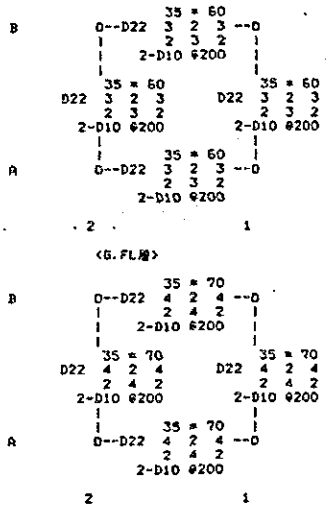
[梁配筋リスト(平面形式)]

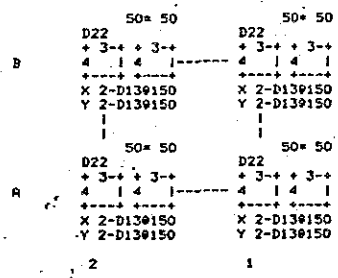
<R.FL階>



<G.FL階>

[柱配筋リスト(平面形式)]

< 1 階 R.FL-G.FL>



ＡＲ－６　屋外機器の基礎

構　造　計　算　書

目　　次

6.1 一般事項

6.1.1 APPLICABLE CODES AND STANDARDS

1) For design and allowable stress of structural materials

Reinforced concrete structure

AIJ : "Standards for calculation of reinforced concrete structures"

Foundation

AIJ : "Standards for structural design of building foundation"

* AIJ : Architectural Institute of Japan

6.1.2 STRUCTURAL MATERIALS TO BE USED AND ALLOWABLE UNIT STRESS

1) Qualities of materials

Concrete ; Comperessive strength of 28 days

$Fc' = 210\ kg/cm^2$

Reinforcement ; Deformed reinforcement

ASTM A615 Grade 40

$fy = 2,812\ kg/cm^2$

2) Physical constants for structural materials

Modulus of elasticity

Concrete	$210\ t/cm^2$
Reinforcement	$2100\ t/cm^2$

3) ALLOWABLE UNIT STRESS

i) Allowable Unit Stress of Concrete (kg/cm^2)

Materials \ stresses		Permanent Stresses					Temporary Stresses		
		Compress	Shear	Bond			Compress	shear	Bond
				A	B	C			
Normal concrete Fc-210	Plain bar	70	7.0	8.4	12.6	8.4	Permanent Stresses x 2.0	Permanent Stresses x 1.5	
	Deformed bar			14.0	21.0	14.0			

* Remarks A ; Top bar of flexural members

B : Bar, except "Item A", of flexural members

C : Anchors and lap splices

ii) Allowable Unit Stress of Reinforcing Bars (kg/cm^2)

Stresses / Materials	Permanent Stresses		Temporary Stresses	
	Tension Compression	Shear Reinforcement	Tension Compression	shear Reinforcement
Deformed bar ASTM A615 Grade 40	1,870	1,870	2,812	2,812

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6.1.3 LOAD COMBINATION

1) Load combination for steel and concrete structure

Long term loading

i) D.L+L.L+M.L+C.L

Short term loading

i) D.L+L.L+M.L+C.D+W.L

ii) D.L+L.L+M.L+C.D+S.L

where;

D.L ; Dead load

L.L ; Live load and over burden load

M.L ; Machine load

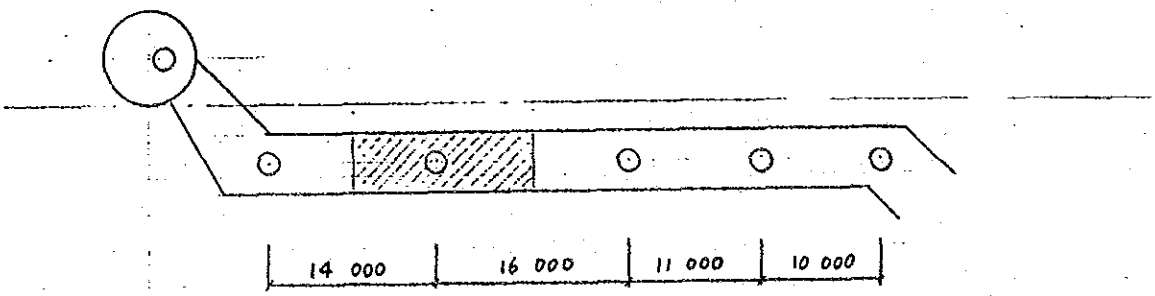
C.L ; Crane operation load

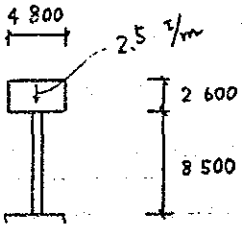
C.D.L ; Crane dead load

W.L ; Wind load

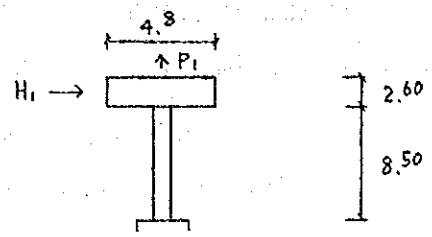
S.L ; Seismic load

§1. GENERAL DRAWING





§2. LOADING DATA



SEISMIC FORCE

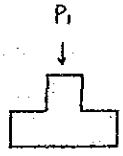
$H_1 = 0.1 \times 2.5 \times 15.0 = 3.75$ t

WIND FORCE

$H_1 = 0.15 \times (0.8+0.4) \times 15.0 \times 2.6 = 7.02$ t

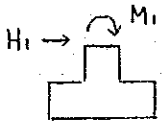
$P_1 = 0.15 \times 0.7 \times 15.0 \times 4.8 = 7.56$ t

D.L



$P_1 = 2.50 \times 15.0 = 37.5$ t

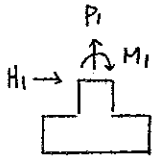
E.L



$H_1 = 3.75$ t

$M_1 = 3.75 \times (8.50 + 2.60/2) = 36.75$ t·m
(9.80)

W.L



$H_1 = 7.02$ t

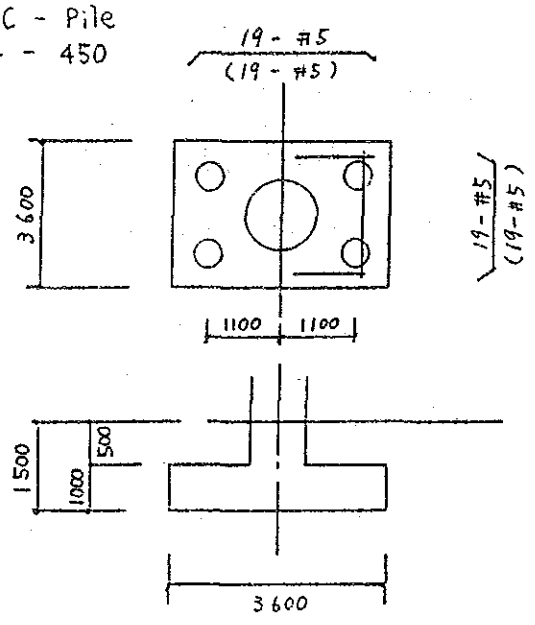
$P_1 = 7.56$ t

$M_1 = 7.02 \times 9.80 = 68.80$ t·m

§3. DESIGN OF FOUNDATION

OUTLINE OF FOUNDATION

RC - Pile
4 - 450



Foundation weight

$$Nf = 2.4 \times (3.6 \times 3.6 \times 1.0 + 1.0 \times 1.0 \times \pi \times 0.7) + 1.8 \times (3.6 \times 3.6 - 1.0 \times 1.0 \times \pi) \times 0.5 = 45.22\ t$$

LOADING

	N (t)	Hx (t)	Hy (t)
D.L	37.50		
L.L			
S.Lx	0	3.75	
S.Ly	0		3.75
W.Lx	-7.56	7.02	
W.Ly			

Stress at bottom of foundation

$$N = 37.50 - 7.56 + 45.22 = 75.16\ t$$

$$M = 68.80 + 7.02 \times 1.70 = 80.73\ t \cdot m$$

CHECK OF BEARING PRESSURE

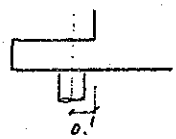
Check of Pile Reaction

$$P_1 = 75.16/4 + 80.73/(2^2 \times 2) = 37.14\ t/pile < 35.0 \times 1.5$$

$$P_1' = 29.94/4 + 80.73/(2^2 \times 2) = 25.83\ t/pile$$

DESIGN OF FOOTING

Factored Load			Pile Reaction	
Load case	ΣN (t)	ΣM (t,m)	P1 (t/n)	P1' (t/n)
D.L + L.L	37.50			
D.L + L.L + W.L				
D.L + L.L + S.L				
D.L + W.L	29.94	80.73	37.14	25.83



Stress

$$QF = 25.83\ t$$

$$MF = 25.83 \times 0.1 = 2.58\ t \cdot m$$

Reinforcement

D = 100 cm, d = 85 cm, j = 7/8d = 74.38 cm

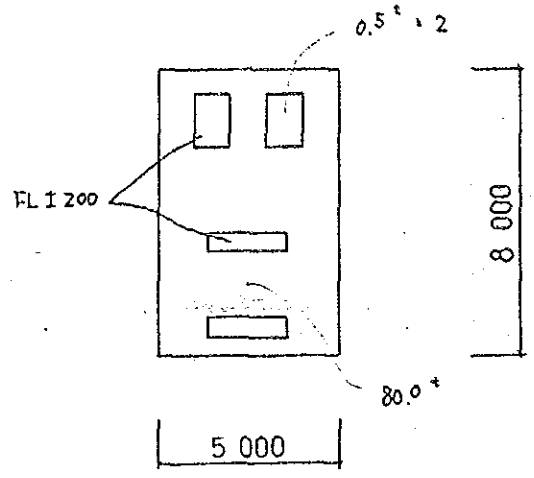
$$\text{nec } At = \frac{MF}{ft \cdot j} = 1.23\ cm^2$$

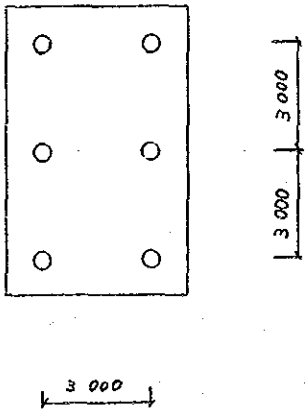
$$\phi = \frac{Q}{fa \cdot j} = 11.02\ cm$$

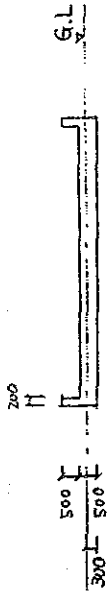
19 - #5 ($at = 38.0\ cm^2$, $\phi = 95.0\ cm$)

$$\tau = \frac{Q}{b \cdot j} = 0.96 < 7.0\ kg/cm^2$$

§1 FOUNDATION PLAN AND SECTION







2-1. DESIGN OF CONCRETE PILE

Foundation weight

$N_f = 2.4 \times \{0.5 \times 5.0 \times 8.0 + 0.2 \times 0.5 \times (8.0 + 5.0) \times 2\}$

$= 54.24$ t

LOADING

D.L $N = 80.0 + 0.5 \times 2 = 81.0$ t

Stress at bottom of foundation

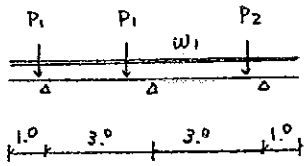
$N = 81.0 + 54.24 = 135.24$ t

$M =$ ——

Check of Pile Reaction

$P_1 = 135.24 / 6 = 22.54$ t/Pile $<$ 35 t/Pile OK

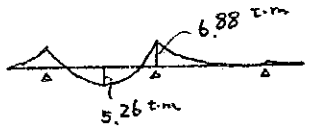
2-2. DESIGN OF FOOTING



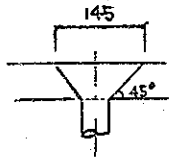
$w_1 = 2.4 \times 0.5 \times 2.5 = 3.00$ t/m (Footing weight)

$P_1 = 80.0/2 \times 1/2 + 2.4 \times 0.2 \times 0.5 \times 2.2/2 = 20.26$ t

$P_2 = 0.5 + 2.4 \times 0.2 \times 1.0 \times 1.5 = 1.22$ t



↑ (23.3 t)



$D = 50$ cm $d = 40$ cm $j = 35.0$ cm

$A_t = \frac{M}{f_t \cdot j} = \frac{6.88 \times 10^5}{1870 \times 35} = 10.51$ cm²

$\phi = \frac{Q}{f_a \cdot j} = \frac{23.3 \times 10^3}{21 \times 35} = 31.70$ cm

($\ell = 145$ cm)
#5 @ 200
($A_s = 16.0$ cm², $\phi = 40.0$ cm)

$\tau = \frac{Q}{b \cdot j} = \frac{23.3 \times 10^3}{145 \times 35} = 4.59 < 7.0$

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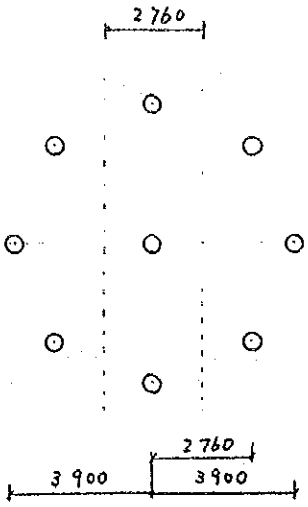
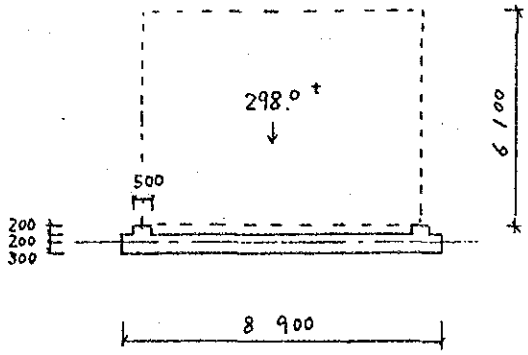
6.4 FUEL OIL SERVICE TANK (燃料油サービスタンク)

§1. FOUNDATION PLAN AND SECTION





§2. DESIGN OF FOUNDATION

2-1 DESIGN OF CONCRETE PILE

Foundation weight

$$N_f = 2.4 \times (8.9/2 \times 8.9/2 \times \pi \times 0.5 + 3.9 \times 3.9 \times \pi \times 0.2)$$

$$= 97.59 \text{ t}$$

Seismic force

$$H = 0.1 \times 298.0 = 29.8 \text{ t}$$

Stress at bottom of foundation

LONG TERM

$$N = 298.0 + 97.59 = 395.59 \text{ t}$$

$$M = \text{——}$$

SHORT TERM

$$N = 395.59 \text{ t}$$

$$M = 29.8 \times (6.1/2 + 0.7) = 111.75 \text{ t·m}$$

Check of Pile Reaction

LONG TERM

$P_1 = 395.59 / 9 = 43.95$ t/pile $<$ 45 t/pile

SHORT TERM

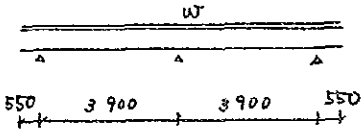
$$Z = \frac{(3.9^2 + 2.76^2 \times 2) \times 2}{3.9} = 15.61$$

$$P_1 = \frac{395.59}{9} \pm \frac{111.75}{15.61} = 51.11 \text{ t/pile} < 45 \times 2, \quad 36.80 \text{ t/pile} > 0$$

OK.

2-2. DESIGN OF FOOTING

LONG TERM



$$w = 298.0 / (8.9/2 \times 8.9/2 \times \pi) \times 2.76 = 13.22 \text{ t/m}$$

$\downarrow 4.79$

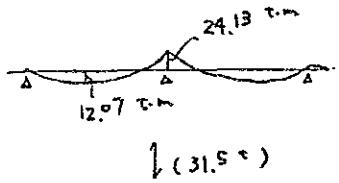
SHORT TERM

$$w = \left(4.79 + \frac{111.75}{46.59}\right) \times 2.76 = 19.84 \text{ t/m}$$

$$Z = \frac{\pi \times 7.8^3}{32} = 46.59$$

LONG TERM

$D = 50.0$ cm $d = 40.0$ cm $j = 35.0$ cm



$\downarrow (31.5\text{ t})$

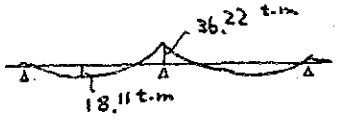
$$At = \frac{M}{f_t \cdot j} = 36.89 \text{ cm}^2$$

$$\phi = \frac{Q}{f_a \cdot j} = 42.86 \text{ cm}$$

$$\tau = \frac{Q}{b \cdot j} = 3.26 < 7.0$$

$\ell = 276$ cm
#6 @ 200
(As = 39.76 cm², φ = 84.00 cm)

SHORT TERM



$\downarrow (47.2\text{ t})$

$At = 36.80$ cm²

$\phi = 42.81$ cm

$\tau = 4.89 < 7.0 \times 1.5$

#6 @ 200
(As = 39.76 cm², φ = 84.00 cm)

ＡＲ－７　空　調　設　備（本館）

目　　次

7. 1　設計条件

1. DESIGN CRITERIA

1 - 1　DESIGN CONDITION

1) For air conditioning system

(a) Outdoor air

Summer　:　42.2°C DB, 28.6°C WB, 37%RH

(b) Room

Summer　:　24°C±2°C DB,　50%RH

Winter　:　Not more than the condition in summer

2) Minimum ventilation air vol.

