

CHAPTER 4

ESTABLISHMENT AND CALCULATION AIR CONDITIONING DIAGRAM

4.1 HEAT FACTORS IN AIR CONDITIONER

4.1.1 ROOM SENSIBLE HEAT FACTOR: RSHF

$$\varepsilon_{hf} = \frac{Q_{hf}}{Q_{hf} + Q_{af}}$$

Where:

Q_{hf} : Total sensible heat of room (no sensible heat of fresh air), (W)

Q_{af} : Total latent heat of room (no latent heat of fresh air), (W)

4.1.2 GRAND SENSIBLE HEAT FACTOR: GSHF

$$\varepsilon_{ht} = \frac{Q_h}{Q_h + Q_a} = \frac{Q_{hf} + Q_{hN}}{(Q_{hf} + Q_{hN}) + (Q_{af} + Q_{aN})} = \frac{Q_h}{Q_t}$$

Where:

Q_h : total sensible heat of conditioning space including heat is due to bring in fresh air (W)

Q_a : total latent heat of conditioning space including heat is due to bring in fresh air (W)

Q_t : Total excess heat used to calculate cooling load $Q_0 = Q_1$ (W).

4.1.3 BYPASS FACTOR: ε_{BF}

$$\varepsilon_{BF} = \frac{G_H}{G_H + G_O} = \frac{G_H}{G}$$

Where:

G_H : Airflow through the cooling coil but not heat moisture exchange, (kg/s)

G_O : Airflow through the cooling coil but with heat moisture exchange, (kg/s)

G : Total airflow through the cooling coil, (kg/s)

Bypass factor following [table 4.22 1, page 162].

$$\Rightarrow \epsilon_{BF} = 0.15$$

4.1.4 EFFECTIVE SENSIBLE HEAT FACTOR: ESHF

$$\epsilon_{hef} = \frac{Q_{hf} + \epsilon_{BF} \cdot Q_{hN}}{(Q_{hf} + \epsilon_{BF} \cdot Q_{hN}) + (Q_{af} + \epsilon_{BF} \cdot Q_{aN})}$$

Where:

Q_{hN} : Sensible heat is brought by fresh air, (W)

Q_{aN} : Latent heat is brought by fresh air, (W)

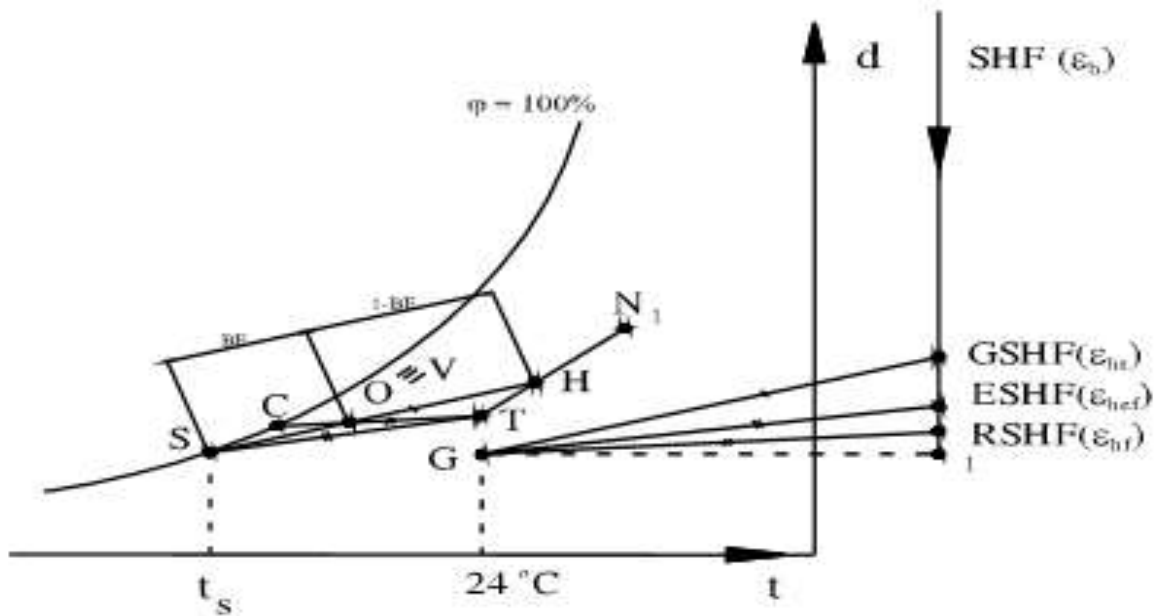


Figure 4.1. Diagram single stage air conditioner with effective factors, by pass factor and interact with points H,T,O,S

4.1.5 Dew point temperature of equipment

Table 4.24 [1, page 166] or t-d graph we choose dew point of device.

