WEEK 9 YANG DICHENG

Monday, 16 December 2019 21:09

Task 1

Use a weather forecast website, and utilize the psychrometric chart and the formula we went through in the class to determine the absoloute humidity, the wet-bulb temperature and the mass of water vapour in the air in ClassRoom A (Aula A) of Piacenza campus in the moment that you are solving this exercise (provide the inputs that you utilized)

Il tempo oggi in Piacenza
Lunedi, 16 Dicembre 2019

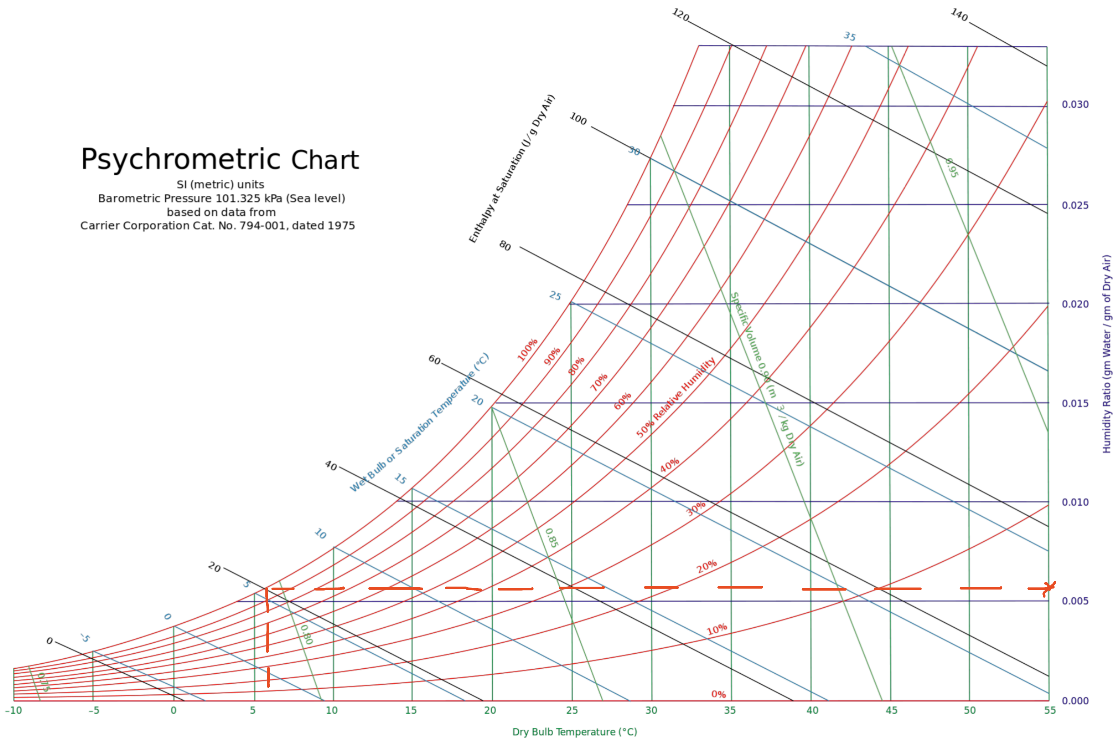
	22:00	23:00
	LightRain	LightRain
Temperatura effettiva	6°C	7°C
Temperatura percepita	6°C	7°C
Precipitazioni	0 mm	0 mm
Umidità	96 %	95 %
Pressione atmosferica	1021 hPa	1020 hPa
Intensità del vento	3 km/h	2 km/h
Direzione del vento	O	O
Probabilità di nebbia	0 %	0 %
Punto di rugiada	6°C	6°C
Nuvole	100 %	100 %
Nuvole basse	100 %	100 %
Nuvole medie	99 %	92 %
Nuvole alte	95 %	100 %

According to the website, at 22:00

The humidity is 96%, so ϕ=96%

The total air pressure is 1021 hPa, P=102.7Kpa

Temperature is 6℃ , T= 6℃



According to the Psychrometric Chart, when the humidity is ϕ=96% and the temperature T=6℃,

THE ABSOLUTE HUMIDITY is ω=0.005

THE WET_BULB TEMPERATURE T_{wb}= 5℃

MASS OF WATER VAPOR

$$V_{\mathrm{room}} = 20X6X6 = 720m^2$$

$$P_v = \frac{P\omega}{0.622+\omega} = \frac{102.7X0.005}{0.622+0.005} = 0.818kg$$

$$m_v = \frac{VP_v}{TR_v} = \frac{0.818X720}{0.4615X(273+6)} = 4.7kg$$

Task 2

Utilize the same methodology we went through in the class and determine the sensible and latent load corresponding to internal gains, the ventilation, and the infiltration in a house with a good construction quality and with the same geometry as that of the example which is located in Brindisi, Italy

