}window}$= $CF_{w\text{-}window\text{-}con}$ + $CF_{w\text{-}window\text{-}rad}$= 232.78 w/m²

So $Q_{w\text{-}window}$ = A*CF=3352.07W

Wood frame:　Heating Load: $CF_{w\text{-}window}$ = $U_{w\text{-}window}$*$DT_{heating}$ = 70.43 W/m²

Q = 14.4*70.43 = 1014.19W

Amluminum frame:　Cooling Load: $CF_{w\text{-}window\text{-}con}$ = 8.76W/m²

$CF_{w\text{-}window\text{-}rad}$ = 234.26W/m^2

$CF_{w\text{-}window}$ = 243.02W/m^2

$Q_{w\text{-}window}$= A*$CF_{w\text{-}window}$ = 3499.7W

Amluminum frame: Heating Load: $HF_{w\text{-}window}$ = 89.53W/m^2

$Q_{w\text{-}window}$= A*$HF_{w\text{-}window}$ = 1289.20W

Difference of total value: Cooling load: 147.4W

Heating load: 274.98W

South window: fixed 3.6 m^2 o and operable 3.6 m^2

Wood frame: Cooling Load: $Q_{w\text{-}window}$= A*$CF_{w\text{-}window}$

$F_{w\text{-}window\text{-}con}$ = 2.84*(7.9-(0.46*11.9)) = 6.89 W/m^2

$F_{w\text{-}window\text{-}rad}$ = 557*0354*0.47 = 141.37 W/m^2

$CF_{w\text{-}window}$= $CF_{w\text{-}window\text{-}con}$+$CF_{w\text{-}window\text{-}rad}$ = 148.26 W/m^2

$Q_{s\text{-}window}$= 3.6*148.26 = 533.75W

Wood frame: Heating Load: $HF_{s\text{-}window}$ = $U_{s\text{-}window}$*$DT_{heating}$ = 70.43 W/m^2

$Q_{s\text{-}window}$= 3.6*70.43 = 253W

Amluminum frame: Cooling Load: $CF_{s\text{-}window\text{-}con}$ = 8.76W/m^2

$CF_{s\text{-}window\text{-}rad}$ = 146.60W/m^2

$CF_{s\text{-}window}$ = 155.36W/m^2

$Q_{s\text{-}window}$= A*$CF_{s\text{-}window}$ = 559W

Amluminum frame: Heating Load: $HF_{s\text{-}window} = 89.53W/m^2$

$$Q_{s\text{-}window} = A*HF_{s\text{-}window} = 322.31W$$

Difference of total value: Cooling load: 25.25W

Heating load: 69.31W