4.1.6 Air temperature after indoor unit

$$\epsilon_{BF} = \frac{t_O - t_S}{t_H - t_S}$$

$$t_O = t_S + \epsilon_{BF} \times (t_H - t_S) = t_V$$

$$t_H = \frac{G_N \times t_N + G_T \times t_T}{G}$$

Where:

t_N, t_T :Outside & inside temperature, °C

G_N, G_T, G : Fresh airflow, recirculating air and total, kg/s

$$G = G_N + G_T$$

4.1.7 Check the room temperature and blow in temperature

$$\Delta t_{VT} = t_T - t_V$$

Where:

t_T : Required temperature in air conditioned space, °C

t_V : Air temperature after cooling coil, °C

- If hygienic, $\Delta t_{VT} \leq 10$ K calculate the airflow.
- If don't hygienic, $\Delta t_{VT} \geq 10$ K it is necessary to use other measures to reduce the blowing temperature (use the diagrams 2 stage air conditioner or additional heating), because the temperature is too low, it will affect human health
- If the demand for the blower temperature is satisfied, calculate the airflow through the cooling coil by formula:

$$L = \frac{Q_{nef}}{1,2(t_T - t_s)(1 - \varepsilon_{BF})}$$

Where: L - Airflow, l/s

4.1.8 Cooling capacity of air conditioning system

$$Q_0 = G \times (I_H - I_V)$$

$$G = \rho \times L$$

$$L = L_N + L_T$$

Where:

Q_0 – Cooling capacity, kW

G – Mass flow rate, kg/s

ρ – Density of air $\rho = 1.2$ (kg/m^3)

L – Volumetric flow rate, m^3/s

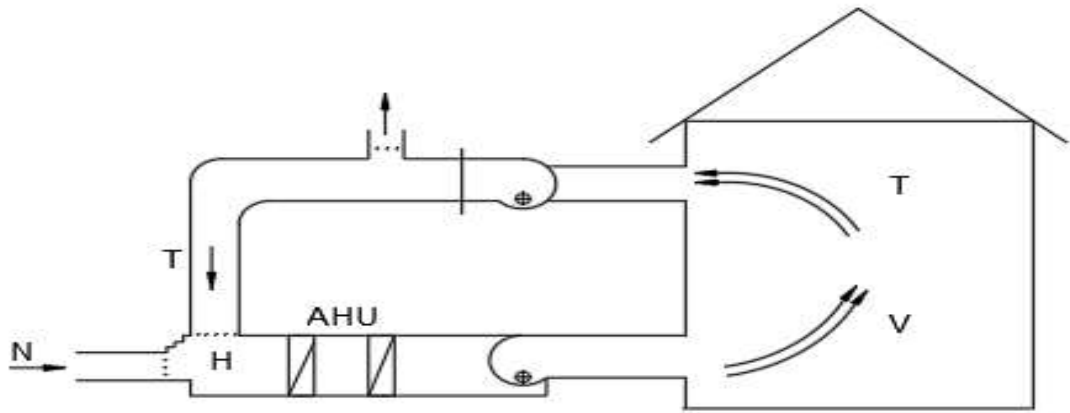
L_N – Fresh air intake, l/s

L_T – Air circulation, l/s

I_H – air enthalpy at the mixing point \equiv air into the cooling coil, kJ/kg

I_V – air enthalpy at the blow in point \equiv ar out of the cooling coil, kJ/kg

4.1.9 Air conditioner diagram



N: Outdoor Air H: Mixing Air
 T: Indoor Air V: Blowing air

Figure 4.2 Air circulate diagram 1 stage

This diagram using part of the air conditioning was mixed with fresh air. Has the advantages of simple, economical, while ensuring the hygienic requirements of air conditioning for comfort areas have no harmful gases.

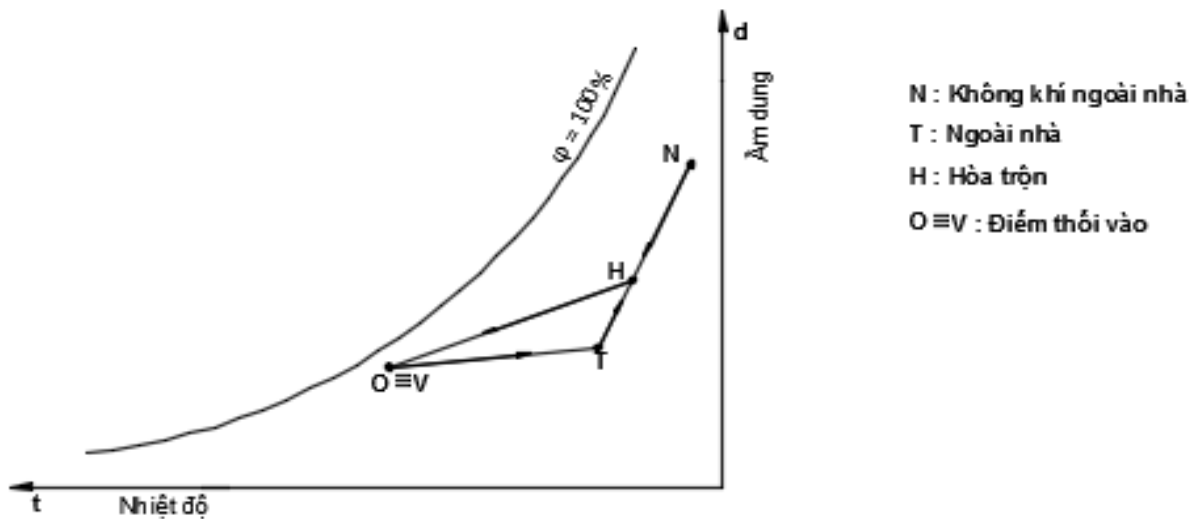


Figure 4.3 Air conditioning diagram on graph t-d

The state of the outdoor air :

- Room temperature outside $t_N = 36\text{ }^\circ\text{C}$

- $\phi_N = 50.1\%$

The state of the indoor air:

- Room temperature $t_T = 27\text{ }^\circ\text{C}$. *The temperature inside the room always ensures comfort for people inside the room*
- $\phi_T = 60\%$

Determine the mixing point parameters :

$$t_H = \frac{L_N \cdot t_N + L_T \cdot t_T}{L}$$

4.1.10 Example

In this section the group decided to select the Fire room on the ground floor as a typical room to calculate the establishment of the air-conditioner scheme and select AHU, FCU.