BRINDISI, Italy WMO#: **163200**

Lat: **40.65N** Long: **17.95E** Elev: **10** StdP: **101.2** Time Zone: **1.00 (EUW)** Period: **86-10** 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%			0.4%		1%				
		99.6%	99%	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)	2	2.9	4.1	-5.1	2.5	7.2	-3.0	3.0	7.4	13.4	10.2	12.4	10.6	3.4	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)	
(2)	8	7.1	32.8	23.6	31.1	24.3	29.9	24.3	27.2	29.7	26.3	29.0	25.6	28.3	4.2	180	(2)

	Dehumidification DP/MCDB and HR									Enthalpy/MCDB						Hours 8 to 4 & 12.8/20.6	
	0.4%			1%			2%			0.4%		1%		2%			
	DP	HR	MCDB	DP	HR	MCDB	DP	HR	MCDB	Enth	MCDB	Enth	MCDB	Enth	MCDB		
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	
(3)	26.3	21.8	29.2	25.4	20.7	28.5	24.7	19.7	27.9	86.0	30.1	82.2	29.1	78.5	28.3	1236	(3)

Extreme Annual Design Conditions

	Extreme Annual WS			Extreme Max WB	Extreme Annual DB				n-Year Return Period Values of Extreme DB								
					Mean		Standard deviation		n=5 years		n=10 years		n=20 years		n=50 years		
	1%	2.5%	5%		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	
(4)	11.3	9.9	8.7	31.4	0.4	37.3	1.4	3.0	-0.6	39.4	-1.4	41.1	-2.2	42.8	-3.2	44.9	(4)

Noc=2

Height=$2.5m^2$

Conditioned Floor Area=$200m^2$

Internal Gains:

$$\dot{Q}_{igsensible} = 136 + 2.2A_{cf} + 22N_{oc} = 136 + 2.2 \times 200 + 22 \times 2 = 620W$$

$$\dot{Q}_{iglatent} = 20 + 0.22A_{cf} + 12N_{oc} = 20 + 0.22 \times 200 + 12 \times 2 = 88W$$

A_{ul}(GOOD CONSTRUCTION) = $1.4\ cm^2/m^2$

$A_{es} = A_{wall} + A_{roof} = 200 + 144 = 344\ m^2$

$A_L = A_{es} \times A_{ul} = 344 \times 1.4 = 481.6\ cm^2$

The cooling temperature in Brindisi is $T_{cooling} = 24\ °C$ and heating temperature $T_{heating} = 20°C$ in Brindisi

$\Delta T_{cooling} = 31.1 - 24 = 7.1°C = 7.1K$

$\Delta T_{heating} = 20 - (-4.1) = 24.1°C = 24.1K$

$DR = 7.1°C = 7.1K$

$IDF_{heating} = 0.073\ L/s \cdot cm^2$

$IDF_{cooling} = 0.033\ L/s \cdot cm^2$

$\dot{V}_{infiltration\ heating} = A_L \times IDF_{heating} = 481.6 \times 0.073 = 35.157\ L/S$

$\dot{V}_{infiltration\ cooling} = A_L \times IDF_{cooling} = 481.6 \times 0.033 = 15.89\ L/$

$\dot{V}_{ventilation} = 0.05A_{cf} + 3.5(N_{br} + 1) = 0.05 \times 200 + 3.5 \times (1 + 1) = 17\ L/S$

$\dot{V}_{inf-ventilation\ heating} = 35.157 + 17 = 52.157\ L/S$

$\dot{V}_{\text{inf–ventilation cooling}} = 15.89 + 17 = 32.893\ \text{L/S}$

$C_{\text{sensible}} = 1.23, C_{\text{latent}} = 3010, \Delta\omega_{\text{cooling}} = 0.0039$

$\dot{Q}_{\text{inf–ventilation cooling sensible}} = C_{\text{sensible}} \times \dot{V} \times \Delta T_{\text{cooling}} = 1.23 \times 32.893 \times 7.1 = 287.25\text{W}$

$\dot{Q}_{\text{inf–ventilation heating sensible}} = C_{\text{sensible}} \times \dot{V} \times \Delta T_{\text{heating}} = 1.23 \times 52.157 \times 24.1$
$= 1546.09\text{W}$

$\dot{Q}_{\text{inf–ventilation cooling latent}} = C_{\text{lantent}} \times \dot{V} \times \ \Delta\omega_{\text{cooling}} = 3010 \times 32.893 \times 0.0039$
$= 386.13\text{W}$