For Control Room　　25 m^3/Hr person

3) Lighting　　20 w/m^2

4) People

Refer to "Cooling and dehumidifying estimate sheets"

5) LOcation

25.4°(N), 68.3°(E)

2 データ
2. DATA

Data used for load estimation is based on Carrier,s Design Manual of the newest condition.

2 - 1 Outdoor air

1) Dry Bulb

Time / Dry Bulb	8	9	10	11	12	13	14	15	16	17	18
°C	28.2	30.3	32.8	35.7	38.4	40.4	41.7	42.2	41.7	40.5	38.7

2) HUmidity Ratio

Time / Humidity Ratio	8	9	10	11	12	13	14	15	16	17	18
g/Kg	19.1	19.0	19.0	19.2	18.9	19.0	18.8	19.0	18.8	18.9	18.8

2 - 2 Solar heat gain

1) Peak solar heat gain thru ordinary glass

EXPOSORE / HEAT	NL	NE	SE	SW	NW	HORIZONTAL	SHADE
Kcal/h m^2		366	252	252	366	674	47

2) Solar gain correction factors

for steel sash : 1/0.85

for dew point : 0.94

3) Load storage factors , solar heat gain thru ordinary glass

TIME / EXPOSURE	8	9	10	11	12	13	14	15	16	17	18
NE	0.57	0.46	0.30	0.24	0.20	0.19	0.17	0.16	0.15	0.13	0.11
SE	0.47	0.61	0.67	0.65	0.57	0.44	0.29	0.24	0.21	0.18	0.15
SW	0.08	0.08	0.10	0.24	0.40	0.55	0.66	0.70	0.64	0.50	0.26
NW	0.09	0.09	0.10	0.10	0.10	0.10	0.16	0.34	0.52	0.65	0.64

NOTE : Venetian blind to be located on the inside of glass.
(Overall factor is 0.65)

2 - 3 Equivalent temperature difference

1) For wall

TIME / EXPOSURE	8	9	10	11	12	13	14	15	16	17	18
NE	4.6	7.9	16.8	16.0	15.3	13.3	11.3	11.9	12.6	13.0	13.5
SE	5.4	8.6	11.1	12.4	13.6	13.8	13.9	12.9	12.4	11.8	11.5
SW	2.6	3.1	3.7	5.0	5.9	9.8	12.1	15.8	18.6	19.2	19.5
NW	3.7	4.5	5.3	6.6	7.9	10.1	11.3	13.5	15.4	19.5	23.2

These figures are basing on medium color, outside air temperature at 42.2°C DB, inside air temperature at 24°C DB daily range of 16.7°C and specific weight of wall 200Kg/m^2.

2) For wall

TIME / EXPOSURE	8	9	10	11	12	13	14	15	16	17	18
NE	15.7	16.2	16.8	14.8	12.8	12.7	12.4	13.0	13.7	13.6	13.5
SE	7.4	9.6	12.1	13.1	14.1	14.4	14.2	13.1	12.6	12.0	11.5
SW	1.9	2.8	3.7	5.7	7.0	12.2	14.9	17.9	20.3	20.4	20.5
NW	3.7	4.7	5.7	7.4	9.1	11.3	12.4	15.8	18.3	22.4	25.5

These figures are basing on medium color, outside air temperature at 42.2°C DB, inside air temperature at 24°C DB daily range of 16.7°C and specific weight of wall 100Kg/m^2.

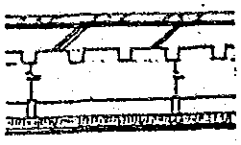
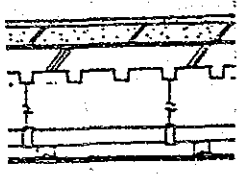
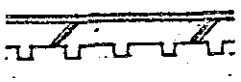
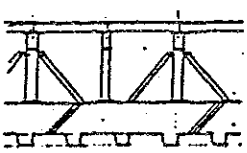
3) For roof

TIME / For roof	8	9	10	11	12	13	14	15	16	17	18
°C	10.3	10.2	10.8	12.4	14.9	18.0	21.2	24.0	26.2	27.8	28.5

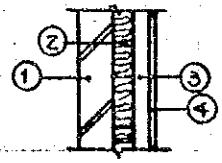
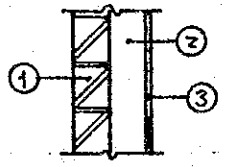
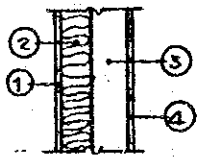
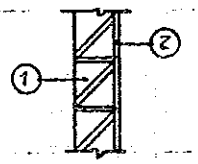
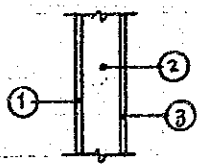
These figures are basing on medium color, outside air temperature at 42.2°C DB, inside air temperature at 24°C DB daily range of 16.7°C and specific weight of wall 300Kg/m^2.

7.3 熱貫流計算

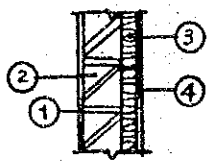
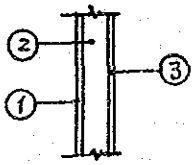
3 HEAT TRANSMISSION : K-Value

TYPE OF STRUCTURE	MATERIALS	THICKNESS (mm)	RESISTANCE ($m^2H°C/Kcal$)	AIR FILM ($m^2H°C/Kcal$)	K-Value ($Kcal/m^2H°C$)
ROOF 1. 				$\gamma_o = 0.05$	
	① CONCRETE BLOCK	30	0.067		
	② SAND	10	0.015		
	③ ASPHALT ROOFING	10	0.108		
	④ CONCRETE	100	0.071		
	⑤ DECK PLATE	1.2	—		
	⑥ AIR SPACE			0.2	
	⑦ GLASS wool	50	1.36		
	⑧ CEILING	25	0.132		
				$\gamma_i' = 0.189$ (2.192)	0.46
CEILING 1. FLOOR 1. 				$\gamma_i' = 0.125$	
	① CEMENT MORTAL	30	0.023		
	② CINDER CONCRETE	60	0.084		
	③ ASPHALT WATER PROOF	10	0.108		
	④ CONCRETE	100	0.071		
	⑤ DECK PLATE	1.2	—		
	⑥ AIR SPACE			0.2	
	⑦ CEILING	25.0	0.132		
				$\gamma_i' = 0.125$ (0.868)	1.16
FLOOR 2. CEILING 2. 				$\gamma_i = 0.125$	
	① VINYL ASBESTOS TILE	2	0.054		
	② CEMENT MORTAL	28	0.022		
	③ CONCRETE	100	0.071		
	④ DECK PLATE	1.2	—		
				$\gamma_i = 0.125$ (0.397)	2.52
FLOOR 3. 				$\gamma_i = 0.125$	
	① FLOORING	12	0.086		
	② AIR SPACE			0.2	
	③ CONCRETE	130	0.093		
	④ DECK PLATE	1.2	—		
				$\gamma_i = 0.125$	
				(0.629)	1.59

HEAT TRANSMISSION : K-Value

TYPE OF STRUCTURE	MATERIALS	THICKNESS (mm)	RESISTANCE ($m^2H°C/Kcal$)	AIR FILM ($m^2H°C/Kcal$)	K-Value ($Kcal/m^2H°C$)
WALL 1 				$\gamma_o = 0.05$	
	① PRECAST CONCRETE	120	0.086		
	② GLASS WOOL	50	1.36		
	③ AIR SPACE			0.2	
	④ PLASTER BOAD	12	0.064		
				$\gamma_i = 0.133$	
				(1.893)	0.53
WALL 2 				$\gamma_o = 0.05$	
	① CONCRETE BLOCK	150	0.334		
	② AIR SPACE			0.2	
	③ PLASTER BOAD	12	0.064		
				$\gamma_i = 0.133$	
				(0.781)	1.29
WALL 3 				$\gamma_o = 0.05$	
	① STEEL	—	—		
	② GLASS WOOL	50	1.36		
	③ AIR SPACE			0.2	
	④ PLASTER BOAD	12	0.064		
				$\gamma_i = 0.133$	
				(1.807)	0.56
PARTITION 1 				$\gamma_i = 0.133$	
	① CONCRETE BLOCK	150	0.334		
	② PLASTER BOAD	12	0.064		
				$\gamma_i = 0.133$	
				(0.664)	1.51
PARTITION 2 				$\gamma_i = 0.133$	
	① PLASTER BOAD	12	0.064		
	② AIR SPACE			0.2	
	③ PLASTER BOAD	12	0.064		
				$\gamma_i = 0.133$	
				(0.594)	1.69

HEAT TRANSMISSION : K-Value

TYPE OF STRUCTURE	MATERIALS	THICKNESS (mm)	RESISTANCE ($m^2H°C/Kcal$)	AIR FILM ($m^2H°C/Kcal$)	K-Value ($Kcal/m^2H°C$)
PARTITION3 				$\gamma_i = 0.133$	
	① PLASTER BOAD	12	0.064		
	② CONCRETE BLOCK	150	0.334		
	③ GLASS WOOL	50	1.36		
	④ PLASTER BOAD	12	0.064		
				$\gamma_i = 0.133$	
				(2.088)	0.48
DOOR 				$\gamma_i = 0.133$	
	① STEEL	1.2	—		
	② AIR SPACE			0.2	
	③ STEEL	1.2	—		
				$\gamma_i = 0.133$	
				(0.466)	2.15
WINDOW (OUT)	ORDINARY GLASS	3			5.1
WINDOW (IN)	ORDINARY GLASS	3			3.8

4. ROOM LOAD SUMMARY

4-1. AC-2

1) ROOM PEAK LOAD

NO	ROOM NAME	AREA (m^2)	VOLUME (m^3)	PEOPLE	PEAK LOAD R.S.H (kcal/H)	PEAK LOAD R.T.H (kcal/H)	INDICATED A.D.P(°C)	DEHUM AIR (m^3/H)	OUT AIR (m^3/H)
OPER. FLOOR O-2	CENTRAL CONTROL ROOM	328.29	978.87	5	42.936	43.656	12.9		650
	SUB TOTAL				42.936	43.656	12.6	14.500	650
FORTH FLOOR F-1	SHIFT ROOM	56.0	156.8	6	4.365	4.791	12.2	1470	150
F-2	REST ROOM	19.6	54.88	2	1.273	1.415	12.1	450	50
F-3	CONFERENCE RM	88.0	246.4	10	5.358	6.169	11.8	1.850	400
F-4	ELECTRICAL & INSTRUMENT REPAIR ROOM	198.0	554.4	6	10.023	10.551	12.5	3.400	300
F-5	PABX ROOM	67.68	189.5	4	3.938	4.223	12.4	1.330	100
	SUB TOTAL				24.957	27.149		8.500	1000
	TOTAL				67.893	70.805	12.6	23,000	1.650
					SHF = 0.96				

SECRET

2). LOAD SUMMARY (TIME)

NO.	ROOM NAME	3:00 E.R.S.H (Kcal/H)	3:00 E.R.T.H (Kcal/H)	4:00 E.R.S.H (Kcal/H)	4:00 E.R.T.H (Kcal/H)	5:00 E.R.S.H (Kcal/H)	5:00 E.R.T.H (Kcal/H)
OPER O-2	CENTRAL CONTROL ROOM	* 42.936	* 43.656	42.568	43.278	41.670	42.380
	SUB TOTAL	42.936	43.656	42.568	43.278	41.670	42.380
4F F-1	SHIFT ROOM	4.358	4.786	* 4.365	* 4.791	4.215	4.641
F-2	REST ROOM	1.175	1.318	* 1.273	* 1.415	1.166	1.308
F-3	CONFERENCE ROOM	5.331	6.159	* 5.358	* 6.169	5.307	6.118
F-4	ELECTRICAL & INSTRUMENT REPAIR ROOM	9.905	10.437	* 10.023	* 10.551	10.013	10.541
F-5	PABX ROOM	3.811	4.096	3.926	4.220	* 3.938	* 4.223
	SUB TOTAL	24.580	26.796	24.945	27.146	24.639	26.831
AC-2	TOTAL	* 67.516	* 70.452	67.513	70.424	66.309	69.211

PSP

4-2 AC-1

3:00

NO	ROOM NAME	AREA (m^2)	VOLUME (m^3)	PEOPLE	R.S.H (Kcal/H)	R.T.H (Kcal/H)	INDICATED A.D.P(°C)	DEHUM.AIR (m^3/H)	OUT.AIR (m^3/H)
OPER. FLOOR O-1	COMPUTER ROOM UNIT NO. 2	84.0	252	4	23.754	24.040	13.0	8.400	100
O-3	COMPUTER ROOM UNIT NO. 1	127.21	381.63	6	35.257	35.685	13.0	12.300	150
TOTAL		211.21	633.63	10	59.011	59.725	13.0	20.700	250

SHF = 0.99.

4-3 AC-3

NO	ROOM NAME	AREA (m^2)	VOLUME (m^3)	PEOPLE	R.S.H (Kcal/H)	R.T.H (Kcal/H)	INDICATED A.D.P(°C)	DEHUM.AIR (m^3/H)	OUT.AIR (m^3/H)
MEZZ. FLOOR M-1	UNIT NO.1 & NO.2 CONTROL EQUIPMENT ROOM	216.33	605.73	6	41.732	42.160	13°	14.600	150
TOTAL		216.33	605.73	6	41.732	42.160	13	14600	150

SHF=0.99

4-4 AC-4

NO	ROOM NAME	AREA (m^2)	VOLUME (m^3)	PEOPLE	R.S.H (Kcal/H)	R.T.H (Kcal/H)	INDICATED A.D.P(°C)	DEHUM.AIR (m^3/H)	OUT.AIR (m^3/H)
MEZZ FLOOR M-1	FUEL LABORATORY	65.57	183.60	4	6.265	6605	12.5	2.200	100
M-2	WATER ANALITICAL ANALITIAL INSTRUMENT ROOM	134.75	377.3	7	12.970	13.464	12.6	4.400	210
TOTAL				11	19.235	20.069	12.6	6.600	310

SHF = 0.96

COOLING AND DEHUMIDIFYING ESTIMATE (METRIC)

INQUIRING No.	INQUIRED BY
JOB NAME	ADDRESS
SPACE USED FOR	CENTRAL CONTROL ROOM (0-2)
SYSTEM	
SIZE	m × m = 328.29 m² × 3 m(H) = 978.87 m³

SHEET No.	10
DATE ORIGINAL	
REVISION	
PERSON IN CHARGE	

ITEM	AREA OR QUANTITY	SUN GAIN OR TEMP DIFF	FACTOR	Kcal/h 3:00	CORRECTION 4:00	CORRECTION 5:00
SOLAR GAIN — GLASS						
(SE)	3.0 m² ×	252×0.74/0.85 ×	0.94 × 0.65	131	115	98
	m² ×	×				
	m² ×	×				
	m² ×	×				
	m² ×	×				
SOLAR & TRANS GAIN — WALLS & ROOF						
WALL (SE)	132.0 m² ×	13.1 ×	0.56	969	932	887
	m² ×	×				
	m² ×	×				
	m² ×	×				
ROOF — SUN	m² ×	×				
ROOF — SHADED	m² ×	×				
TRANS. GAIN — EXCEPT WALLS & ROOF						
GLASS	3.0 m² ×	18.2 ×	5.1	279	271	258
CEILING	75.04 m² ×	9.1 ×	1.16	793	771	719
FLOOR	328.29 m² ×	9.1 ×	2.52	7529	7322	6826
PARTITION (1)	73.74 m² ×	9.1 ×	1.51	1014	986	919
(2)	2.7 m² ×	9.1 ×	1.69	42	41	38
DOOR (IN)	5.4 m² ×	9.1 ×	2.15	106	103	96
GLASS (IN)	3.66 m² ×	9.1 ×	5.8	127	123	115
INTERNAL HEAT						
PEOPLE	5 PEOPLE × 41			205	205	205
Kw	29.7 Kw ×	0.8 ×	860	20434	20434	20434
LIGHTS	328.29 × 20 W ×		1.08	7091	7091	7091
APPLIANCES ETC.						
CREDIT FOR THERMAL STORAGE	m² ×	deg ×		(-)	(-)	
Sub Total						
SAFETY FACTOR			%			
ROOM SENSIBLE HEAT SUB TOTAL				38720	38394	37684
SUPPLY DUCT HEAT GAIN + SUPPLY DUCT LEAK LOSS + FAN HP			= 10%	3872	3840	3769
BYPASS OUTSIDE AIR	650 CMH × 18.2 deg × 0.1 BF × 0.29			344	334	215
EFFECTIVE ROOM SENSIBLE HEAT				42936	42568	41670
ROOM LATENT HEAT						
INFILTRATION	CMH ×	g/kg ×	0.72			
PEOPLE	5 PEOPLE × 49			245		
STEAM		kg/h ×	540			
APPLIANCES ETC.						
VAPOR TRANS.						
Sub Total						
SAFETY FACTOR			%			
ROOM LATENT HEAT SUB TOTAL				245	245	245
SUPPLY DUCT LEAKAGE LOSS			10 %	25	25	25
BYPASS OUTSIDE AIR	650 CMH × 9.6 g/kg × 0.1 BF × 0.72			450	440	440
EFFECTIVE ROOM LATENT HEAT				720	710	710
EFFECTIVE ROOM TOTAL HEAT				43656	43278	42380
OUTSIDE AIR HEAT						
SENSIBLE:	CMH ×	deg × (1 - BF) × 0.29				
LATENT:	CMH ×	g/kg × (1 - BF) × 0.72				
GRAND TOTAL HEAT SUB TOTAL						
RETURN DUCT HEAT GAIN + RETURN DUCT LEAK GAIN + PUMP H.P + PIPE GAIN			= %			
(U.S.R.T) GRAND TOTAL HEAT						