$$\varepsilon_{hf} = \frac{Q_{hf}}{Q_{hf} + Q_{af}} = \frac{4109.7}{4109.7 + 949.3} = 0.81$$

$$\varepsilon_{ht} = \frac{Q_h}{Q_h + Q_a} = \frac{4109.7 + 4188.9}{(4109.7 + 4188.9) + (949.3 + 1079.3)} = 0.8$$

Select $\varepsilon_{BF} = 0.15$, according to table 4.22 [1, page 162].

$$\varepsilon_{hef} = \frac{4109.7 + 0.15 \times 4188.9}{(4109.7 + 0.15 \times 4188.9) + (949.3 + 0.15 \times 1079.3)} = 0.81$$

- With the temperature and humidity conditions of the internal air as selected to design the air conditioner for the operating room: $t_T = 27\text{ }^\circ\text{C}$, $\phi = 60\%$ and $\text{ESHF}=0.81$.
- Look at table 4.24, we have the dew point temperature of the device $t_s = 17.5\text{ }^\circ\text{C}$.
- Air flow through indoor unit:

$$L = \frac{4125.54}{1.2(27 - 17.5)(1 - 0.15)} = 425.75 \left(\frac{L}{s}\right)$$

NO	ROOM NAME	CODE ROOM	RSHF	GSHF	ESHF	ts	L

CENTRAL PLANT-1F							
1	Fire room	104	0.81	0.80	0.81	17.5	425.75
2	Corridor	1CR	0.63	0.59	0.62	15	267.42
3	Server room	D101	0.95	0.94	0.95	18	13060.93
4	Server room support	D102	0.71	0.68	0.71	16	496.63
5	Chillers and Pumps room	C101	1.00	1.00	1.00	18.6	361718.89
6	Corridor	E106	0.78	0.76	0.78	17	2008.17
7	Fuel Storage Tank	E101	0.83	0.82	0.83	17.5	780.89
8	Transformer room	E102	0.83	0.83	0.83	17.5	1542.64
9	Medium voltage switchgear room	E103	0.84	0.84	0.84	17.5	1631.92
10	Transformer room	E104	0.89	0.88	0.89	18	2665.66
11	Low voltage switchgear room	E105	0.86	0.85	0.86	17.5	1801.42
12	Corridor	1CR2	0.54	0.51	0.54	4.5	90.76
13	Control center	W103	0.77	0.76	0.77	17	865.20
14	Technical room	W102	0.82	0.81	0.82	17.5	546.36
15	Odor treatment room	W101	0.80	0.78	0.80	17.5	502.84
CENTRAL PLANT-2F							
16	UPS battery room	D201	0.79	0.77	0.79	17.5	336.53
17	Corridor	2CR3	0.59	0.55	0.58	13	186.54
18	Server room support	D200	0.96	0.95	0.95	18	6195.27
19	Server room	D202	0.95	0.95	0.95	18	6393.21
20	Storage	D205	0.78	0.75	0.77	17	221.17
21	Corridor	2CR2	0.64	0.60	0.63	15	335.77
22	Janitor	2JC1	0.78	0.75	0.77	17	239.78
23	Corridor-hành lang	2CR4	0.62	0.58	0.61	13	233.99
24	Electrical workroom area	D203	0.74	0.72	0.74	17	480.47
25	Control room	D204	0.77	0.76	0.77	17	348.29
CENTRAL PLANT-RF							
26	Cooling towers	C301	0.96	0.96	0.96	18.6	16896.85
27	Generator room	E301	0.79	0.78	0.79	17	1175.94
28	Mechanical room	300B	0.76	0.74	0.76	17	721.17
29	AHU sever	D301	0.78	0.77	0.78	17	865.62
LIBRARY-1F							
30	Conference/Training room	114	0.73	0.70	0.73	16	1247.08
31	Storage	114A	0.68	0.64	0.67	16	183.06
32	Janitor	1JC1	0.78	0.74	0.77	17	153.14
33	Frist Aid	102	0.79	0.76	0.78	17	311.65
34	Aid relaxing room	102B	0.71	0.67	0.70	16	229.54
35	Storage	103A	0.82	0.79	0.82	17.5	265.66

