Weeklysubmission-9

1.

Absolute

Il tempo oggi in Piacenza
Martedì, 03 Dicembre 2019

	13:00	14:00	16:00	18:00	20:00	21:00	22:00
	LightCloud	LightCloud	PartlyCloud	LightCloud	Sun	Sun	Sun
Temperatura effettiva	9°C	10°C	8°C	6°C	4°C	2°C	2°C
Temperatura percepita	7°C	10°C	6°C	4°C	2°C	0°C	0°C
Precipitazioni	0 mm	0 mm	0 mm	0 mm	0 mm	0 mm	0 mm
Umidità	67 %	65 %	69 %	70 %	75 %	83 %	87 %
Pressione atmosferica	1025 hPa	1025 hPa	1025 hPa	1026 hPa	1027 hPa	1027 hPa	1028 hPa
Intensità del vento	15 km/h	14 km/h	9 km/h	9 km/h	7 km/h	8 km/h	8 km/h
Direzione del vento	E	E	E	E	SE	SE	SE
Probabilità di nebbia	0 %	0 %	0 %	0 %	0 %	0 %	0 %
Punto di rugiada	3°C	3°C	3°C	1°C	-1°C	0°C	-1°C
Nuvole	21 %	13 %	42 %	15 %	2 %	3 %	3 %
Nuvole basse	11 %	7 %	42 %	15 %	2 %	3 %	3 %
Nuvole medie	18 %	12 %	2 %	0 %	1 %	0 %	0 %
Nuvole alte	0 %	0 %	0 %	0 %	0 %	0 %	0 %

03/12/19, 18:00,
Temperature: 6 $°C$
Relative humidity: 70%
P=1026 hPa= 102.6 kPa
Aula A volume=10m*20m*3 m

Absolute Humidity: $0.642 \frac{Kg_{vapour}}{kg_{dryAir}}$
Wet-bulb temperature: 4 $°C$
The mass of water vapour:3 kg

Absolute Humidity:

$\phi = \frac{m_v}{m_g} \quad --> m_g the\ mass\ of\ water\ at\ sat\ condition$

From Steam tables I can find the saturation pressure of water 6 C = 0.0093 bar= 0.93 kPa

$\phi = \frac{m_v}{m_g} = \frac{P_v}{P_g} --> P_g = P_{sat} 6\ °C = 0.93\ kPa$

$$\phi = \frac{P_v}{P_g} \rightarrow P_V = \phi \times P_g = 0.7 * 0.93 = 0.651\ kPa$$

$partial\ pressure\ of\ dry\ air{:}\ \ P_a = P - P_v$
$= 100\ kPa - 0.651\ kPa = 99.349\ kPa$

$$\omega = 0.622\frac{P_v}{P_a} = 0.622\frac{102.6}{99.349} = 0.642\frac{Kg_{vapour}}{kg_{dryAir}}$$

The mass of water vapour

for ideal gases : $m = \frac{PV}{R_{sp.}T}$

for air : $m_a = \frac{P_a V_a}{R_a \mathrm{T}}$

From the table

$R_a = 0.287,\ R_v = 0.4615$

$$m_a = \frac{99.349 * (10 * 20 * 3)}{0.287 * (273 + 6)} = 744.4\ kg$$

$$m_v = \frac{0.651 * (10 * 20 * 3)}{0.4615 * (273 + 6)} = 3\ kg$$

2.

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)

Internal Gains

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

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

Infiltration

Table 3 Unit Leakage Areas

Construction	Description	A_{ul}, cm^2/m^2
Tight	Construction supervised by air-sealing specialist	0.7
Good	Carefully sealed construction by knowledgeable builder	1.4
Average	Typical current production housing	2.8
Leaky	Typical pre-1970 houses	5.6
Very leaky	Old houses in original condition	10.4

Good quality - $A_{ul} = 1.4 \frac{cm^2}{m2}$

Exposed surface = Wall area +roof area

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

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

$IDF_{heating} = 0.073 \frac{L}{s.\,cm^2}$

$IDF_{cooling} = 0.032 \frac{L}{s.\,cm^2}$

Table 5 Typical IDF Values, L/(s·cm²)

H, m	Heating Design Temperature, °C					Cooling Design Temperature, °C			
	−40	−30	−20	−10	0	10	30	35	40
2.5	0.10	0.095	0.086	0.077	0.069	0.060	0.031	0.035	0.040
3	0.11	0.10	0.093	0.083	0.072	0.061	0.032	0.038	0.043
4	0.14	0.12	0.11	0.093	0.079	0.065	0.034	0.042	0.049
5	0.16	0.14	0.12	0.10	0.086	0.069	0.036	0.046	0.055
6	0.18	0.16	0.14	0.11	0.093	0.072	0.039	0.050	0.061
7	0.20	0.17	0.15	0.12	0.10	0.075	0.041	0.051	0.068
8	0.22	0.19	0.16	0.14	0.11	0.079	0.043	0.058	0.074

$\dot{V}_{infiltration_{heating}} = A_L \times IDF = 481.6 * 0.073 = 35.16 \frac{L}{s}$

$$\dot{V}_{infiltration_{cooling}} = A_L \times IDF = 481.6 * 0.033 = 15.89 \frac{L}{s}$$

Ventilation

$\dot{V}_{ventilation} = 0.05\ A_{cf} + 3.5\ (N_{br} + 1)$
= 0.05*200+ 3.5* 2 = 17 L/S
$\dot{V}_{inf-ventilation_{heating}} = 35.16 + 17 = 52.16\ L/s$
$\dot{V}_{inf-ventilation_{cooling}} = 15.89 + 17 = 32.89\ L/s$