ESTIMATE FOR	AM / PM	PEAK LOAD	AM / PM 3
HOURS OF OPERATION	Hour (~)		
OUTSIDE DESIGN CONDITIONS	°CDB	°CWB	%RH

CONDITIONS	DB ℃	WB ℃	%RH	DP ℃	g/kg
OUTSIDE	42.2	28.6	37		19.0
ROOM	24.0		50		9.4
DIFFERENCE	18.2	×××	×××	×××	9.6

BLIND	NON-EXISTENCE (OUTSIDE, INSIDE) L. M. D
GLASS	ORDINARY. THICK. ABSORBENT. %. DOUBLE
COLOR	LIGHT. MEDIUM. DARK.
WEIGHT	kg/m² (FLOOR) kg/m² (WALL)
INTERNAL HEAT	W/m² m²/PEOPLE

INFILTRATION

SWINGING / REVOLVING DOORS PEOPLE × CMH/PER.	
OPEN DOORS DOORS × CMH/DOOR	
EXHAUST AIR	
CRACK m × CMH/m	
INFILTRATION CMH ■	

VENTILATION

5 PEOPLE × 25 CMH/PER.	125
m² × CMH/m²	⇓
VENTILATION CMH ■	650

SENSIBLE HEAT FACTOR

E.S.H.F = 42.936 (ERSH) / 43.656 (ERTH) = 0.98 (12.9°C)

DEHUMIDIFIED AIR

APPARATUS DEWPOINT 12.6 ℃

42.936 (ERSH) / (24 RM - 12.6 ADP)(1 - 0.1 BF) × 0.29 = 14.500 CMH

NOTES

SR = 23.0 × 13.75 + 6.0 + (3.05 + 5.0) × 1.5 / 2 = 328.29

GLASS (SE) : 1.5 × 1.0 × 2 = 3.0

WALL (SE) : 27.0 × 5.0 - 3.0 = 132.0

PARTITION (1) : 27.0 × 3.0 - (3.66 + 3.6) = 73.74

(2) : 1.5 × 3.0 - 1.8 = 2.7

DOOR (IN) : 0.9 × 2.0 × 3 = 5.4

GLASS (IN) : 3.05 × 1.2 = 3.66

CEILING : 23.0 × 3.0 + (3.05 + 5.0) × 1.5 / 2 = 75.04

FLOOR : SR

FORM E-20E

COOLING AND DEHUMIDIFYING ESTIMATE (METRIC)

Inquiring No.		Inquired By	
Job Name		Address	
Space Used For	SHIFT ROOM (E-1)		System
Size	m × m = 56.0 m²	× 2.8 m(H) =	156.8 m³

Sheet No 11
Date Original
Revision
Person in Charge

Item	Area or Quantity	Sun Gain or Temp Diff.	Factor	Kcal/h 4:00	Correction 5:00	Correction 3:00
SOLAR GAIN — GLASS						
(SE)	3.0 m²	× 253 × 0.21 / 0.85	× 0.94 × 3.65	115	98	131
(NE)	1.5 m²	× 366 × 0.15 / 0.85	× 0.94 × 0.65	60	52	64
	m²	×	×			
	m²	×	×			
	m²	×	×			
SOLAR & TRANS GAIN—WALLS & ROOF						
Wall (SE)	32.48 m²	× 12.6	× 0.56	230	219	239
(NE)	32.52 m²	× 13.7	× 0.56	250	248	237
	m²	×	×			
	m²	×	×			
Roof—Sun	56.0 m²	× 26.2	× 0.46	675	717	619
Roof—Shaded	m²	×	×			
TRANS. GAIN—EXCEPT WALLS & ROOF						
Glass	4.5 m²	× 17.7	× 5.1	407	399	418
Ceiling	m²	×	×			
Floor	25.65 m²	× 8.85	× 1.16	264	246	271
Partition (1)	12.76 m²	× 8.85	× 1.51	171	123	176
(2)	15.68 m²	× 8.85	× 1.69	235	196	242
Door (IN)	1.8 m²	× 8.85	× 2.15	35	32	36
Infiltration	CMH ×	deg ×	0.29			
INTERNAL HEAT						
People	6 People × 41			246	246	246
Kw	Kw ×	×	860			
Lights	56.0 × 20 W ×		1.08	1210	1210	1210
Appliances etc.						
Credit for Thermal Storage	m² ×	deg ×		(−)	(−)	
			Sub Total			
Safety Factor			%			
Room Sensible Heat Sub Total				3898	3766	3889
Supply Duct Heat Gain	Supply Duct +Leak Loss	Fan +HP	=10%	390	377	389
Bypass outside air	150 CMH × 17.7 − 22.2 × 0.1	BF × 0.29		77	72	80
Effective Room Sensible Heat			■	4365	4715	4358
ROOM LATENT HEAT						
Infiltration	CMH ×	g/kg ×	0.72			
People	6 People × 49			294		294
Steam	kg/h ×		540			
Appliances etc.						
Vapor trans.						
			Sub Total			
Safety Factor			%			
Room Latent Heat Sub Total				294	294	294
Supply Duct Leakage Loss			10 %	30	30	30
Bypass Outside Air	150 CMH × 9.4 g/kg × 0.1	BF × 0.72		102	102	104
Effective Room Latent Heat			■	426	426	428
Effective Room Total Heat			■	4791	4641	4786
OUTSIDE AIR HEAT						
Sensible:	CMH ×	deg × (1 − BF) × 0.29				
Latent:	CMH ×	g/kg × (1 − BF) × 0.72				
Grand Total Heat Sub Total						
Return Duct Heat Gain +	Return Duct Leak Gain +	Pump H.P −	Pipe Gain = %			
(U.S.R.T) Grand Total Heat			■			

Estimate For: AM / PM — Peak Load: AM / PM 4

Hours of Operation: Hour (~)

Outside Design Conditions	°CDB	°CWB	%RH	
Conditions	DB °C	WB °C	% RH	DP °C	g/kg
Outside	41.7	28.4	38		18.8
Room	24.0		50		9.4
Difference	17.7	×××	×××	×××	9.4

Blind: (Non-Existence / Outside, Inside) L. M. D
Glass: (Ordinary, Thick, Absorbent, %, Double)
Color: (Light, Medium, Dark)
Weight: kg/m² (Floor) kg/m² (Wall)
Internal Heat: W/m² m²/People

Infiltration
Swinging
Revolving Doors People × CMH/PER.
Open Doors Doors × CMH/DOOR
Exhaust Air
Crack m × CMH/m
Infiltration CMH ■

Ventilation
6 People × 25 CMH/PER. 150
m² × CMH/m²
Ventilation CMH ■ 150

Sensible Heat Factor
E.S.H.F = 4365 (ERSH) / 4791 (ERTH) = 0.91 (12.2)

Dehumidified Air
Apparatus Dewpoint 12.6 °C
4365 (ERSH) / (29 RM − 12.6 ADP)(1 − BF) × 0.29 = 1470 CMH

NOTES

GLASS (SE) : 1.0 × 1.5 × 2 = 3.0
(NE) : 1.0 × 1.5 = 1.5

WALL (SE) : 7.3 × 4.8 − 3.0 = 32.48
(NE) : 7.0 × 4.8 − 1.5 = 32.52

PARTITION (1) : 5.2 × 2.8 − 1.8 = 12.76
(2) : 5.6 × 2.8 = 15.68

DOOR (IN) : 0.9 × 2.0 = 1.8

FLOOR : 3.3 × 7.0 + 1.7 × 1.5 = 25.65

ROOF : SR.

SR = 7.3 × 7.0 + 1.4 × 3.5 = 56.0

FORM E-20E

COOLING AND DEHUMIDIFYING ESTIMATE (METRIC)

Inquiring No. | Inquired By | Sheet No. 12
Job Name | Address | Date Original
Space Used For REST ROOM (F-2) | System | Revision
Size 5.6 m × 3.5 m = 19.6 m² × 2.8 m(H) = 54.88 m³ | Person in Charge

Item	Area or Quantity	Sun Gain or Temp. Diff.	Factor	Kcal/h 4:00	Correction 5:00	3:00
SOLAR GAIN — GLASS						
(SE) 1.5	m² × 252 × 0.71 / 0.85 × 0.94 × 0.65			58	49	66
	m² ×		×			
	m² ×		×			
	m² ×		×			
	m² ×		×			
SOLAR & TRANS GAIN—WALLS & ROOF						
Wall (SE) 15.51	m² ×	12.6	× 0.56	196	105	114
	m² ×		×			
	m² ×		×			
	m² ×		×			
Roof—Sun 19.6	m² ×	26.2	× 0.46	237	251	217
Roof—Shaded	m² ×		×			
TRANS. GAIN—EXCEPT WALLS & ROOF						
Glass 1.5	m² ×	17.7	× 5.1	136	127	140
Ceiling	m² ×		×			
Floor	m² ×		×			
Partition	m² ×		×			
Infiltration	CMH ×	deg ×	0.29			
INTERNAL HEAT						
People	2 People × 41			82	82	82
Kw	Kw ×		× 860			
Lights	19.6 × 20	W ×	1.08	424	424	424
Appliances etc.						
Credit for Thermal Storage	m² ×	deg ×		(-)	(-)	
			Sub Total			
Safety Factor			%			
Room Sensible Heat Sub Total				1133	1038	1043
Supply Duct Heat Gain	Supply Duct +Leak Loss		Fan −HP = 10%	114	104	105
Bypass Outside Air	50 CMH × 17.7 deg × 0.1 B.F × 0.29			26	24	27
EFFECTIVE ROOM SENSIBLE HEAT	■			1273	1166	1175
ROOM LATENT HEAT						
Infiltration	CMH ×	g/kg ×	0.72			
People	2 People × 49			98		98
Steam		kg/h ×	540			
Appliances etc.						
Vapor Trans.						
			Sub Total			
Safety Factor			%			
Room Latent Heat Sub Total				98	98	98
Supply Duct Leakage Loss			10 %	10	10	10
Bypass Outside Air	25 CMH × 9.4 g/kg × 0.1 BF × 0.72			34	34	35
EFFECTIVE ROOM LATENT HEAT	■			142	142	143
EFFECTIVE ROOM TOTAL HEAT	▣			1415	1308	1318
OUTSIDE AIR HEAT						
Sensible:	CMH ×	deg × (1 − BF) × 0.29				
Latent:	CMH ×	g/kg × (1 − BF) × 0.72				
Grand Total Heat Sub Total						
Return Duct Heat Gain + Return Duct Leak Gain		Pump H.P	+ Pipe Gain = %			
(U.S.R.T) GRAND TOTAL HEAT	▣					

Estimate For.	AM / PM	Peak Load	AM / PM
Hours of Operation	Hour (	~	)

Outside Design Conditions	DB °C	WB °C	CDB %RH	CWB DP °C	%RH g/kg
Outside	41.7	28.4	38		18.8
Room	24.0		50		9.4
Difference	17.7	×××	×××	×××	9.4

Blind	(Non-Existence (Outside, Inside)	L. M. D
Glass	Ordinary, Thick, Absorbent,	%, Double
Color	Light, Medium, Dark.	
Weight	kg/m²(Floor)	kg/m²(Wall)
Internal Heat	W/m²	m²/People

Infiltration

Swinging		
Revolving Doors	People × CMH/Per.	
Open Doors	Doors × CMH/Door	
Exhaust Air		
Crack	m × CMH/m	
Infiltration	CMH ■	

Ventilation

2 People ×	25 CMH/Per.	50
m² ×	CMH/m²	
Ventilation	CMH ■	50

Sensible Heat Factor

E.S.H.F = 1273 (ERSH) / 1415 (ERTH) = 0.9 (12.1)

Dehumidified Air

Apparatus Dewpoint 12.6 °C

1273 (ERSH) / (12 RM − 12.6 ADP)(1 − 0.1 BF) × 0.29 = 430 CMH

NOTES

GLASS (SE) : 1.0 × 1.5 = 1.5

WALL (SE) : 3.5 × 4.86 − 1.5 = 15.51

FORM E-205

12

COOLING AND DEHUMIDIFYING ESTIMATE (METRIC)

Inquiring No. | Inquired By | Sheet No 13
Job Name | Address | Date Original
Space Used For CONFERENCE Room (F-3) | System | Revision
Size 8.0 m × 11 m = 88 m² × 2.8 m H = 246.4 m³ | Person in Charge

Item	Area or Quantity	Sun Gain or Temp Diff.	Factor	Kcal/h	Correction	
				4100	5:00	3:00
SOLAR GAIN — GLASS						
(SE) 4.5	m² × 252 × 0.21/685 × 0.94 × 0.65			177	149	196
	m² ×	×				
	m² ×	×				
	m² ×	×				
	m² ×	×				
SOLAR & TRANS GAIN—WALLS & ROOF						
Wall (SE) 34.38	m² ×	12.6	× 0.56	243	231	253
	m² ×	×				
	m² ×	×				
	m² ×	×				
	m² ×	×				
Roof—Sun 88	m² ×	26.2	× 0.46	1061	1126	972
Roof—Shaded	m² ×	×				
TRANS. GAIN—EXCEPT WALLS & ROOF						
Glass 4.5	m² ×	17.7	× 5.1	407	379	418
Ceiling	m² ×	×				
Floor	m² ×	×				
Partition (1) 18.8	m² ×	8.85	× 1.51	252	235	259
(2) 11.2 m²	×	8.85	× 1.69	168	157	173
Door 3.6 m²	×	8.85	× 2.15	69	64	71
Infiltration	CMH ×	deg ×	0.29			
INTERNAL HEAT						
People	10 People × 41			410	410	410
Kw	Kw ×	×	860			
Lights	88.0 × 20 W ×		1.08	1901	1901	1901
Appliances etc.						
Credit for Thermal Storage	m² ×	deg ×		(−)	(−)	
			Sub Total			
Safety Factor			%			
Room Sensible Heat Sub Total				4683	4650	4653
Supply Duct Heat Gain	Supply Duct + Leak Loss	Fan + HP	= 10%	469	465	466
Bypass Outside Air 400 CMH × 17.7 deg × 0.1 B.F × 0.29				206	192	212
Effective Room Sensible Heat ■				5358	5307	5331
ROOM LATENT HEAT						
Infiltration	CMH ×	g/kg ×	0.72			
People	10 People × 49			490		490
Steam		kg/h ×	540			
Appliances etc.						
Vapor Trans.						
			Sub Total			
Safety Factor			%			
Room Latent Heat Sub Total				490	490	490
Supply Duct Leakage Loss			10%	50	50	50
Bypass Outside Air 400 CMH × 9.4 g/kg × 0.1 BF × 0.72				271	271	288
Effective Room Latent Heat ■				811	811	828
Effective Room Total Heat ▣				6169	6118	6159
OUTSIDE AIR HEAT						
Sensible:	CMH ×	deg × (1 − BF) × 0.29				
Latent:	CMH ×	g/kg × (1 − BF) × 0.72				
Grand Total Heat Sub Total						
Return Duct Heat Gain + Return Duct Leak Gain + Pump H.P + Pipe Gain			= %			
(U.S.R.T) GRAND TOTAL HEAT ▣						