36	Book return room	101	0.79	0.76	0.78	17	361.57
37	Corridor	1CR1	0.72	0.69	0.72	16	630.32
38	Post room	104	0.78	0.75	0.77	17	293.12
39	Storage/Receiving	107	0.81	0.78	0.80	17.5	297.74
40	Porter room	113	0.71	0.66	0.69	16	202.93
41	Uni shop	112	0.72	0.68	0.71	16	1311.37
42	Coffee shop	110	0.72	0.68	0.71	16	543.42
43	Coffee Storage room	111	0.81	0.78	0.80	17.5	217.65
44	Mechanical room	109	0.86	0.84	0.86	18	788.10
45	Elec/tele	108	0.71	0.66	0.70	16	205.41
LIBRARY-2F							
46	Journal display/reading	215	0.57	0.53	0.56	10	139.01
47	Journal display/reading	215	0.57	0.53	0.56	10	139.01
48	Journal display/reading	214	0.57	0.53	0.56	10	134.29
49	Journal display/reading	214	0.57	0.53	0.56	10	134.29
50	Group Workroom	217	0.68	0.63	0.67	16	367.52
51	Group Workroom	218	0.68	0.63	0.67	16	367.52
52	Group Workroom	219	0.68	0.63	0.67	16	367.52
53	Group Workroom	220	0.68	0.63	0.67	16	367.52
54	Storage	213	0.75	0.71	0.74	17	124.52
55	Storage	221	0.75	0.71	0.74	17	122.77
56	Storage	210	0.74	0.70	0.74	17	119.28
57	Prints/Storage	209	0.87	0.85	0.87	18	614.92
58	Kitchen/staff lounge	208	0.80	0.76	0.79	17	759.32
59	Directors office	206	0.78	0.75	0.77	17	244.77
60	Assistants desk	205	0.78	0.75	0.77	17	173.59
61	Meeting room	203	0.70	0.65	0.69	16	447.60
62	Computer pool	225	0.71	0.67	0.70	16	1047.47
LIBRARY-3F							
63	Reading theatre	316	0.60	0.56	0.59	13	378.58
64	Reading theatre	BS2	0.61	0.59	0.61	13	685.17
65	Book stacks/Reading room	BS1	0.67	0.64	0.66	15	1994.30
66	Learing room	310	0.48	0.45	0.48	4.5	210.52
67	Learing room	311	0.48	0.45	0.48	4.5	210.52
68	Storage	312	0.70	0.65	0.69	16	76.53
69	Copy/print	313	0.82	0.78	0.81	17.5	247.37
70	Group Workroom	303	0.66	0.62	0.65	15	299.96
71	Group Workroom	304	0.66	0.61	0.65	15	293.40
72	Group Workroom	307	0.65	0.60	0.64	15	267.16
73	Group Workroom	308	0.65	0.60	0.64	15	267.16

74	Group Workroom	309	0.66	0.61	0.65	15	285.20
75	Study carells	315	0.77	0.77	0.77	17	420.95
76	Multimedia workroom	314	0.70	0.67	0.70	16	474.27
LIBRARY-4F							
77	Book stacks/Reading room	BS1	0.66	0.64	0.66	15	1801.12
78	Reading room	BS2	0.63	0.60	0.62	13	597.46
LIBRARY-5F							
79	Yard		0.98	0.98	0.98	18.6	2810.47
80	Roof mechanical room		0.73	0.72	0.73	18	734.30
81	Roof mechanical room		0.74	0.73	0.74	18	724.61
LIBRARY-RF							
82	Open to below-Sky glass		1.00	1.00	1.00	18.6	0.00
83	Roof		1.00	1.00	1.00	18.6	237.58

Table 4.1: Air flow through evaporator:

- We have:

The state of the outdoor air :

- Room temperature outside $t_N = 36 \text{ }^\circ\text{C}$
- $\phi_N = 50.1\%$
 $\Rightarrow i_N = 100 \text{ kJ/kg}; d_N = 18.96 \text{ g/kg}$

The state of the indoor air:

- Room temperature $t_T = 27 \text{ }^\circ\text{C}$. *The temperature inside the room always ensures comfort for people inside the room*
- $\phi_T = 60 \%$
 $\Rightarrow i_T = 60 \text{ kJ/kg}; d_T = 11.4 \text{ g/kg}$

Determine the mixing point parameters :

$$t_H = \frac{L_N \cdot t_N + L_T \cdot t_T}{L}$$

Which: $L_N = n \cdot l = 2 \times 7.5 = 15 \text{ l/s}$, $L_T = L - L_N = 425.75 - 15 = 410.75$

Which: L_N – Air entering the room

$$\Rightarrow t_H = \frac{15 \times 36 + 410.75 \times 27}{425.75} = 27.32$$

Look up t-d graph: H point is on NT line

$i_H = 61 \text{ kJ/kg}$

Look up t-d graph: Determination of O: paraments after the indoor unit

$$I_0 = 42 \text{ kJ/kg}$$

In which:

- G: Mass flow of air entering the room .
- $G = \rho \cdot L$ (kg/s)
- $G = 1.2 \times 10^{-3} \times 425.75 = 0.51$ (kg/s)

Actual refrigerated load of the room :

$$Q_0 = G \cdot (I_H - I_0) = 0.51 \times (61 - 42) = 9.69 \text{ (kW)}$$

So, the cooling capacity for Fire room is:

$$Q_0 = 9.69 \text{ (kW)}$$

NO	ROOM NAME	L	LN	LT	tH	tO	G	Qo	Δt
CENTRAL PLANT-1F									
1	Fire room	425.75	15	410.75	27.32	18.97	0.51	9.46	8.03
2	Corridor	267.42	75	192.42	29.52	17.18	0.32	6.32	9.82
3	Server room	13060.93	150	12910.93	27.10	19.37	15.67	278.55	7.63
4	Server room support	496.63	60	436.63	28.09	17.81	0.60	10.80	9.19
5	Chillers and Pumps room	361718.89	37.5	361681.39	27.00	19.86	434.06	7441.33	7.14
6	Corridor	2008.17	75	1933.17	27.34	18.55	2.41	41.17	8.45
7	Fuel Storage Tank	780.89	15	765.89	27.17	18.95	0.94	15.67	8.05
8	Transformer room	1542.64	15	1527.64	27.09	18.94	1.85	30.39	8.06
9	Medium voltage switchgear room	1631.92	15	1616.92	27.08	18.94	1.96	31.66	8.06
10	Transformer room	2665.66	15	2650.66	27.05	19.36	3.20	50.90	7.64
11	Low voltage switchgear room	1801.42	75	1726.42	27.37	18.98	2.16	34.30	8.02
12	Corridor	90.76	37.5	53.26	30.72	8.43	0.11	1.91	9.10
13	Control center	865.20	15	850.20	27.16	18.52	1.04	15.88	8.48
14	Technical room	546.36	15	531.36	27.25	18.96	0.66	9.92	8.04
15	Odor treatment room	502.84	15	487.84	27.27	18.97	0.60	9.02	8.03
CENTRAL PLANT-2F									
16	UPS battery room	336.53	75	261.53	29.01	19.23	0.40	6.33	7.77

17	Corridor	186.54	60	126.54	29.89	15.53	0.22	3.57	7.01
18	Server room support	6195.27	37.5	6157.77	27.05	19.36	7.43	105.86	7.64
19	Server room	6393.21	15	6378.21	27.02	19.35	7.67	107.69	7.65
20	Storage	221.17	75	146.17	30.05	18.96	0.27	4.09	8.04
21	Corridor	335.77	15	320.77	27.40	16.86	0.40	5.59	9.23
22	Janitor	239.78	75	164.78	29.82	18.92	0.29	4.29	8.08
23	Corridor-hành lang	233.99	30	203.99	28.15	15.27	0.28	3.90	9.52
24	Electrical workroom area	480.47	15	465.47	27.28	18.54	0.58	7.67	8.46
25	Control room	348.29	75	273.29	28.94	18.79	0.42	5.83	8.21
CENTRAL PLANT-RF									
26	Cooling towers	16896.85	15	16881.85	27.01	19.86	20.28	260.77	7.14
27	Generator room	1175.94	30	1145.94	27.23	18.53	1.41	18.08	8.47
28	Mechanical room	721.17	30	691.17	27.37	18.56	0.87	11.02	8.44
29	AHU sever	865.62	150	715.62	28.56	18.73	1.04	13.64	8.27
LIBRARY-1F									
30	Conference/Training room	1247.08	37.5	1209.58	27.27	17.69	1.50	18.55	9.31
31	Storage	183.06	15	168.06	27.74	17.76	0.22	2.74	9.24
32	Janitor	153.14	22.5	130.64	28.32	18.70	0.18	2.31	8.30
33	Frist Aid	311.65	37.5	274.15	28.08	18.66	0.37	4.62	8.34
34	Aid relaxing room	229.54	15	214.54	27.59	17.74	0.28	3.30	9.26
35	Storage	265.66	22.5	243.16	27.76	19.04	0.32	3.81	7.96
36	Book return room	361.57	75	286.57	28.87	18.78	0.43	5.33	8.22
37	Corridor	630.32	22.5	607.82	27.32	17.70	0.76	8.70	9.30
38	Post room	293.12	15	278.12	27.46	18.57	0.35	4.02	8.43
39	Storage/Receiving	297.74	37.5	260.24	28.13	19.10	0.36	4.15	7.90
40	Porter room	202.93	150	52.93	33.65	18.65	0.24	3.34	8.35
41	Uni shop	1311.37	75	1236.37	27.51	17.73	1.57	17.49	9.27
42	Coffee shop	543.42	15	528.42	27.25	17.69	0.65	7.11	9.31
43	Coffee Storage room	217.65	30	187.65	28.24	19.11	0.26	2.92	7.89
44	Mechanical room	788.10	37.5	750.60	27.43	19.41	0.95	10.17	7.59
45	Elec/tele	205.41	75	130.41	30.29	18.14	0.25	2.90	8.86
LIBRARY-2F									
46	Journal display/reading	139.01	75	64.01	31.86	13.28	0.17	2.04	9.69
47	Journal display/reading	139.01	75	64.01	31.86	13.28	0.17	2.02	9.69
48	Journal display/reading	134.29	75	59.29	32.03	13.30	0.16	1.95	9.69
49	Journal display/reading	134.29	75	59.29	32.03	13.30	0.16	1.93	9.69
50	Group Workroom	367.52	75	292.52	28.84	17.93	0.44	4.71	9.07

51	Group Workroom	367.52	75	292.52	28.84	17.93	0.44	4.67	9.07
52	Group Workroom	367.52	75	292.52	28.84	17.93	0.44	4.62	9.07
53	Group Workroom	367.52	15	352.52	27.37	17.71	0.44	4.35	9.29
54	Storage	124.52	15	109.52	28.08	18.66	0.15	1.50	8.34
55	Storage	122.77	15	107.77	28.10	18.66	0.15	1.47	8.34
56	Storage	119.28	22.5	96.78	28.70	18.75	0.14	1.44	8.25
57	Prints/Storage	614.92	75	539.92	28.10	19.51	0.74	7.21	7.49
58	Kitchen/staff lounge	759.32	15	744.32	27.18	18.53	0.91	8.54	8.47
59	Directors office	244.77	15	229.77	27.55	18.58	0.29	2.77	8.42
60	Assistants desk	173.59	75	98.59	30.89	19.08	0.21	2.18	7.92
61	Meeting room	447.60	150	297.60	30.02	18.10	0.54	5.42	8.90
62	Computer pool	1047.47	127.5	919.97	28.10	17.81	1.26	11.77	9.19
LIBRARY-3F									
63	Reading theatre	378.58	150	228.58	30.57	15.63	0.45	4.59	9.12
64	Reading theatre	685.17	225	460.17	29.96	15.54	0.82	8.08	9.23
65	Book stacks/Reading room	1994.30	225	1769.30	28.02	16.95	2.39	21.80	9.74
66	Learing room	210.52	225	-14.48	36.62	9.32	0.25	2.98	9.34
67	Learing room	210.52	15	195.52	27.64	7.97	0.25	2.23	9.85
68	Storage	76.53	22.5	54.03	29.65	18.05	0.09	0.86	8.95
69	Copy/print	247.37	75	172.37	29.73	19.33	0.30	2.78	7.67
70	Group Workroom	299.96	75	224.96	29.25	17.14	0.36	3.29	9.86
71	Group Workroom	293.40	75	218.40	29.30	17.15	0.35	3.20	9.85
72	Group Workroom	267.16	75	192.16	29.53	17.18	0.32	2.91	9.82
73	Group Workroom	267.16	75	192.16	29.53	17.18	0.32	2.89	9.82
74	Group Workroom	285.20	7.5	277.70	27.24	16.84	0.34	2.82	9.67
75	Study carells	420.95	60	360.95	28.28	18.69	0.51	4.30	8.31
76	Multimedia workroom	474.27	225	249.27	31.27	18.29	0.57	5.31	8.71
LIBRARY-4F									
77	Book stacks/Reading room	1801.12	150	1651.12	27.75	16.91	2.16	17.77	9.65
78	Reading room	597.46	22.5	574.96	27.34	15.15	0.72	5.76	9.12
LIBRARY-5F									
79	Yard	2810.47	22.5	2787.97	27.07	19.87	3.37	26.66	7.13
80	Roof mechanical room	734.30	15	719.30	27.18	19.38	0.88	6.94	7.62
81	Roof mechanical room	724.61	0	724.61	27.00	19.35	0.87	6.76	7.65
LIBRARY-RF									
82	Open to below-Sky glass	0.00							0.00
83	Roof	237.58	0	237.58	27.00	19.86	0.29	2.18	7.14