Estimate For.	AM / PM	Peak Load	AM / PM 4
Hours of Operation	Hour (	−	)
Outside Design Conditions	DB	WB	%RH
Conditions	DB °C	WB °C	%RH	DP °C	g/kg
Outside	41.7	28.9	38		18.8
Room	24.0		50		9.4
Difference	17.7	×××	×××	×××	9.4
Blind	Non-existence / Outside / Inside	L M D			
Glass	Ordinary / Thick / Absorbent	% / Double			
Color	Light / Medium / Dark				
Weight	kg/m² (Floor)	kg/m² (Wall)			
Internal Heat	W/m²	m²/People			

Infiltration

Swinging			
Revolving Doors	People ×	CMH/Per.	
Open Doors	Doors ×	CMH/Door	
Exhaust Air			
Crack	m ×	CMH/m	
Infiltration	CMH ■		

Ventilation

10 People ×	25	CMH/Per.	250
m² ×		CMH/m²	⇓
Ventilation	CMH ■		400

Sensible Heat Factor

E.S.H.F = 5358 (ERSH) / 6169 (ERTH) = 0.87 (11.8°C)

Dehumidified Air

Apparatus Dewpoint 12.6 °C

5358 (ERSH) / [24 RM − 12.6 (ADP)](1 − BF) × 0.29 = 1800 CMH (0.1)

NOTES

GLASS (SE): 1.0 × 1.5 × 3 = 4.5

WALL (SE): 8.0 × 4.86 − 4.5 = 34.38

PARTITION (1): 8.0 × 2.8 − 3.6 = 18.8

(2): 4.0 × 2.8 = 11.2

ROOF: SR

DOOR (IN): 1.8 × 2.0 = 3.6

FORM E-20E

COOLING AND DEHUMIDIFYING ESTIMATE (METRIC)

Inquiring No. | Inquired By | Sheet No. 14
Job Name | Address | Date Original
Space Used For ELECTRICAL & INSTRUMENT REPAIR ROOM (F-4) SYSTEM | Revision
Size 18.0 m × 11.0 m = 198.0 m² × 2.8 m(H) = 554.4 m³ | Person in Charge

Item	Area or Quantity	Sun Gain or Temp. Diff.	Factor	Kcal/h 4:00	5:00	3:00
SOLAR GAIN — GLASS					Correction	
(SE)	6.0 m²	× 252 × 0.21 / 0.85 ×	0.94 × 0.65	229	196	261
	m²	×	×			
	m²	×	×			
	m²	×	×			
	m²	×	×			
SOLAR & TRANS GAIN—WALLS & ROOF						
Wall (SE)	81.48 m²	× 12.6	× 0.56	575	548	598
	m²	×	×			
	m²	×	×			
	m²	×	×			
Roof—Sun	198.0 m²	× 26.2	× 0.46	2387	2537	2186
Roof—Shaded	m²	×	×			
TRANS. GAIN—EXCEPT WALLS & ROOF						
Glass	6.0 m²	× 17.7	× 5.1	542	505	557
Ceiling	m²	×	×			
Floor	m²	×	×			
Partition	43.2 m²	× 8.85	× 1.51	578	539	594
Door	7.2 m²	× 8.85	× 2.15	137	128	141
Infiltration	CMH ×	deg ×	0.29			
INTERNAL HEAT						
People	6 People ×	41		246	246	246
Kw	Kw ×	×	860			
Lights	198.0 × 20 W ×		1.08	4277	4277	4277
Appliances Etc.						
Credit for Thermal Storage	m² ×	deg ×		(—)	(—)	
			Sub Total			
Safety Factor			%			
Room Sensible Heat Sub Total				8971	8971	8860
Supply Duct Heat Gain	Supply Duct −Leak Loss	Fan +HP	=10%	898	898	886
Bypass Outside Air	300 CMH × 17.7 deg × 0.1 BF × 0.29			154	144	159
Effective Room Sensible Heat	■			10023	10013	9905
ROOM LATENT HEAT						
Infiltration	CMH ×	g/kg ×	0.72			
People	6 People ×	49		294		294
Steam	kg/h ×		540			
Appliances Etc.						
Vapor Trans.						
			Sub Total			
Safety Factor			%			
Room Latent Heat Sub Total				294	294	294
Supply Duct Leakage Loss			10 %	30	30	30
Bypass Outside Air	300 CMH × 9.4 g/kg × 0.1 BF × 0.72			204	204	208
Effective Room Latent Heat	■			528	528	532
Effective Room Total Heat	≡			10551	10541	10437
OUTSIDE AIR HEAT						
Sensible:	CMH ×	deg × (1 − BF) × 0.29				
Latent:	CMH ×	g/kg × (1 − BF) × 0.72				
Grand Total Heat Sub Total						
Return Duct Heat Gain + Return Duct Leak Gain	− Pump H.P	+ Pipe Gain	= %			
(U.S.R.T) Grand Total Heat	≡					

Estimate For.	AM	PM	Peak Load	AM	PM 4
Hours of Operation	Hour (		~		)

Outside Design Conditions	DB °C	WB °C	%RH	DP °C	g/kg
Outside	41.7	28.4	28		18.8
Room	24.0		50		9.4
Difference	17.7	×××	×××	×××	9.4

Blind	(Non-Existence Outside. Inside)	L. M. D
Glass	Ordinary. Thick. Absorbent.	%. Double
Color	Light. Medium. Dark.	
Weight	kg/m²(Floor)	kg/m²(Wall)
Internal Heat	W/m²	m²/People

Infiltration		
Swinging		
Revolving Doors	People × CMH/Per.	
Open Doors	Doors × CMH/Door	
Exhaust Air		
Crack	m × CMH/m	
Infiltration	CMH ■	

Ventilation		
6 People ×	25 CMH/Per.	150
m² ×	CMH/m²	↓↓
Ventilation	CMH ■	300

SENSIBLE HEAT FACTOR

$$E.S.H.F = \frac{10.023\ (ERSH)}{10.551\ (ERTH)} = 0.95\ (12.5°C)$$

DEHUMIDIFIED AIR

Apparatus Dewpoint 12.6 °C

$$\frac{10023\ (ERSH)}{(24\ RM - 12.6\ ADP)(1 - 0.1\ BF) \times 0.29} = 3.400\ CMH$$

NOTES

GLASS (SE) : 1.0 × 1.5 × 4 = 6.0
WALL (SE) : 18.0 × 4.86 − 6.0 = 81.48
PARTITION : 18.0 × 2.8 − 7.2 = 43.2
DOOR (IN) : 1.8 × 2.0 × 2 = 7.2
ROOF : SR

FORM E-20E

9677

COOLING AND DEHUMIDIFYING ESTIMATE(METRIC)

Inquiring No. | Inquired By | Sheet No. 15
Job Name | Address | Date Original
Space Used For PABX Room (F-5) | System | Revision
Size m× m= 67.68 m² × 2.8 m(H)= 189.50 m³ | Person in Charge

Item	Area or Quantity	Sun Gain or Temp. Diff.	Factor	Kcal/h 5:00	Correction 3:00	Correction 4:00
SOLAR GAIN — GLASS						
	m²×	×				
	m²×	×				
	m²×	×				
	m²×	×				
	m²×	×				
SOLAR & TRANS GAIN—WALLS & ROOF						
Wall (SE)	33.05 m²×	12.0 ×	0.56	222	243	234
(SW)	41.80 m²×	20.4 ×	0.56	478	419	476
	m²×	×				
	m²×	×				
Roof—Sun	67.68 m²×	27.8 ×	0.46	866	748	816
Roof—Shaded	m²×	×				
TRANS. GAIN—EXCEPT WALLS & ROOF						
Glass	m²×	×				
Ceiling	m²×	×				
Floor	m²×	×				
Partition	22.44 m²×	8.25 ×	1.51	280	309	300
Door (IN)	3.6 m² ×	8.25 ×	2.15	64	71	69
Infiltration	CMH×	deg×	0.29			
INTERNAL HEAT						
People	4 People×	41		164	164	164
Kw	Kw×	×	860			
Lights	67.68 × 20 W×		1.08	1462	1462	1462
Appliances Etc.						
Credit for Thermal Storage	m³×	deg×		(—)	(—)	
			Sub Total			
Safety Factor			%			
Room Sensible Heat Sub Total				3536	3416	3521
Supply Duct Heat Gain	Supply Duct +Leak Loss	Fan +HP	=10%	354	342	353
Bypass Outside Air	100 CMH× 16.5 deg× 0.1 BF×0.29			48	53	52
Effective Room Sensible Heat				3938	3811	3926
ROOM LATENT HEAT						
Infiltration	CMH×	g/kg×	0.72			
People	4 People×	49		196	196	196
Steam	kg/h×		540			
Appliances etc.						
Vapor Trans.						
			Sub Total			
Safety Factor			%			
Room Latent Heat Sub Total				196	196	196
Supply Duct Leakage Loss			10%	20	20	20
Bypass Outside Air	100 CMH× 9.5 g/kg×0.1 BF×0.72			69	69	68
Effective Room Latent Heat				285	285	284
Effective Room Total Heat				4223	4096	4220
OUTSIDE AIR HEAT						
Sensible:	CMH×	deg×(1− BF)×0.29				
Latent:	CMH×	g/kg×(1− BF)×0.72				
Grand Total Heat Sub Total						
Return Duct Heat Gain + Return Duct Leak Gain		Pump H.P − Pipe Gain	= %			
(U.S.R.T) Grand Total Heat						

Estimate For.	AM / PM	Peak Load	AM / PM 5
Hours of Operation	Hour (–)		

Outside Design Conditions	DB °C	WB °C	%RH	DP °C	°CDB	°CWB	%RH	g/kg
Outside	40.5	28.2	39					18.9
Room	24.0	.	50					9.4
Difference	16.5	×××	×××	×××				9.5

Blind	Non-existence(outside, inside)	L. M. D
Glass	Ordinary. Thick. Absorbent.	%. Double
Color	Light. Medium. Dark.	
Weight	kg/m²(floor)	kg/m²(wall)
Internal Heat	W/m²	m³/People

Infiltration		
Swinging		
Revolving Doors	People× CMH/per.	
Open Doors	Doors× CMH/door	
Exhaust Air		
Crack	m× CMH/m	
Infiltration	CMH ■	

Ventilation		
4 People×	25 CMH/per.	100
m²×	CMH/m²	
Ventilation	CMH ■	100

Sensible Heat Factor

E.S.H.F = 3938 (ERSH) / 4223 (ERTH) = 0.93 (12.4)

Dehumidified Air

Apparatus Dewpoint 12.6 °C

3938 (ERSH) / (24 RM−12.6 ADP)(1 − 0.1 BF)×0.29 = 1330 CMH

NOTES

SR = 6.8 × 11.0 − 2.85 × 2.5 = 67.68

WALL (SE) : 6.8 × 4.86 = 33.05

(SW) : 8.6 × 4.86 = 41.80

PARTITION : 9.3 × 2.8 − 3.6 = 22.44

DOOR (IN) : 1.8 × 2.0 = 3.6

ROOF : SR

FORM E-20E

COOLING AND DEHUMIDIFYING ESTIMATE (METRIC)

INQUIRING NO. | INQUIRED BY | SHEET NO 16
JOB NAME | ADDRESS | DATE ORIGINAL
SPACE USED FOR COMPUTER RM. UNIT No.2 (0-1) | SYSTEM | REVISION
SIZE 12.0 m × 7.0 m = 84 m² × 3.0 m H = 252 m³ | PERSON IN CHARGE

ITEM	AREA OR QUANTITY	SUN GAIN OR TEMP. DIFF.		FACTOR	Kcal/h 3:00	CORRECTION
SOLAR GAIN — GLASS						
	m²×		×			
	m²×		×			
	m²×		×			
	m²×		×			
	m²×		×			
SOLAR & TRANS GAIN—WALLS & ROOF						
WALL	m²×		×			
	m²×		×			
	m²×		×			
	m²×		×			
ROOF—SUN	m²×		×			
ROOF—SHADED	m²×		×			
TRANS. GAIN—EXCEPT WALLS & ROOF						
GLASS	m²×		×			
CEILING	49.0 m²×	9.1	×	1.16	518	
FLOOR	84.0 m²×	9.1	×	1.59	1216	
PARTITION(1)	13.5 m²×	9.1	×	1.51	186	
(2)	50.4 m²×	9.1	×	1.69	776	
DOOR(IN)	3.6 m²×	9.1	×	2.15	71	
INFILTRATION	CMH×	deg×		0.29		
INTERNAL HEAT						
PEOPLE	4 PEOPLE× 41				164	
KW	KW×		×	860	16800	
LIGHTS	84.0 × 20 W×			1.08	1815	
APPLIANCES ETC.						
CREDIT FOR THERMAL STORAGE	m²×	deg×				
				SUB TOTAL		
SAFETY FACTOR				%		
ROOM SENSIBLE HEAT SUB TOTAL					21546	
SUPPLY DUCT HEAT GAIN	SUPPLY DUCT +LEAK LOSS		FAN +HP	=10%	2155	
BYPASS OUTSIDE AIR	100 CMH × 18.2 dec × 0.1 B.F × 0.29				53	
EFFECTIVE ROOM SENSIBLE HEAT ■					23754	
ROOM LATENT HEAT						
INFILTRATION	CMH×	g/kg×		0.72		
PEOPLE	4 PEOPLE× 49				196	
STEAM	kg/h×			540		
APPLIANCES ETC.						
VAPOR TRANS.						
				SUB TOTAL		
SAFETY FACTOR				%		
ROOM LATENT HEAT SUB TOTAL					196	
SUPPLY DUCT LEAKAGE LOSS				10%	20	
BYPASS OUTSIDE AIR	100 CMH × 9.6 g/kg × 0.1 BF × 0.72				70	
EFFECTIVE ROOM LATENT HEAT ■					286	
EFFECTIVE ROOM TOTAL HEAT ≡					24040	
OUTSIDE AIR HEAT						
SENSIBLE:	CMH×	deg × (1 − BF) × 0.29				
LATENT:	CMH×	g/kg × (1 − BF) × 0.72				
GRAND TOTAL HEAT SUB TOTAL						
RETURN DUCT HEAT GAIN + RETURN DUCT LEAK GAIN − PUMP H.P − PIPE GAIN				= %		
(U.S.R.T) GRAND TOTAL HEAT ≡						

ESTIMATE FOR.	AM / PM	PEAK LOAD	AM / PM 3
HOURS OF OPERATION	HOUR (	~	)
OUTSIDE DESIGN CONDITIONS	°CDB	°CWB	%RH
CONDITIONS	DB °C	WB °C	%RH	DP °C	g/kg
OUTSIDE	42.2	28.6	37		19.0
ROOM	24.0		50		9.4
DIFFERENCE	18.2	×××	×××	×××	9.6
BLIND	NON-EXISTENCE / OUTSIDE. INSIDE) L M.D				
GLASS	ORDINARY. THICK. ABSORBENT.				%. DOUBLE
COLOR	LIGHT. MEDIUM. DARK.				
WEIGHT	kg/m²(FLOOR)				kg/m²(WALL)
INTERNAL HEAT	W/m²				m²/PEOPLE

INFILTRATION

SWINGING			
REVOLVING DOORS	PEOPLE×	CMH/PER.	
OPEN DOORS	DOORS×	CMH/DOOR	
EXHAUST AIR			
CRACK	m×	CMH/m	
INFILTRATION		CMH ■	

VENTILATION

4 PEOPLE×	25	CMH/PER.	100
m²×		CMH/m²	
VENTILATION		CMH ■	100

SENSIBLE HEAT FACTOR

E.S.H.F = 23,754 (ERSH) / 24040 (ERTH) = 0.99 (13°C)

DEHUMIDIFIED AIR

APPARATUS DEWPOINT 13°C

23,754 (ERSH) / [24 RM − 13 ADP)(1 − 0.1 BF) × 0.29] = 8400 CMH

NOTES

PARTITION(1) : 4.5 × 3.0 = 13.5
(2) : 18.0 × 3.0 − 3.6 = 50.4

DOOR(IN) : 1.8 × 2.0 = 3.6

CEILING : 7.0 × 7.0 = 49.0

FLOOR : SR

FORM E-20E

COOLING AND DEHUMIDIFYING ESTIMATE (METRIC)

Inquiring No | Inquired By | Sheet No 17
Job Name | Address | Date Original
Space Used For COMPUTER ROOM UNIT NO.1 (0-3) | System | Revision
Size m × m = 127.21 m² × 3.0 m(H) = 381.63 m³ | Person in Charge