Table 4.2: Determining evaporator capacity.

4.2 SELECTING FCU AND AHU DEVICES

FCU (Fan-Coil Unit) is an air handling device; It is part of the HVAC (heating, ventilation and air conditioning) system that uses flexible ducting in residential, commercial or industrial buildings.

FCU, like AHU, is an air handling device, but it is simple in structure and smaller in size. Is a device used to treat air, but very modest capacity, only about 2kW-20kW. Common types of FCU such as: Cassette with blown / 4 directions / 1 direction, wall and ceiling pressure; concealed wall, concealed ceiling, wall mounted type, concealed ceiling, duct ...

AHU (Air Handling Unit) is a device of the HVAC system. AHU is used in almost all manufacturing industries requiring high purity such as pharmaceuticals, food, functional foods, cosmetics, electronics, microelectronics, semiconductors, etc. Currently, AHU is also installed in many Commercial buildings, high-class hotels, etc.

AHU is a multifunctional unit installed in the HVAC system to work together with other platforms and systems to handle temperature, humidity, cleanliness, pressure for a given environment. For commercial buildings, hotels, big restaurants, ... AHU is mainly used to ensure the temperature and humidity. In manufacturing plants requiring higher cleanliness, AHU ensures the above factors and enhances the cleanliness by a multi-stage filter system (at least 3 floors) from primary to final filtration stages.

INDOOR UNITS				2-PIPE								4-PIPE						
				FWD04AT	FWD06AT	FWD08AT	FWD10AT	FWD12AT	FWD16AT	FWD18AT	FWD04AF	FWD06AF	FWD08AF	FWD10AF	FWD12AF	FWD16AF	FWD18AF	
Cooling capacity	Total capacity	High	kW	3.90	6.20	7.80	8.82	11.90	16.40	18.30	3.90	6.20	7.80	8.82	11.90	16.40	18.30	
	Sensible capacity	High	kW	3.08	4.65	6.52	7.16	9.36	12.80	14.10	3.08	4.65	6.52	7.16	9.36	12.80	14.10	
Heating capacity	2-Pipe	High	kW	4.05	7.71	9.43	10.79	14.45	19.81	21.92	-							
	4-Pipe	High	kW	-						4.49	6.62	9.21	15.86	21.15				
Power input	High	W	234	349	443		714	1,197		234	349	443		714	1,197			
Dimensions	Unit	HxWxD	mm	280x734x559	280x946x559	280x1,174x559		320x1,174x559	352x1,384x718		280x734x559	280x946x559	280x1,174x559		320x1,174x559	352x1,384x718		
Weight	Unit	kg	33	41	47	49	65	77	80	35	43	50	52	71	83	86		
Heat exchanger	Water volume	l	1.06	1.42	1.79	2.38	2.5	4.02	5.03	1.06	1.42	1.79	2.38	2.50	4.02	5.03		
Additional heat exchanger	Water volume	l	-						0.35	0.47	0.59		1.42	1.72				
Water flow	Cooling	l/h	674	1,064	1,339	1,514	2,056	2,833	3,140	674	1,064	1,339	1,514	2,056	2,833	3,140		
	Heating	l/h	674	1,064	1,339	1,514	2,056	2,833	3,140	349	581	808		1,392	1,856			
Water pressure drop	Cooling	kPa	17	24		16	26	34	45	17	24		16	26	34	45		
	Heating	kPa	14	20		13	21	28	37	9	15	13		12	16			
Fan	Type	Centrifugal multi-blade, double suction								Centrifugal multi-blade, double suction								
	Air flow rate	High	m ³ /h	800	1,250	1,600		2,200	3,000	800	1,250	1,600		2,200	3,000			
	Available pressure	High	Pa	66	58	68	64	97	145	134	63	53	63	59	92	138	128	
Sound power level	High	dB(A)	66	69	72		74	78		66	69	72		74	78			
Riping connections	Drain	OD	mm	16						16								
Water connections	Std. heat exchanger	inch	3/4				1				3/4				1			
Power supply	Phase / Frequency / Voltage	Hz / V	1~ / 50 / 230								1~ / 50 / 230							
Current input	High	A	0.95	1.58	1.97		3.21	5.37		0.95	1.58	1.97		3.21	5.37			

Figure 4.1: Catalog Daikin FCU:

Unit Size	Air Vol.		4 Rows / 10 FPI				6 Rows / 10 FPI			
			Total	Sensible	Water Flow	Water Side Pressure Drop kPa	Total	Sensible	Water Flow	Water Side Pressure Drop kPa
	l/s	CMH	kW	kW	l/s		kW	kW	l/s	
25	825	2970	8.4	8.4	0.4	0.9 (HF)	14.4	11.3	0.7	3.4 (HF)
35	1200	4320	16.2	13.2	0.8	3.8 (HF)	22.7	17.1	1.1	10.2 (HF)
50	1583	5700	22.2	17.7	1.1	5.9 (HF)	30.5	22.8	1.5	15.1 (HF)
55	1828	6580	25.1	20.3	1.2	4.6 (HF)	34.8	26.1	1.7	12.1 (HF)
70	2286	8290	33.3	26.1	1.6	9.0 (HF)	44.8	33.2	2.1	22.6 (HF)
80	2628	9480	39.1	30.3	1.9	13.5 (HF)	52.4	38.5	2.5	33.5 (HF)
100	3270	11770	49.7	38.1	2.4	19.3 (HF)	66.5	48.5	3.2	47.8 (HF)
120	3773	13580	57.8	44.2	2.6	22.6 (HF)	77.3	56.2	3.7	56.1 (HF)
140	4445	16000	70.3	53.0	3.4	36.8 (HF)	84.8	63.5	4.1	11.6 (SF)
150	5056	18200	80.8	60.5	3.9	42.6 (HF)	97.0	72.5	4.6	13.2 (SF)
170	5723	20600	93.0	69.2	4.4	60.9 (HF)	111.4	82.8	5.3	18.8 (SF)
200	6792	24450	100.7	78.2	4.8	12.4 (SF)	135.5	99.6	6.5	31.0 (SF)
230	7570	27250	112.8	87.4	5.4	13.7 (SF)	151.6	111.3	7.2	34.2 (SF)
250	8640	31100	129.1	99.9	6.2	13.7 (SF)	173.7	127.0	8.3	34.1 (SF)
280	9401	33840	142.9	109.6	6.8	17.7 (SF)	190.7	139.2	9.1	43.6 (SF)
300	10240	36850	158.1	120.4	7.6	22.8 (SF)	210.5	152.8	10.1	56.1 (SF)
350	11695	42100	184.9	139.2	8.8	33.9 (SF)	222.1	166.8	10.6	10.6 (SF)
400	13188	47400	205.8	157.0	10.0	34.2 (SF)	251.2	186.3	12.0	10.6 (SF)
480	16096	57940	254.7	191.7	12.2	34.0 (SF)	305.8	229.6	14.6	10.6 (SF)
570	19021	68470	301.2	226.6	14.4	34.1 (SF)	362.8	271.9	17.3	10.6 (SF)
660	21946	79000	346.5	261.1	16.6	34.1 (SF)	417.4	313.3	19.9	10.6 (SF)
700	23410	84270	369.8	278.6	17.7	34.1 (SF)	445.3	334.2	21.3	10.6 (SF)

SINKO Air Handling Units are lined up with various types such as horizontal type, vertical type, ceiling type, and special ultra-thin type to solve space constraint.

SINKO Air Handling Units are composed of aluminum alloy frame and double skin casing filled with PU foam heat insulation material to achieve complete internal and external heat isolation without condensation. This structure is also very strong against deformation with high air tightness, low noise, and stylish appearance.

SINKO Air Handling Units are designed and manufactured to satisfy various request by the customers for general commercial application and special industrial application such as hotels, business premises, department stores, public venues, hospitals, semiconductor industry.

Product Nomenclature



Figure 4.2: Catalog Sinko AHU:

N O	ROOM NAME	Qo	Device s	Manufactur er	Mode l	Total Capaci ty	Q.ty	
							AH U	FC U
CENTRAL PLANT-1F								
1	Fire room	9.46	FCU	Daikin	FWD - 12AT	11.9		1
2	Corridor	6.32	FCU	Daikin	FWD - 08AT	7.8		1
3	Server room	278.5 5	AHU	Sinko	TA- H- 290	285.8	2	
4	Server room support	10.80	FCU	Daikin	FWD - 12AT	11.9		1
6	Corridor	41.17	AHU	Sinko	TA- H- 050	44.4	2	
7	Fuel Storage Tank	15.67	FCU	Daikin	FWD - 16AT	16.4		1
8	Transformer room	30.39	AHU	Sinko	TA- H- 070	33.3	1	
9	Medium voltage switchgear room	31.66	AHU	Sinko	TA- H- 070	33.3	1	
10	Transformer room	50.90	AHU	Sinko	TA- H- 120	57.8	1	
11	Low voltage switchgear room	34.30	AHU	Sinko	TA- H- 050	44.4	2	
12	Corridor	1.91	FCU	Daikin	FWD - 04AT	3.9		1
13	Control center	15.88	FCU	Daikin	FWD - 16AT	16.4		1
14	Technical room	9.92	FCU	Daikin	FWD - 12AT	11.9		1