Item	Area or Quantity	Sun Gain or Temp. Diff.	Factor	Kcal/h 3:00	Correction
SOLAR GAIN — GLASS					
	m² ×	×			
	m² ×	×			
	m² ×	×			
	m² ×	×			
	m² ×	×			
SOLAR & TRANS GAIN—WALLS & ROOF					
Wall (SE)	51.5 m² ×	13.1 ×	0.56	378	
(SW)	43.0 m² ×	17.9 ×	0.56	431	
	m² ×	×			
	m² ×	×			
Roof—Sun	m² ×	×			
Roof—Shaded	m² ×	×			
TRANS. GAIN—EXCEPT WALLS & ROOF					
Glass	m² ×	×			
Ceiling	22.35 m² ×	9.1 ×	1.16	236	
Floor	127.21 m² ×	9.1 ×	1.59	1841	
Partition	42.75 m² ×	9.1 ×	1.51	588	
Door	3.6 m² ×	9.1 ×	2.15	71	
Infiltration	CMH ×	deg ×	0.29		
INTERNAL HEAT					
People	6 People ×	41		246	
Kw	Kw ×	×	860	25440	
Lights	127.21 × 20 W ×		1.08	2748	
Appliances Etc.					
Credit for Thermal Storage	m³ ×	deg ×		(-)	(-)
			Sub Total		
Safety Factor			%		
Room Sensible Heat Sub Total				31979	
Supply Duct Heat Gain	Supply Duct ÷Leak Loss	÷HP	=10%	3198	
Bypass Outside Air	150 CMH × (8.2 deg × 0.1 B.F × 0.29)			80	
Effective Room Sensible Heat				35257	
ROOM LATENT HEAT					
Infiltration	CMH ×	g/kg ×	0.72		
People	6 People ×	49		294	
Steam		kg/h ×	540		
Appliances Etc.					
Vapor Trans.					
			Sub Total		
Safety Factor			%		
Room Latent Heat Sub Total				294	
Supply Duct Leakage Loss			%	30	
Bypass Outside Air	150 CMH × 9.6 g/kg ×	BF × 0.72		104	
Effective Room Latent Heat				428	
Effective Room Total Heat				35685	
OUTSIDE AIR HEAT					
Sensible:	CMH ×	deg × (1 − BF) × 0.29			
Latent:	CMH ×	g/kg × (1 − BF) × 0.72			
Grand Total Heat Sub Total					
Return Duct Heat Gain + Return Duct Leak Gain		Pump H.P	Pipe − Gain = %		
(U.S.R.T) Grand Total Heat					

Estimate For	AM / PM	Peak Load	AM / PM 3
Hours of Operation	Hour (~)		

Outside Design Conditions	°CDB	°CWB	%RH

Conditions	DB °C	WB °C	%RH	DP °C	g/kg
Outside	42.2	28.6	37		19.0
Room	24.0		50		9.4
Difference	18.2	×××	×××	×××	9.6

Blind	(Non-Existence / Outside, Inside) L. M. D
Glass	(Ordinary, Thick, Absorbent) %. Double
Color	(Light, Medium, Dark)
Weight	kg/m² (Floor) kg/m² (Wall)
Internal Heat	W/m² m²/People

Infiltration
Swinging
Revolving Doors People × CMH/Per.
Open Doors Doors × CMH/Door
Exhaust Air
Crack m × CMH/m
Infiltration CMH ■

Ventilation
6 People × 25 CMH/Per. = 150
m² × CMH/m²
Ventilation CMH ■ 150

Sensible Heat Factor
E.S.H.F = 35257 (ERSH) / 35685 (ERTH) = 099 (13°C)

Dehumidified Air
Apparatus Dewpoint 13.0 °C
35257 (ERSH) / (24RM · 13ADP)(1 − 0.1 BF) × 0.29 = 12.300 CMH

NOTES
SR = 10.3 × 8.6 + 5.15 × 7.5 = 127.21
WALL (SE) : 10.3 × 5.0 = 51.5
(SW) : 8.6 × 5.0 = 43.0
PARTITION : 15.45 × 3.0 − 3.6 = 42.75
DOOR (IN) : 1.8 × 2.0 = 3.6
CEILING : 7.45 × 3.0 = 22.35
FLOOR : SR

FORM E-20E

COOLING AND DEHUMIDIFYING ESTIMATE (METRIC)

Inquiring No. | Inquired By | Sheet No 18
Job Name | Address | Date Original
Space Used For UNITS No.1 & No.2 CONTROL EQUIPMENT ROOM (M-3) SYSTEM | Revision
Size m × m = 216.33 m² × 2.8 m(H) = 605.73 m³ | Person in Charge

Item	Area or Quantity	Sun Gain or Temp. Diff.	Factor	Kcal/h 3:00	Correction
SOLAR GAIN — GLASS					
	m² ×	×			
	m² ×	×			
	m² ×	×			
	m² ×	×			
	m² ×	×			
SOLAR & TRANS GAIN—WALLS & ROOF					
Wall (SE)	51.24 m² ×	12.9 ×	0.53	351	
(SW)	26.23 m² ×	15.8 ×	0.53	220	
	m² ×	×			
	m² ×	×			
Roof—Sun	m² ×	×			
Roof—Shaded	m² ×	×			
TRANS. GAIN—EXCEPT WALLS & ROOF					
Glass	m² ×	×			
Ceiling	216.33 m² ×	9.1 ×	2.52	4961	
Floor	216.33 m² ×	9.1 ×	2.52	4961	
Partition (1)	56.06 m² ×	9.1 ×	1.51	771	
(2)	38.5 m² ×	9.1 ×	1.69	592	
Door (IN)	5.4 m² ×	9.1 ×	2.15	106	
Infiltration	CMH ×	deg ×	0.29		
INTERNAL HEAT					
People	6 People × 41			246	
Kw	3.65 Kw × 0.8 ×		860	20.984	
Lights	216.33 × 20 W ×		1.08	4673	
Appliances etc.					
Credit for Thermal Storage	m² ×	deg ×		(—)	(—)
			Sub Total		
Safety Factor			%		
Room Sensible Heat Sub Total				37 865	
Supply Duct Heat Gain	Supply Duct +Leak Loss	Fan -HP	=10%	3787	
Bypass Outside Air	150 CMH × 18.2 deg × 0.1 B.F × 0.29			80	
Effective Room Sensible Heat	■			41 732	
ROOM LATENT HEAT					
Infiltration	CMH ×	g/kg ×	0.72		
People	6 People × 49			294	
Steam	kg/h ×		540		
Appliances etc.					
Vapor Trans.					
			Sub Total		
Safety Factor			%		
Room Latent Heat Sub Total				294	
Supply Duct Leakage Loss			10 %	30	
Bypass Outside Air	150 CMH × 9.6 g/kg × BF × 0.72			104	
Effective Room Latent Heat	■			428	
Effective Room Total Heat	≡			42 160	
OUTSIDE AIR HEAT					
Sensible:	CMH ×	deg × (1 − BF) × 0.29			
Latent:	CMH ×	g/kg × (1 − BF) × 0.72			
Grand Total Heat Sub Total					
Return Duct Heat Gain + Return Duct Leak Gain		Pump H.P − Pipe Gain	= %		
(U.S.R.T) Grand Total Heat	≡				

Estimate For.	AM / PM — Peak Load — AM / PM 3
Hours of Operation	Hour (—)
Outside Design Conditions	°CDB °CWB %RH

Conditions	DB °C	WB °C	%RH	DP °C	g/kg
Outside	42.2	28.6	37		19.0
Room	24.0		50		9.4
Difference	18.2	×××	×××	×××	9.6

Blind	(Non-existence/Outside. Inside) L. M. D.
Glass	Ordinary. Thick. Absorbent. %. Double
Color	Light. Medium. Dark.
Weight	kg/m²(Floor) kg/m²(Wall)
Internal Heat.	W/m² m²/People

INFILTRATION

Swinging		
Revolving Doors	People × CMH/Per.	
Open Doors	Doors × CMH/Door	
Exhaust Air		
Crack	m × CMH/m	
Infiltration	CMH ■	

VENTILATION

6 People ×	25 CMH/Per.	150
m² ×	CMH/m²	
Ventilation	CMH ■	150

SENSIBLE HEAT FACTOR

E.S.H.F = 41.732 (ERSH) / 42.160 (ERTH) = 0.99 (13.3°C)

DEHUMIDIFIED AIR

Apparatus Dewpoint 13.0 °C

41.732 (ERSH) / 24 RM-13 ADP (1 − 0.1 BF) × 0.29 = 14.600 CMH

NOTES

WALL (SE): 16.8 × 3.05 = 51.24
(SW): 8.6 × 3.05 = 26.23

CEILING : SR
FLOOR : SR
PARTITION (1): 21.95 × 2.8 − 5.4 = 56.06
(2): 13.75 × 2.8 = 38.5

DOOR (IN): (1.8 + 0.9) × 2.0 = 5.4

SR = 16.8 × 13.75 − 2.85 × 5.15 = 216.33

FORM E-2050

9

COOLING AND DEHUMIDIFYING ESTIMATE (METRIC)

Inquiring No. | Inquired By | Sheet No. 19
Job Name | Address | Date Original
Space Used For FUEL LABORATORY (M-1.) | System | Revision
Size 8.3 m × 7.9 m = 65.57 m² × 2.8 m(H) = 183.60 m³ | Person in Charge

Item	Area or Quantity	Sun Gain or Temp. Diff.	Factor	Kcal/h 3:00	Correction
SOLAR GAIN — GLASS					
(SE)	3.0 m²	× 252×0.24/685	× 0.94 × 0.65	131	
	m²	×	×		
	m²	×	×		
	m²	×	×		
	m²	×	×		
SOLAR & TRANS GAIN—WALLS & ROOF					
Wall (SE)	22.32 m²	× 12.9	× 0.53	153	
(NE)	24.10 m²	× 11.9	× 0.53	152	
	m²	×	×		
	m²	×	×		
Roof—Sun	m²	×	×		
Roof—Shaded	m²	×	×		
TRANS. GAIN—EXCEPT WALLS & ROOF					
Glass	3.0 m²	× 18.7	× 5.1	279	
Ceiling	65.57 m²	× 9.1	× 2.52	1504	
Floor	65.57 m²	× 9.1	× 2.52	1504	
Partition (1)	7.98 m²	× 9.1	× 1.51	110	
(2)	15.12 m²	× 9.1	× 1.69	233	
Infiltration	CMH	× deg ×	0.29		
INTERNAL HEAT					
People	4 People	× 41		164	
Kw	Kw	×	× 860		
Lights	65.57	× 20 W ×	1.08	1417	
Appliances Etc.					
Credit for Thermal Storage	m³	× deg ×		(−)	(−)
			Sub Total		
Safety Factor			%		
Room Sensible Heat Sub Total				5647	
Supply Duct Heat Gain	Supply Duct +Leak Loss	FAN +HP	=10%	565	
Bypass Outside Air	100 CMH	× 18.2 deg	× 0.1 BF × 0.29	53	
Effective Room Sensible Heat ■				6265	
ROOM LATENT HEAT					
Infiltration	CMH	× g/kg ×	0.72		
People	5 People	× 49		245	
Steam		kg/h ×	540		
Appliances Etc.					
Vapor Trans.					
			Sub Total		
Safety Factor			%		
Room Latent Heat Sub Total				245	
Supply Duct Leakage Loss			%	25	
Bypass Outside Air	100 CMH	× 9.6 g/kg	× 0.1 BF × 0.72	70	
Effective Room Latent Heat ■				340	
Effective Room Total Heat ◙				6605	
OUTSIDE AIR HEAT					
Sensible:	CMH	× deg × (1− BF)	× 0.29		
Latent:	CMH	× g/kg × (1− BF)	× 0.72		
Grand Total Heat Sub Total					
Return Duct Heat Gain + Return Duct Leak Gain	+ Pump H.P	+ Pipe Gain	= %		
(U.S.R.T) GRAND TOTAL HEAT ◙					

Estimate For.	AM / PM	Peak Load	AM / PM 3
Hours of Operation	Hour (	−	)

Outside Design Conditions	°CDB	°CWB	%RH	DP °C	g/kg
Conditions	DB °C	WB °C	%RH	DP °C	g/kg
Outside	42.2	28.6	37		19.0
Room	24.0		50		9.4
Difference	18.2	×××	×××	×××	9.6

Blind	(NON-EXISTENCE(OUTSIDE, INSIDE) L. M. D
Glass	ORDINARY. THICK. ABSORBENT. %. DOUBLE
Color	LIGHT. MEDIUM. DARK.
Weight	kg/m²(FLOOR) kg/m²(WALL)
Internal Heat	W/m² m²/PEOPLE

INFILTRATION

Swinging		
Revolving Doors	People × CMH/PER.	
Open Doors	Doors × CMH/DOOR	
Exhaust Air		
Crack	m × CMH/m	
Infiltration	CMH ■	

VENTILATION

4 People ×	25 CMH/PER.	100
m² ×	CMH/m²	
Ventilation	CMH ■	

SENSIBLE HEAT FACTOR

E.S.H.F = 6.265 (ERSH) / 6.605 (ERTH) = 0.95 (12.5°C)

DEHUMIDIFIED AIR

Apparatus Dewpoint 12.6 °C

6.265 (ERSH) / (24 RM − 12.6 ADP)(1 − 0.1 BF) × 0.29 = 2.200 CMH

NOTES

GLASS (SE): 1.0 × 1.5 × 2 = 3.0
WALL (SE): 8.3 × 3.05 − 3.0 = 22.32
(NE): 7.9 × 3.05 = 24.1
CEILING: SR
FLOOR: SR
PARTITION (1) 2.85 × 2.8 = 7.98
(2) 5.4 × 2.8 = 15.12

FORM E-20

COOLING AND DEHUMIDIFYING ESTIMATE (METRIC)

Inquiring No.	Inquired By
Job Name	Address (M-2)
Space Used For WATER ANALYSIS & ANALYTICAL INSTRUMENT ROOM	System
Size m × m = 134.75 m² × 2.8 m(H) = 377.3 m³	

Sheet No. - 20
DATE ORIGINAL
REVISION
PERSON IN CHARGE

Item	Area or Quantity	Sun Gain or Temp. Diff.	Factor	Kcal/h 3:00	Correction
SOLAR GAIN — GLASS					
(SE)	3.0 m² ×	252×0.24/6.85 ×	0.94×0.65	131	
	m² ×		×		
	m² ×		×		
	m² ×		×		
	m² ×		×		
SOLAR & TRANS GAIN — WALLS & ROOF					
Wall (SE)	23.23 m² ×	12.9	× 0.53	159	
	m² ×		×		
	m² ×		×		
	m² ×		×		
Roof — Sun	m² ×		×		
Roof — Shaded	m² ×		×		
TRANS. GAIN — EXCEPT WALLS & ROOF					
Glass	3.0 m² ×	18.2	× 5.1	279	
Ceiling	134.75 m² ×	9.1	× 2.52	3090	
Floor	134.75 m² ×	9.1	× 2.52	3090	
Partition (1)	50.04 m² ×	9.1	× 1.51	688	
(2)	20.88 m² ×	9.1	× 1.69	322	
(3)	38.5 m² ×	9.1	× 1.69	592	
Door (IN)	7.2 m² ×	9.1	× 2.15	101	
INTERNAL HEAT					
People	7 People × 41			287	
Kw	Kw ×		× 860		
Lights	134.75 × 20 W ×		1.08	2911	
Appliances Etc.					
Credit for Thermal Storage	m² ×	deg ×		(−)	(−)
			Sub Total		
Safety Factor			%		
Room Sensible Heat Sub Total				11690	
Supply Duct Heat Gain + Supply Duct Leak Loss + Fan HP			= 10 %	1169	
Bypass Outside Air	210 CMH × 18.2 deg × 0.1 BF × 0.29			111	
EFFECTIVE ROOM SENSIBLE HEAT				12970	
ROOM LATENT HEAT					
Infiltration	CMH ×	g/kg ×	0.72		
People	7 People × 49			343	
Steam		kg/h ×	540		
Appliances Etc.					
Vapor Trans.					
			Sub Total		
Safety Factor			%		
Room Latent Heat Sub Total				343	
Supply Duct Leakage Loss			10 %	35	
Bypass Outside Air	210 CMH × 9.6 g/kg × 0.1 BF × 0.72			146	
EFFECTIVE ROOM LATENT HEAT				524	
EFFECTIVE ROOM TOTAL HEAT				13494	
OUTSIDE AIR HEAT					
Sensible:	CMH ×	deg × (1 − BF) × 0.29			
Latent:	CMH ×	g/kg × (1 − BF) × 0.72			
Grand Total Heat Sub Total					
Return Duct Heat Gain + Return Duct Leak Gain + Pump H.P + Pipe Gain			= %		
(U.S.R.T) GRAND TOTAL HEAT					

Estimate For	AM / PM	Peak Load	AM / PM 3
Hours of Operation	Hour (~)		

Outside Design Conditions: CDB CWB %RH

Conditions	DB ℃	WB ℃	%RH	DP ℃	g/kg
Outside	42.2	28.6	37		19.0
Room	24.0		50		9.4
Difference	18.2	×××	×××	×××	9.6

BLIND	NON-EXISTENCE (OUTSIDE, INSIDE) L. M. D.
GLASS	ORDINARY, THICK, ABSORBENT, %, DOUBLE
COLOR	LIGHT, MEDIUM, DARK
WEIGHT	kg/m² (FLOOR) kg/m² (WALL)
INTERNAL HEAT	W/m² m²/PEOPLE