15	Odor treatment room	9.02	FCU	Daikin	FWD - 12AT	11.9		1
CENTRAL PLANT-2F								
16	UPS battery room	6.33	FCU	Daikin	FWD - 08AT	7.8		1
17	Corridor	3.57	FCU	Daikin	FWD - 04AT	3.9		1
18	Server room support	105.86	AHU	Sinko	TA-H-230	112.8	1	
19	Server room	107.69	AHU	Sinko	TA-H-230	112.8	1	
20	Storage	4.09	FCU	Daikin	FWD - 06AT	6.2		1
21	Corridor	5.59	FCU	Daikin	FWD - 06AT	6.2		1
22	Janitor	4.29	FCU	Daikin	FWD - 06AT	6.2		1
23	Corridor-hành lang	3.90	FCU	Daikin	FWD - 04AT	3.9		1
24	Electrical workroom area	7.67	FCU	Daikin	FWD - 08AT	7.8		1
25	Control room	5.83	FCU	Daikin	FWD - 06AT	6.2		1
CENTRAL PLANT-RF								
27	Generator room	18.08	FCU	Daikin	FWD - 18AT	18.3		1
28	Mechanical room	11.02	FCU	Daikin	FWD - 12AT	11.9		1
29	AHU sever	13.64	FCU	Daikin	FWD - 16AT	16.4		1
LIBRARY-1F								

30	Conference/Training room	18.55	FCU	Daikin	FWD - 12AT	23.8		2
31	Storage	2.74	FCU	Daikin	FWD - 04AT	3.9		1
32	Janitor	2.31	FCU	Daikin	FWD - 04AT	3.9		1
33	Frist Aid	4.62	FCU	Daikin	FWD - 06AT	6.2		1
34	Aid relaxing room	3.30	FCU	Daikin	FWD - 04AT	3.9		1
35	Storage	3.81	FCU	Daikin	FWD - 04AT	3.9		1
36	Book return room	5.33	FCU	Daikin	FWD - 06AT	6.2		1
37	Corridor	8.70	FCU	Daikin	FWD - 10AT	8.82		1
38	Post room	4.02	FCU	Daikin	FWD - 06AT	6.2		1
39	Storage/Receiving	4.15	FCU	Daikin	FWD - 06AT	6.2		1
40	Porter room	3.34	FCU	Daikin	FWD - 04AT	3.9		1
41	Uni shop	17.49	FCU	Daikin	FWD - 18AT	18.3		1
42	Coffee shop	7.11	FCU	Daikin	FWD - 10AT	8.82		1
43	Coffee Storage room	2.92	FCU	Daikin	FWD - 04AT	3.9		1
44	Mechanical room	10.17	FCU	Daikin	FWD - 12AT	11.9		1

45	Elec/tele	2.90	FCU	Daikin	FWD - 04AT	3.9		1
LIBRARY-2F								
46	Journal display/reading	2.04	FCU	Daikin	FWD - 04AT	3.9		1
47	Journal display/reading	2.02	FCU	Daikin	FWD - 04AT	3.9		1
48	Journal display/reading	1.95	FCU	Daikin	FWD - 04AT	3.9		1
49	Journal display/reading	1.93	FCU	Daikin	FWD - 04AT	3.9		1
50	Group Workroom	4.71	FCU	Daikin	FWD - 06AT	6.2		1
51	Group Workroom	4.67	FCU	Daikin	FWD - 06AT	6.2		1
52	Group Workroom	4.62	FCU	Daikin	FWD - 06AT	6.2		1
53	Group Workroom	4.35	FCU	Daikin	FWD - 06AT	6.2		1
54	Storage	1.50	FCU	Daikin	FWD - 04AT	3.9		1
55	Storage	1.47	FCU	Daikin	FWD - 04AT	3.9		1
56	Storage	1.44	FCU	Daikin	FWD - 04AT	3.9		1
57	Prints/Storage	7.21	FCU	Daikin	FWD - 10AT	8.82		1
58	Kitchen/staff lounge	8.54	FCU	Daikin	FWD - 10AT	8.82		1
59	Directors office	2.77	FCU	Daikin	FWD - 04AT	3.9		1

60	Assistants desk	2.18	FCU	Daikin	FWD - 04AT	3.9		1
61	Meeting room	5.42	FCU	Daikin	FWD - 06AT	6.2		1
62	Computer pool	11.77	FCU	Daikin	FWD - 12AT	11.9		1
LIBRARY-3F								
63	Reading theatre	4.59	FCU	Daikin	FWD - 06AT	6.2		1
64	Reading theatre	8.08	FCU	Daikin	FWD - 10AT	8.82		1
65	Book stacks/Reading room	21.80	AHU	Sinko	TA- H-50	22.2	1	
66	Learing room	2.98	FCU	Daikin	FWD - 04AT	3.9		1
67	Learing room	2.23	FCU	Daikin	FWD - 04AT	3.9		1
68	Storage	0.86	FCU	Daikin	FWD - 04AT	3.9		1
69	Copy/print	2.78	FCU	Daikin	FWD - 04AT	3.9		1
70	Group Workroom	3.29	FCU	Daikin	FWD - 04AT	3.9		1
71	Group Workroom	3.20	FCU	Daikin	FWD - 04AT	3.9		1
72	Group Workroom	2.91	FCU	Daikin	FWD - 04AT	3.9		1
73	Group Workroom	2.89	FCU	Daikin	FWD - 04AT	3.9		1
74	Group Workroom	2.82	FCU	Daikin	FWD - 04AT	3.9		1

75	Study carells	4.30	FCU	Daikin	FWD - 06AT	6.2		1
76	Multimedia workroom	5.31	FCU	Daikin	FWD - 06AT	6.2		1
LIBRARY-4F								
77	Book stacks/Reading room	16.87	FCU	Daikin	FWD - 18AT	18.3		1
78	Reading room	4.88	FCU	Daikin	FWD - 06AT	6.2		1