INFILTRATION

Swinging	
Revolving Doors People × CMH/PER.	
Open Doors Doors × CMH/DOOR	
Exhaust Air	
Crack m × CMH/m	
Infiltration CMH	

VENTILATION

7 People × 25 CMH/PER.	175
m² × CMH/m²	↓
Ventilation CMH	210

SENSIBLE HEAT FACTOR

E.S.H.F = 12970 (ERSH) / 13494 (ERTH) = 0.96 (12.6℃)

DEHUMIDIFIED AIR

Apparatus Dewpoint 12.6 ℃

12970 (ERSH) / (24 RM − 12.6 ADP)(1 − 0.1 BF) × 0.29 = 4400 CMH

NOTES

SR = 13.75 × 8.6 + 5.5 × 3.0 = 134.75

GLASS (SE) : 1.0 × 1.5 × 2 = 3.0

WALL (SE) : 8.6 × 3.05 − 3.0 = 23.23

CEILING : SR

FLOOR : SR

PARTITION (1) : 19.8 × 2.8 − 5.4 = 50.04

(2) : 8.1 × 2.8 − 1.8 = 20.88

(3) : 13.75 × 2.8 = 38.5

DOOR (IN) : 1.8 × 2.0 + 0.9 × 2.0 × 2 = 7.2

FORM E-205

5. EQUIPMENT LOAD

5-1 AHU-1 x 2ea (100% STANBY)

(1) CONDITIONS

		D.B	W.B	ENTHALPY
ROOM	:	24.0°C	17.1°C.	11.5 Kcal/kg
OUTSIDE	:	42.2°C	28.6°C	22.0 Kcal/kg
R S.H	:	59.011 Kcal/H		
S.H.F	:	0.99		
DEHUMIDIFIED AIR	:	20.700 m^3/H		
OUT AIR	:	250 m^3/H		
RETURN AIR	:	20.450		

(2) REQUIRED COOLING CAPACITY

$$\text{MIX POINT} = \frac{250^{m^3/H} \times 22.0^{Kcal/kg} + 20450^{m^3/H} \times 11.5^{Kcal/kg}}{20.700\ m^3/H} = 11.6\ Kcal/kg$$

$$\therefore [\ 20.700^{m^3/H} \times 1.2^{kg/m^3} \times (11.6 - 8.7)^{kcal/kg} \times (1 - 0.1)^{BF} \times 1.05$$

$$= 68.000\ Kcal/H$$

⊙ PEAK LOAD (PM 3:00)

E.R.T.H : 59.725 Kcal/H

OUTSIDE AIR HEAT : $250^{m^3/h} \times 18.2 \times (1-0.1) \times 0.29 = 1.188^{Kcal/h}$ ... ②

$250^{m^3/H} \times 9.6 \times (1-0.1) \times 0.72 = 1.556^{kcal/h}$ ... ③

TOTAL = ① + ② + ③

$= (59.725 + 1.188 + 1556) \times 1.05 = 66.000^{Kcal/h}$

PSYCHROMETRIC CHART

ZONE NAME : COMPUTER ROOM (AC-1)

SA : 20.700 CMH

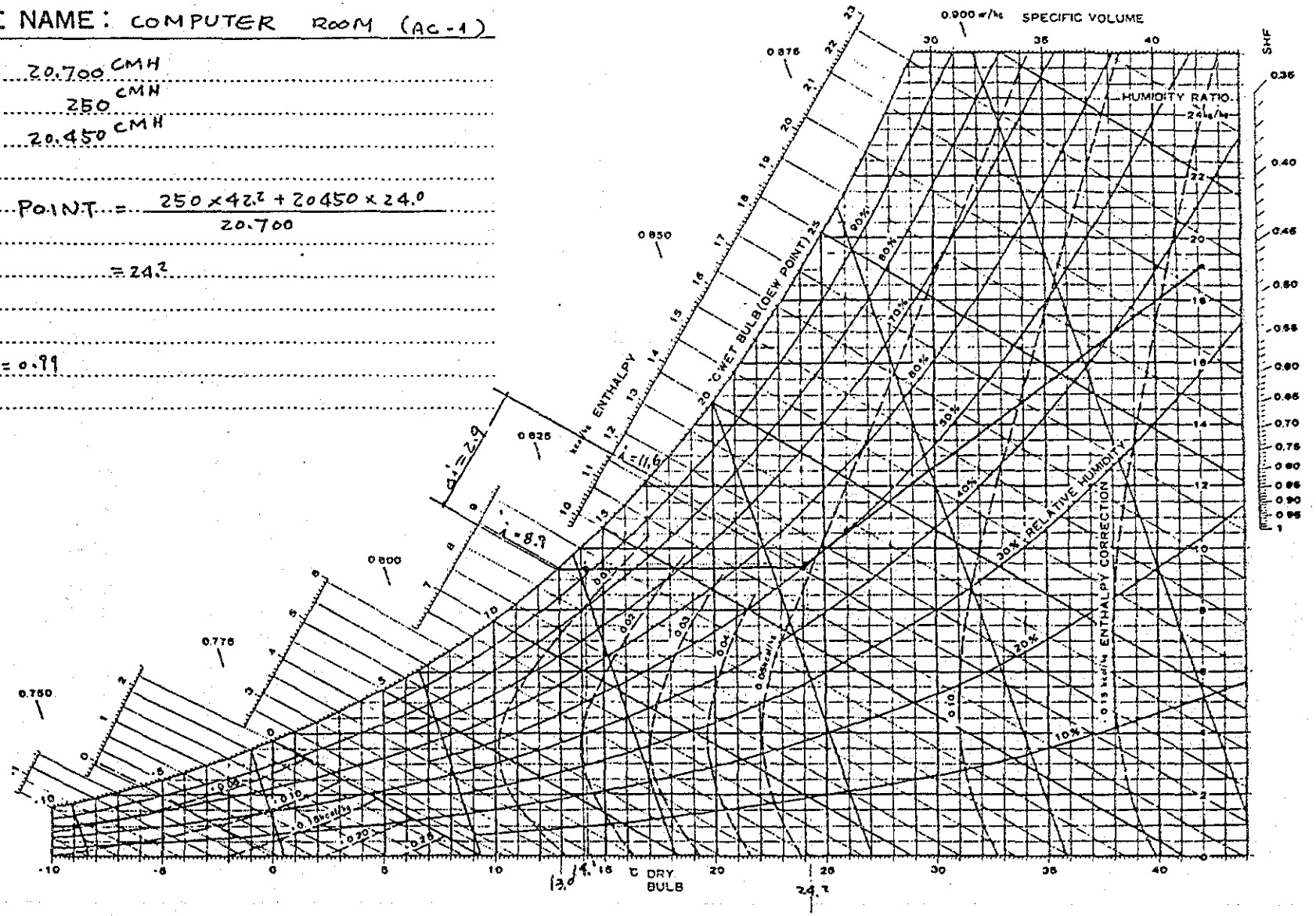
OA : 250 CMH

RA : 20.450 CMH

MIX POINT = $\frac{250 \times 42.2 + 20450 \times 24.0}{20.700}$

$= 24.2$

SHF = 0.99



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5 - 2 AHU - 2 x2 ea (50% x 2)

(1) CONDITIONS

		D.B	W.B	ENTHALPY
ROOM	:	24.0°C	17.1°C.	11.5 Kcal/kg
OUTSIDE	:	42.2°C	28.6°C	22.0 Kcal/kg
R S.H	:	67.893	Kcal/H /2 = 33.947 Kcal/H	
S.H.F	:	0.9		
DEHUMIDIFIED AIR	:	23000 m³/H /2 = 11500 m³/H		
OUT AIR	:	1.650 m³/H /2 = 825		
RETURN AIR	:	21.350 m³/H /2 = 10675		

(2) REQUIRED COOLING CAPACITY

$$\text{MIX POINT} = \frac{825^{m^3/H} \times 22.0^{kcal/kg} + 10675^{m^3/H} \times 11.5^{kcal/kg}}{11.500} = 12.3^{kcal/kg}$$

$$\therefore [\ 11500^{m^3/H} \times 1.2^{kg/m^3} \times (12.3 - 8.6)^{kcal/kg} \times (1 - 0.1)^{BF} \times 1.05$$

$$= 48.000^{kcal/H}$$

⊙ PEAK LOAD (PM 3:00)

E.R.T.H : 70452 Kcal/H ...①

OUTSIDE AIR HEAT : $1650^{m^3/H} \times 18.2 \times (1-0.1) \times 0.29 = 7.838^{Kcal/H}$ ...②

$1650^{m^3/H} \times 9.6 \times (1-0.1) \times 0.72 = 10.265^{Kcal/H}$ ...③

TOTAL = ① + ② + ③

= (70452 + 7838 + 10265) × 1.05 /2 = 47.000 Kcal/H

PSYCHROMETRIC CHART

ZONE NAME: CENTRAL CONTROL ROOM etc (AC-2 x 2)

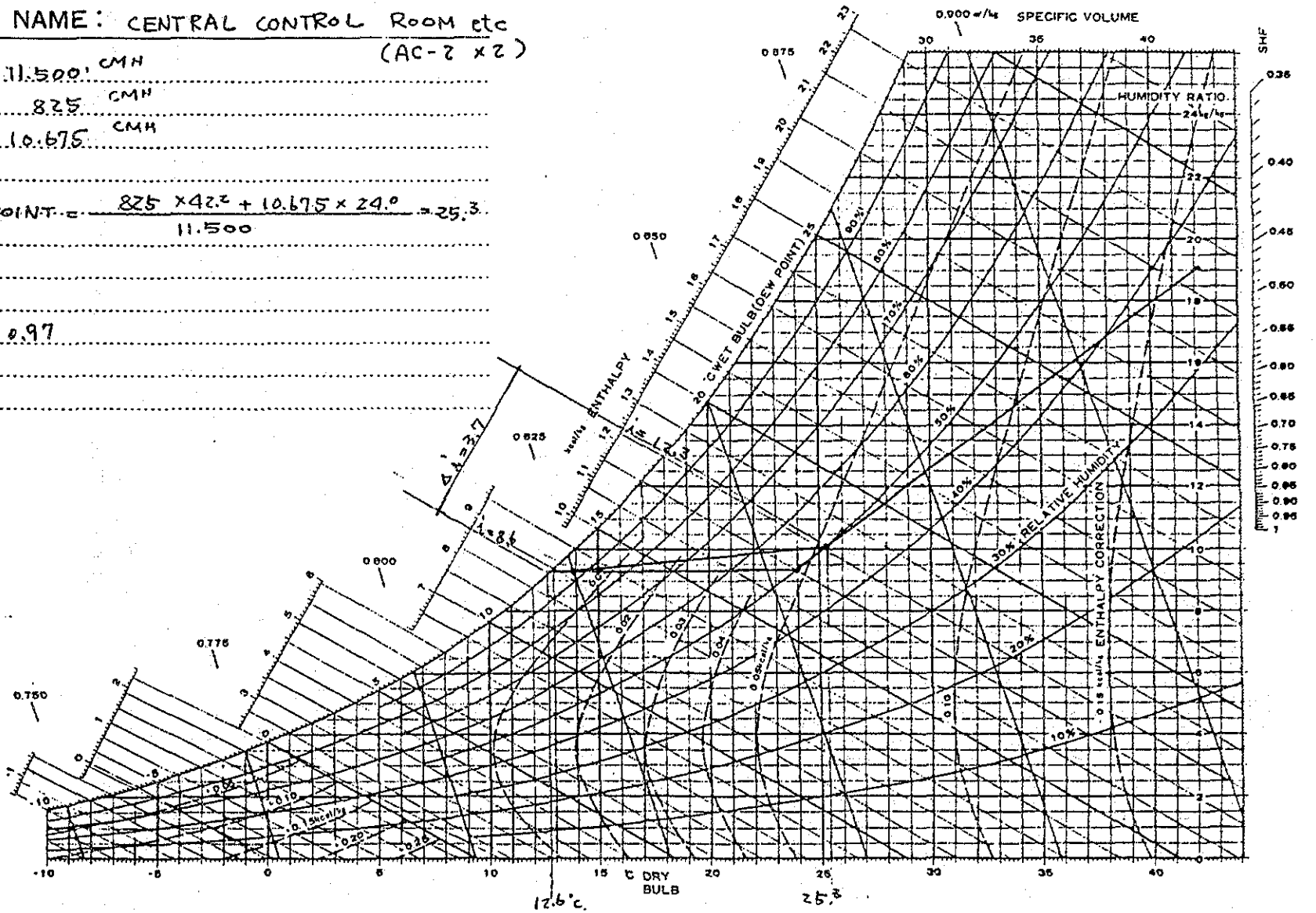
SA : 11.500 CMH

OA : 825 CMH

RA : 10.675 CMH

$$\text{MIX POINT} = \frac{825 \times 42.2 + 10.675 \times 24.0}{11.500} = 25.3$$

SHF = 0.97



5 - 3 AHU - 3 × 2ea (50% × 2)

(1) CONDITIONS

		D.B	W.B	ENTHALPY
ROOM	:	24.0°C	17.1°C	11.5 Kcal/kg
OUTSIDE	:	42.2°C	28.6°C	22.0 Kcal/kg
R S.H	:	41.733	Kcal/H /2 = 20.867 Kcal/H	
S.H.F	:	0.99		
DEHUMIDIFIED AIR	:	14.600 m³/H	/2 = 7300 m³/H	
OUT AIR	:	150 m³/H	/2 = 75	
RETURN AIR	:	14.450 m³/H	/2 = 7.225	

(2) REQUIRED COOLING CAPACITY

$$\text{MIX POINT} = \frac{75\ m^3/H \times 22.0\ Kcal/kg + 7.225\ m^3/H \times 11.5\ Kcal/kg}{7.300} = 11.6\ Kcal/kg$$

$$\therefore [\ 7.300\ m^3/H \times 1.2\ kg/m^3 \times (11.6 - 8.7)\ Kcal/kg \times (1 - 0.1)\ BF \times 1.05$$

$$= 24.000\ Kcal/H$$

⊙ PEAK LOAD (PM 3:00)

E.R.T.H = 42.160 Kcal/H ... ①

OUTSIDE AIR HEAT : $150\ m^3/H \times 18.2 \times (1-0.1) \times 0.29 = 713\ Kcal/H$ ... ②

$150\ m^3/H \times 9.6 \times (1-0.1) \times 0.72 = 934\ Kcal/H$ ... ③

TOTAL = ① + ② + ③

= (42.160 + 713 + 934) × 1.05/2 = 23.000 Kcal/H

PSYCHROMETRIC CHART

ZONE NAME : UNIT NO.1 & NO.2 CONTROL EQUIPMENT ROOM (AC-3×2)

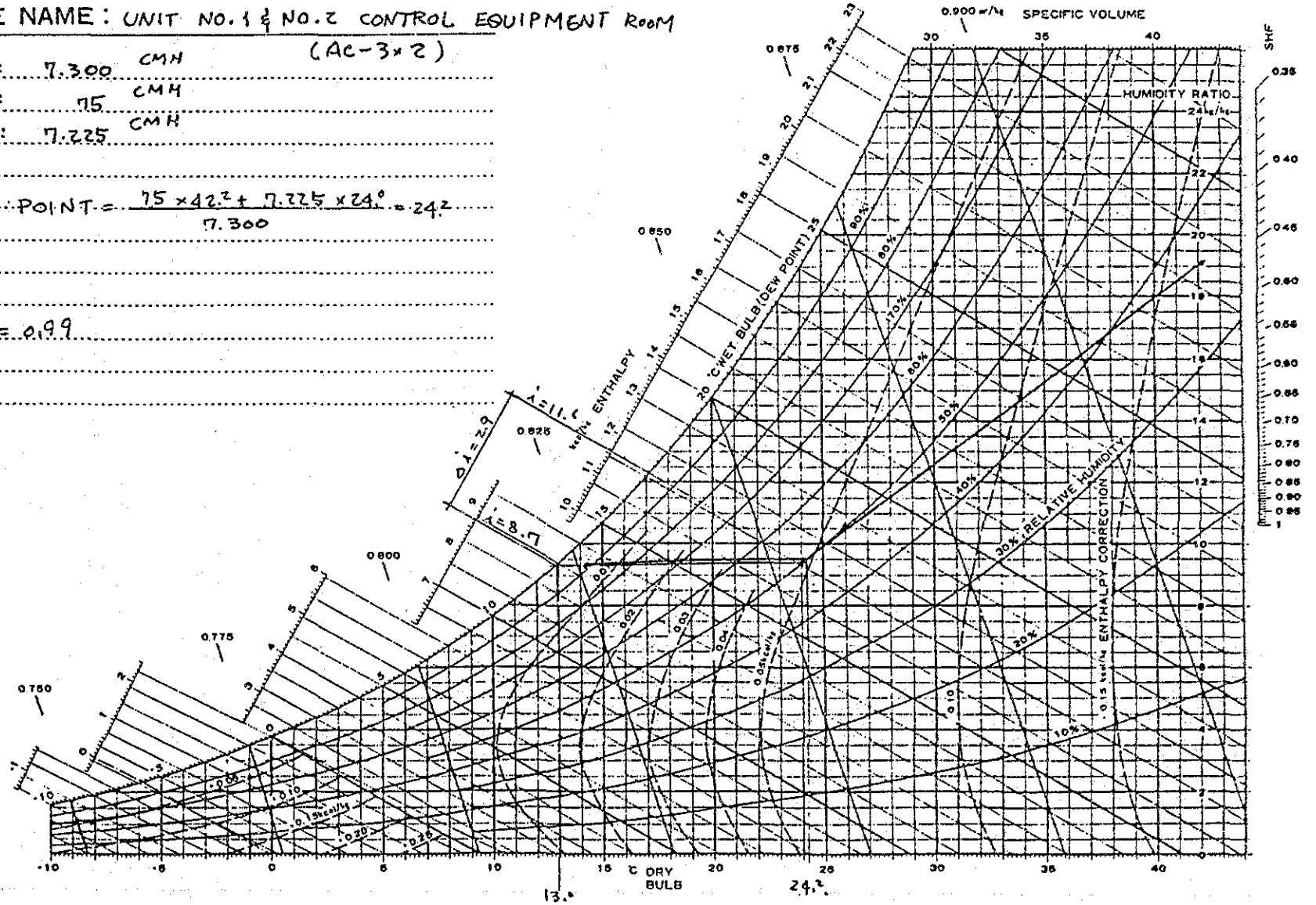
SA : 7.300 CMH

OA : 75 CMH

RA : 7.225 CMH

MIX POINT = $\frac{75 \times 42.2 + 7.225 \times 24.0}{7.300} = 24.2$

SHF = 0.99



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5 - 4 AHU - 4 × 2ea (50% × 2)

(1) CONDITIONS

		D.B	W.B	ENTHALPY
ROOM	:	24.0 °C	17.1 °C.	11.5 kcal/kg
OUTSIDE	:	42.2 °C	28.6 °C	22.0 kcal/kg
R S.H	:	19.235 kcal/H/2 = 9.618 kcal/H		
S.H.F	:	0.96		
DEHUMIDIFIED AIR	:	6.600 m³/H /2 = 3.300		
OUT AIR	:	310 m³/H /2 = 155		
RETURN AIR	:	6.290 m³/H /2 = 3.145		

(2) REQUIRED COOLING CAPACITY

$$\text{MIX POINT} = \frac{155^{m^3/H} \times 22.0^{kcal/kg} + 3.145^{m^3/H} \times 11.5^{kcal/kg}}{3.300} = 12.0^{kcal/kg}$$

$$\therefore [\ 3.300^{m^3/H} \times 1.2^{kg/m^3} \times (12.0 - 8.5)^{kcal/kg} \times (1 - 0.1)^{BF} \times 1.05$$

$$= 13.000^{kcal/H}$$

① PEAK LOAD (PM 3:00)

E.R.T.H = 20.069 kcal/H ... ①

OUTSIDE AIR HEAT : $310^{m^3/H} \times 18.2 \times (1-0.1) \times 0.29 = 1.473^{kcal/H}$ ... ②

$310^{m^3/H} \times 9.6 \times (1-0.1) \times 0.72 = 1.929$ ... ③

TOTAL = ① + ② + ③

= (20.069 + 1.473 + 1.929) × 1.05 /2 = 13.000 kcal/H

PSYCHROMETRIC CHART

ZONE NAME : FUEL LABORATORY
WATER ANALYSIS & ANALITICAL INSTRUMENT RM

(AC-4)

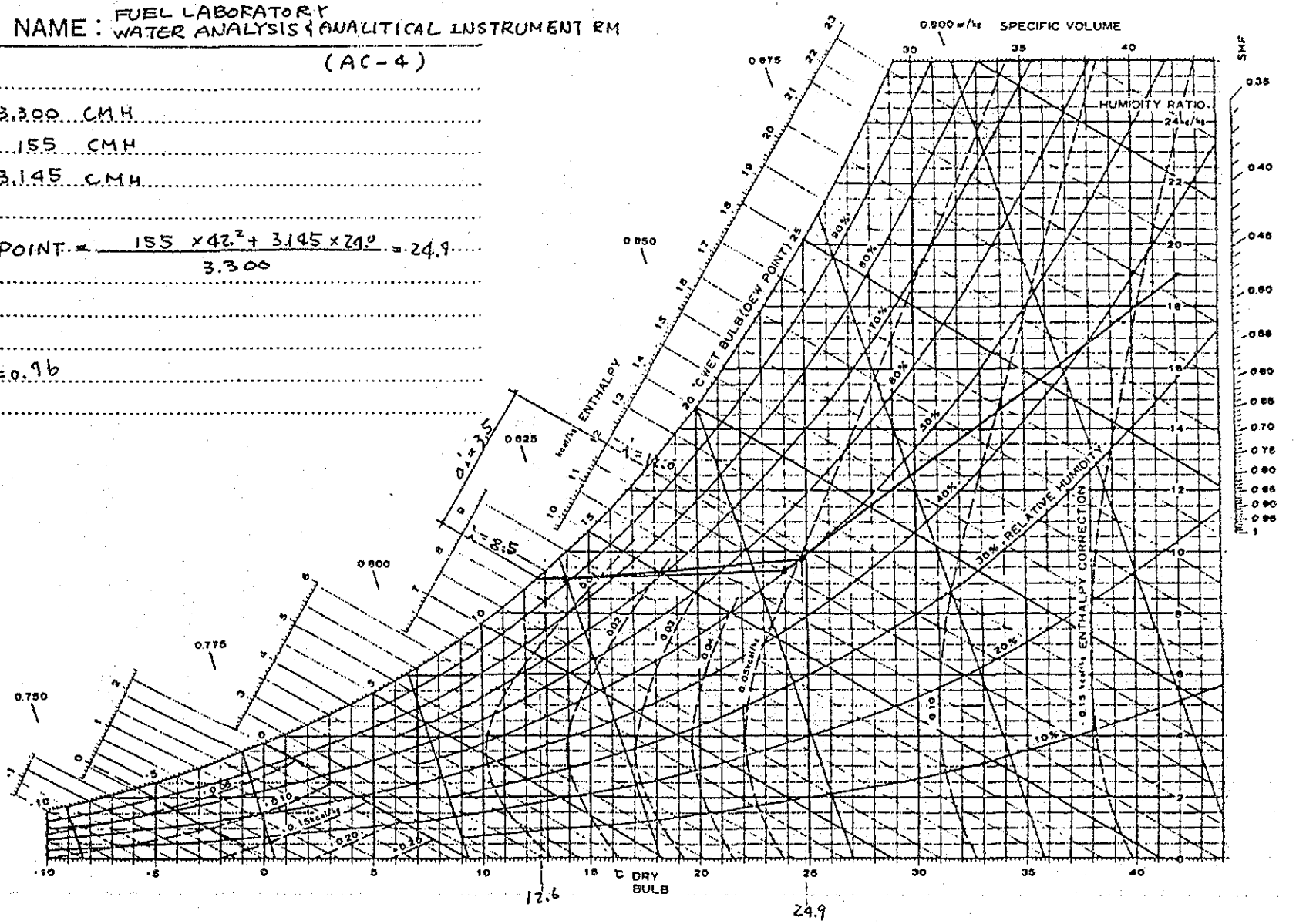
SA : 3,300 CMH

OA : 155 CMH

RA : 3,145 CMH

MIX POINT = $\frac{155 \times 42.^{2} + 3.145 \times 24.^{0}}{3.300} = 24.9$

SHF = 0.96



6. SELECTION OF COOLING EQUIPMENT

6-1. TOTAL LOAD SAMMARY

AHU-1　66.000 Kcal/H/2 (REHEAT 20.000 Kcal/H)

AHU-2.　94 000 Kcal/H/2

AHU-3　46 000 Kcal/H/2

AHU-4　26.000 Kcal/H/2

TOTAL 116.000 Kcal/H ..... RT-2 (50% x 2 ea)

· CAPACITY , CHILLED WATER.

RT-1.　FOR AHU-1

66.000 Kcal/H /3024 = 22 RT

66.000 Kcal/H /5x60 = 220 l/min.

RT-2.　FOR AHU-1 ~ 4.

116.000 Kcal/H/3024 = 39 RT

116.000 Kcal/H /5x60 = 387 l/min.

6.-2 EQUIPMENT

(1) AIR COOLED
PACKAGED. LIQUID CHILLER UNIT

R-1

COOLING LOAD CAPACITY : 66.000 Kcal/Hr (22 RT)

CHILLED WATER

WATER TEMP. : IN 12 - OUT 7 °C

WATER FLOW RATE : 220 lit/min

WATER FRICTION LOSS : 0.8 m (COIL SECTION)

CONNECTION PIPE DIA. : ϕ 65 (GAS STEEL PIPE)

REFRIGERANT TYPE : R- 22

ELECTRIC POWER(OUTPUT)

COMPRESSOR	:	30	Kw	(3ϕ - V)
FAN	:	0.75 x 3	Kw	(-do-)
	:		Kw	(-do-)
	:		Kw	(-do-)

DIMENSION : W 3.300 x D 1.200 x H 2000 (mm)

WEIGHT : Kg (OPERATING 1.810 Kg)

Mfr. MODEL NO : 30AE040 (or equal)
(CARRIER)

NOTE : TON IS REFGIGERATION(U.S) IS 3,024 Kcal/Hr.

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AIR COOLED
PACKAGED LIQUID CHILLER UNIT

R - 2 x 2 ea

COOLING LOAD CAPACITY : 116.000 Kcal/Hr (39 RT)

CHILLED WATER

WATER TEMP.	: IN	12 - OUT 7 °C
WATER FLOW RATE	:	387 lit/min
WATER FRICTION LOSS	:	2.1 m (COIL SECTION)
CONNECTION PIPE DIA.	:	ϕ 80 (GAS STEEL PIPE)

REFRIGERANT TYPE : R- 22

ELECTRIC POWER(OUTPUT)

COMPRESSOR	:	30 x 2 Kw	(3ϕ - 380 V)
FAN	:	0.75 x 6 Kw	(-do-)
	:	Kw	(-do-)
	:	Kw	(-do-)

DIMENSION : W 3.690 x D 2.000 x H 2.300 (mm)

WEIGHT : Kg (OPERATING 2.810 Kg)

Mfr. MODEL NO : 30AE 080 (or equal)
(CARRIER)

NOTE : TON IS REFGIGERATION(U.S) IS 3,024 Kcal/Hr.

882

(2) PUMP

PUMP / VOLUTE CWP - 1 x 20 ea

WATER RATE FLOW	:	220	lit/min
WATER FLOW PIPE DIA.	:	ϕ 65	
WATER FLOW SPEED	:	1.1	m/sec
PIPE FRICTION LOSS(R)	:	40	mmAq/m
PIPE EQUIVALENT LENGTH (Le)			
STRAIGHT PIPE	:	150	m
ELBOW	:	ea x m/ea =	150 m
GATE VALVE	:	ea x m/ea =	x m
CHECK VALVE	:	ea x m/ea =	0.5 m
OTHERS	:	=	= 75 m
TOTAL (Le)		225	m
PIPE HEAD LOSS(*1)	:	(Le) 225 m x (R) 0.04 =	9 m
LIFT HEAD(*2)	:	5	m
EQUIPMENT or OTHERS HEAD LOSS			
1. R-1 Coil	:	0.8	m
2. AHU coil	:	2	m
3. Reheater	:	2	m
4.	:		m
TOTAL (*3)		4.8	m

TOTAL PIPE HEAD LOSS : (*1)+(*2)+(*3) = 18.8 m x 10%
= 20 m

SELECTION OF PUMP

TYPE	: (VOLUTE) / TURBINE / IN_LINE	
DIA.	: ϕ 50x40	
WATER FLOW RATE	: 220	lit/min
POWER OUTPUT	: 2.2	Kw (ϕ 3 - 380 V)
NUMBER	: 2	ea
WEIGHT	: 81	Kg
Mfr. MODEL NO.	: 50x40 FS4J 52.2 or equal (EBARA)	

NOTE :

PUMP / VOLUTE CWP-2 x2eq

WATER RATE FLOW	:		387	lit/min
WATER FLOW PIPE DIA.	:	ϕ 80		
WATER FLOW SPEED	:		1.2	m/sec
PIPE FRICTION LOSS(R)	:		40	mmAq/m
PIPE EQUIVALENT LENGTH (Le)				
STRAIGHT PIPE	:		160	m
ELBOW	:	ea x	m/ea=	m
GATE VALVE	:	ea x	m/ea= 160 x 0.5	m
CHECK VALVE	:	ea x	m/ea=	m
OTHERS	:		= 80	m
TOTAL (Le)			240	m
PIPE HEAD LOSS(*1)	:	(Le) 240 m x(R)0.04	= 9.6	m
LIFT HEAD(*2)	:		5	m
EQUIPMENT or OTHERS HEAD LOSS				
1. R-1 Coil	:		2.1	m
2. AHU Coil	:		2	m
3.	:			m
4.	:			m
TOTAL (*3)			4.1	m

TOTAL PIPE HEAD LOSS : (*1)+(*2)+(*3)= 18.7 m x 10%
= 20 m

SELECTION OF PUMP

TYPE	: (VOLUTE) / TURBINE / IN_LINE	
DIA.	: ϕ 65x50	
WATER FLOW RATE	: 387	lit/min
POWER OUTPUT	: 3.7	Kw (ϕ 3 - 380 V)
NUMBER	: 2	ea
WEIGHT	: 130	Kg
Mfr. MODEL NO.	: 65x50FS4J53.7 (EBARA)	or equal

NOTE :

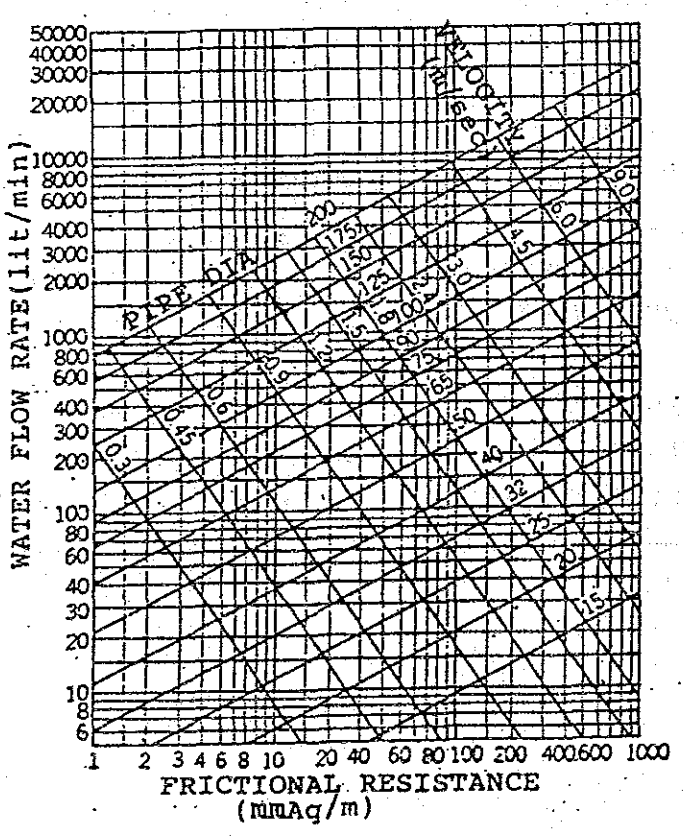
PAK

* EQUIVALENT LENGTH OF PIPE FITTINGS & VALVES

DIA	90°ELBOW	90°TEE	GATE VALVE	GLOVE VALVE	CHECK VALVE
20	0.75	1.2	0.15	6.0	1.6
25	0.9	1.5	0.18	7.5	2.0
32	1.2	1.8	0.24	10.5	2.5
40	1.5	2.1	0.3	13.5	3.1
50	2.1	3.0	0.39	16.5	4.0
65	2.4	3.6	0.48	19.5	4.6
80	3.0	4.5	0.63	24.0	5.7
100	4.2	6.3	0.81	37.5	7.6
125	5.1	7.5	0.99	42.0	10.0
150	6.0	9.0	1.20	49.5	12.0
200	6.5	14.0	1.40	70.0	15.0
250	8.0	20.0	1.70	90.0	19.0

* FRICTIONAL RESISTANCE CHART OF PIPING

(at GALVANIZED STEEL PIPE)



(3) AIR HANDLING UNIT

AHU-1 x 2ea (one for stand by)

AIR FLOW RATE	:	20.700 m^3/H (345 m^3/min)
COOLING LOAD	:	66.000 Kcal/H (REHEAT LOAD : 20.000 Kcal/H)
FAN MOTOR	:	11 KW
EXTERNAL STATIC PRES.	:	70 mmAq
AIR INLET	:	24.2°C DB , 17.7°C WB , 11.6 Kcal/Kg
OUTLET		14.1°C DB , 13.4°C WB , 9.0 Kcal/Kg
CHILLED WATER	:	220 lit/min (66.000 /5×60)

TYPE	:	VERTICAL
AIR FLOW RATE	:	20.700 m^3/H
COOLING COIL	:	1 x 26
FAN MOTOR	:	11 Kw , REHEATER : 24 KW
POWER	:	Ø3- 380 V, 50Hz
TAPPING SIZE	:	CHILLED WATER 65Ax2, DRAIN 20A
DIMENSION	:	3000 x 845 x 1.930 H (mm)
WEIGHT	:	1.660 Kg

MODEL : 39 ACJ 11 (CARRIER)

986

AIR HANDLING UNIT

AHU-2 x 2 ea

AIR FLOW RATE	:	11.500 m^3/H (192 m^3/min)
COOLING LOAD	:	47.000 Kcal/H
FAN MOTOR	:	3.7 KW
EXTERNAL STATIC PRES.	:	60 mm Aq
AIR INLET	:	25.3°C DB , 17.3°C WB , 12.3 Kcal/Kg
OUTLET		13.9°C DB , 13.4°C WB , 9.° Kcal/Kg
CHILLED WATER	:	157 lit/min (47.000/6x60)

TYPE	:	VERTICAL
AIR FLOW RATE	:	11.500 m^3/H
COOLING COIL	:	1x22
FAN MOTOR	:	3.7 Kw
POWER	:	Ø3-380 V, 50Hz
TAPPING SIZE	:	CHILLED WATER 40 Ax2, DRAIN 20 A
DIMENSION	:	2090 x 780 x 1.790 H (mm)
WEIGHT	:	1.060 Kg

MODEL : 39ACJ 9 (CARRIER)

AIR HANDLING UNIT

AHU-3 x 2 ea

AIR FLOW RATE	:	7.300 m^3/H (122 m^3/min)
COOLING LOAD	:	23.000 Kcal/H
FAN MOTOR	:	2.2 KW
EXTERNAL STATIC PRES.	:	60 mmAq
AIR INLET	:	24.2 °C DB , 17.2 °C WB , 11.6 Kcal/Kg
OUTLET		14.1 °C DB , 13.4 °C WB , 9.° Kcal/Kg
CHILLED WATER	:	77 lit/min (23.000 / 5 x 60)

TYPE	:	VERTICAL
AIR FLOW RATE	:	7.300 m^3/H
COOLING COIL	:	1 x 22
FAN MOTOR	:	2.2 Kw
POWER	:	Ø3-380 V, 50Hz
TAPPING SIZE	:	CHILLED WATER 40 Ax2, DRAIN 20 A
DIMENSION	:	1.580 x 780 x 1.790 H (mm)
WEIGHT	:	810 Kg

MODEL : 39 ACJ 8 (CARRIER)

AIR HANDLING UNIT

AHU - 4 x 2ea

AIR FLOW RATE	:	3.300 m^3/H (55 m^3/min).
COOLING LOAD	:	13.000 Kcal/H.
FAN MOTOR	:	1.5 KW
EXTERNAL STATIC PRES.	:	60 mmAq
AIR INLET	:	24.9 °C DB , 17.7 °C WB , 12.9 Kcal/Kg
OUTLET		13.8 °C DB , 13.1 °C WB , 8.8 Kcal/Kg
CHILLED WATER	:	44 lit/min (13.000 /5x60)

TYPE	:	VERTICAL
AIR FLOW RATE	:	3.300 m^3/H
COOLING COIL	:	1 x 16
FAN MOTOR	:	1.5 Kw
POWER	:	Ø3 - 380 V, 50Hz
TAPPING SIZE	:	CHILLED WATER 32 Ax2, DRAIN 20 A
DIMENSION	:	1.125 x 670 x 1.550 H (mm)
WEIGHT	:	360 Kg

MODEL : 39 ACJ 6 (CARRIER)

7.7 換 気

7. VENTILATION SYSTEM

7-1 ESTIMATE OF VENTILATION AIR VOLUME

FLOOR	ROOM NAME	AREA (m^2)	VOL. (m^3)	AIR CHANGE (T/Hr)	AIR FLOW (m^3/Hr)	EXHAUST AIR (m^3/Hr)	SUPPLY AIR (m^3/Hr)	
MEZZANINE FLOOR	STORAGE ROOM	14.6	40.9	5	205	210 *	-	(III) VF-4
	BATTERY ROOM	144.5	404.6	10	4046	-		(I)
				35 m^3/m^2	5058 *	5060	5060	OAG EF-3
	SUB TOTAL					5.270	5060	
CABLE TREATMENT FLOOR	CABLE TREATMENT AREA	628.9	1509	10	15090	15100	15100	OF-1 (I) EF-1
	SUB TOTAL					15.100		
OPERATING FLOOR	KITCHEN	5.4	16.2	10	162	170		(III) VF-5
	LAVATORY	19.1	57.3	10	573	600 *	650	(III) VF-2
	JAN	2.3	6.9	5	35	50 *		(III) VF-7
	SUB TOTAL					820		
FORTH FLOOR	LOCKER ROOM	22.4	62.7.	10	627	630 *	1000	(III) VF-1
	KITCHEN	5.3	148	10	148	150		(III) VF-6
	JAN	2.3	6.4	5	32	50 *		(III) VF-7
	LAVATORY	11.5	32.2	10	322	320 *		(III) VF-3
	AIR CONDITIONING MACHINE ROOM	310	1500	10	15000	15000		(III) EF-2
	SUB TOTAL					16.150		
ROOF	TURBINE ROOM	$\frac{200.000\ KW \times 0.003 \times 860\ Kcal/KW}{0.29 \times 5}$			=355.862 ≒356.000 /16 = 22.300 /EA			(III) RF-1
		VR = 22.0×111.6×15.5 + 10.0×111.6×5 = 43.435 m^3		7	305.450			

7-2 SELECTION OF VENTILATION EQUIPMENT

V - 1

MEZZANINE FLOOR STORAGE ROOM

MACHINE NO	VF-4	
TYPE OF VENTILATOR	: CEILING	x 1 ea
AIR FLOW RATE	: 210 m^3/Hr	x 8 mmAq
FAN MOTOR	: ~~W~~ or 35 W	
POWER	: 1φ 220v / ~~3φ ---v~~	(50/~~60~~ Hz)
SIZE	: 308 x 308 x 226H	(mm)
ACCESSORY	: 150φ VENT CAP	

V - 2

MEZZANINE FLOOR BATTERY ROOM

MACHINE NO	EF-2 SS #2½	
TYPE OF VENTILATOR	: CENTIFUGAL MULTI-BANE	x 1 ea
AIR FLOW RATE	: 5060 m^3/Hr	x 25 mmAq
FAN MOTOR	: 1.5 KW or	W
POWER	: ~~1φ 220v~~ / 3φ 380v	(50/~~60~~ Hz)
SIZE	: 960L x 360W x 805H	(mm)
ACCESSORY	:	

V - 3

CABLE TREATMENT AREA

MACHINE NO	EF-1 (OF-1) SS #4	
TYPE OF VENTILATOR	: DITTO	x 1+1 ea
AIR FLOW RATE	: 15100 m^3/Hr	x 25 mmAq
FAN MOTOR	: 3.7 KW or	W
POWER	: ~~1φ 220v~~ / 3φ 380v	(50/~~60~~ Hz)
SIZE	: 1540L x 545W x 1.140H	(mm)
ACCESSORY	:	

V - 4

OPERATING FLOOR : KITCHEN

MACHINE NO		VF-5
TYPE OF VENTILATOR	:	CEILING x 1 ea
AIR FLOW RATE	:	170 m^3/Hr x 8 mmAq
FAN MOTOR	:	~~KW~~ or 35 W
POWER	:	1φ 220v / ~~3φ 200v~~ (50/~~60~~ Hz)
SIZE	:	308 x 308 x 226 H (mm)
ACCESSORY	:	150φ VENT CAP

V - 5

OPERATING FLOOR LAVATORY

MACHINE NO		VF-2
TYPE OF VENTILATOR	:	CEILING x 1 ea
AIR FLOW RATE	:	600 m^3/Hr x 8 mmAq
FAN MOTOR	:	~~KW~~ or 95 W
POWER	:	1φ 220v / ~~3φ 200v~~ (50/~~60~~ Hz)
SIZE	:	464 x 464 x 278 H (mm)
ACCESSORY	:	150φ VENT CAP

V - 6

OPERATING FLOOR JAN (= FORTH FLOOR JAN)

MACHINE NO		VF-7
TYPE OF VENTILATOR	:	CEILING x 2 ea
AIR FLOW RATE	:	50 m^3/Hr x 6 mmAq
FAN MOTOR	:	~~KW~~ or 18 W
POWER	:	1φ 220v / ~~3φ 200v~~ (50/~~60~~ Hz)
SIZE	:	223 x 223 x 165.5 (mm)
ACCESSORY	:	100φ VENT CAP

992

V - 7

FORTH FLOOR LOCKER ROOM

MACHINE NO	VF - 1	
TYPE OF VENTILATOR	: CEILING	x 1 ea
AIR FLOW RATE	:	630 m^3/Hr x 8 mmAq
FAN MOTOR	:	~~xxx~~ or 95 w
POWER	:	1ϕ 220v / ~~3ϕ xxx v~~ (50/60 Hz)
SIZE	:	464 x 464 x 278H (mm)
ACCESSORY	:	150ϕ VENT CAP

V - 8

FORTH FLOOR KITCHEN

MACHINE NO	VF - 6	
TYPE OF VENTILATOR	: CEILING	x 1 ea
AIR FLOW RATE	:	150 m^3/Hr x 8 mmAq
FAN MOTOR	:	~~xxx~~ or 35 w
POWER	:	1ϕ 220v / ~~3ϕ xxx v~~ (50/60 Hz)
SIZE	:	308 x 308 x 243H (mm)
ACCESSORY	:	150ϕ VENT CAP

V - 9

FORTH FLOOR LAVATORY

MACHINE NO	VF - 3	
TYPE OF VENTILATOR	: CEILING	x 1 ea
AIR FLOW RATE	:	320 m^3/Hr x 7 mmAq
FAN MOTOR	:	~~xxx~~ or 46 w
POWER	:	1ϕ 220v / ~~3ϕ xxx v~~ (50/60 Hz)
SIZE	:	345 x 345 x 243H. (mm)
ACCESSORY	:	150ϕ VENT CAP

V - 10

FORTH FLOOR AIR CONDITIONING MACHINE ROOM

MACHINE NO	EF-3	
TYPE OF VENTILATOR	: AXIAL.	x 1 ea
AIR FLOW RATE	: 15.000	m^3/Hr x 15 mmAq
FAN MOTOR	: 2.2	KW or W
POWER	: ~~1ϕ 220v~~ / 3ϕ 380v	(50/60 Hz)
SIZE	: x x	(mm)
ACCESSORY	:	

V - 11

ROOF TURBINE ROOM.

MACHINE NO	RF-1.	
TYPE OF VENTILATOR	: ROOF VENTILATOR	x 16 ea
AIR FLOW RATE	: 22.300	m^3/Hr x 10 mmAq (+1200)
FAN MOTOR	: 3.7	KW or W
POWER	: ~~1ϕ 220v~~ / 3ϕ 380v	(50/~~60~~ Hz)
SIZE	: 2.250 x 2.250 x 1520H.	(mm)
ACCESSORY	:	

V - 1

MACHINE NO		
TYPE OF VENTILATOR	:	x ea
AIR FLOW RATE	:	m^3/Hr
FAN MOTOR	:	KW or W
POWER	: 1ϕ 220v / 3ϕ	v (50/60 Hz)
SIZE	: x x	(mm)
ACCESSORY	:	

PPK

V - 12.

FORTH FLOOR : AIR CONDITIONING MACHINE ROOM

MACHINE NO	EF-4	<FOR AHU-1>
TYPE OF VENTILATOR	: AXIAL	x 1 ea
AIR FLOW RATE	: 250 m^3/Hr x 10 mmAq	
FAN MOTOR	: ~~kW~~ or 80 W	
POWER	: 1ϕ 220v / ~~3ϕ ... v~~ (50/~~60~~ Hz)	
SIZE	: 375$^{\phi}$ x 320^{L} x	(mm)
ACCESSORY	:	

V - 13

MACHINE NO	EF-5	<FOR AHU-3>
TYPE OF VENTILATOR	: AXIAL	x 1 ea
AIR FLOW RATE	: 150 m^3/Hr x 10 mmAq	
FAN MOTOR	: ~~kW~~ or 12 W	
POWER	: 1ϕ 220v / ~~3ϕ ... v~~ (50/60 Hz)	
SIZE	: 250$^{\phi}$ x 220^{L} x 274^{H}	(mm)
ACCESSORY	:	

V - 14

MACHINE NO	EF-6	<FOR AHU-4>
TYPE OF VENTILATOR	: AXAL	x 1 ea
AIR FLOW RATE	: 100 m^3/Hr x 7 mmAq	
FAN MOTOR	: ~~kW~~ or 12 W	
POWER	: 1ϕ 220v / ~~3ϕ ... v~~ (50/~~60~~ Hz)	
SIZE	: 250$^{\phi}$ x 220^{L} x 274^{H}	(mm)
ACCESSORY	:	

AR－8　空　調　設　備（事務建屋）

目　　次

8. 1　設計条件

1. DESIGN CRITERIA

1 - 1　DESIGN CONDITION

1) For air conditioning system

(a) Outdoor air

Summer　:　42.2°C DB, 28.6°C WB, 37%RH

(b) Room

Summer　:　24°C±2°C DB,　50%RH

Winter　:　Not more than the condition in summer

2) Minimum ventilation air vol.

For Control Room　　25 m^3/Hr person

3) Lighting　　20 W/m^2

4) People

Refer to "Cooling and dehumidifying estimate sheets"

5) LOcation

25.4°(N), 68.3°(E)

8. 2 データ

2. DATA

Data used for load estimation is based on Carrier,s Design Manual of the newest condition.

2 - 1 Outdoor air

1) Dry Bulb

Time / Dry Bulb	8	9	10	11	12	13	14	15	16	17	18
°C	28.2	30.3	32.8	35.7	38.4	40.4	41.7	42.2	41.7	40.5	38.7

2) HUmidity Ratio

Time / Humidity Ratio	8	9	10	11	12	13	14	15	16	17	18
g/Kg	19.1	19.0	19.0	19.2	18.9	19.0	18.8	19.0	18.8	18.9	18.8

2 - 2 Solar heat gain

1) Peak solar heat gain thru ordinary glass

EXPOSORE / HEAT	NL	NE	SE	SW	NW	HORIZONTAL	SHADE
Kcal/h m^2		366	252	252	366	674	47

2) Solar gain correction factors

for steel sash : 1/0.85

for dew point : 0.94

3) Load storage factors , solar heat gain thru ordinary glass

TIME / EXPOSURE	8	9	10	11	12	13	14	15	16	17	18
NE	0.57	0.46	0.30	0.24	0.20	0.19	0.17	0.16	0.15	0.13	0.11
SE	0.47	0.61	0.67	0.65	0.57	0.44	0.29	0.24	0.21	0.18	0.15
SW	0.08	0.08	0.10	0.24	0.40	0.55	0.66	0.70	0.64	0.50	0.26
NW	0.09	0.09	0.10	0.10	0.10	0.10	0.16	0.34	0.52	0.65	0.64

NOTE : Venetian blind to be located on the inside of glass.
(Overall factor is 0.65)

2 - 3 Equivalent temperature difference

1) For wall

TIME / EXPOSURE	8	9	10	11	12	13	14	15	16	17	18
NE	4.6	7.9	16.8	16.0	15.3	13.3	11.3	11.9	12.6	13.0	13.5
SE	5.4	8.6	11.1	12.4	13.6	13.8	13.9	12.9	12.4	11.8	11.5
SW	2.6	3.1	3.7	5.0	5.9	9.8	12.1	15.8	18.6	19.2	19.5
NW	3.7	4.5	5.3	6.6	7.9	10.1	11.3	13.5	15.4	19.5	23.2

These figures are basing on medium color, outside air temperature at 42.2°C DB, inside air temperature at 24°C DB daily range of 16.7°C and specific weight of wall 200Kg/m^2.

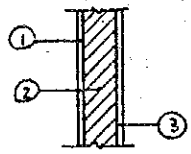
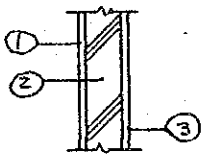
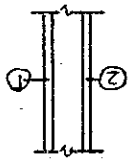
2) For roof

TIME / For roof	8	9	10	11	12	13	14	15	16	17	18
°C	10.3	10.2	10.8	12.4	14.9	18.0	21.2	24.0	26.2	27.8	28.5

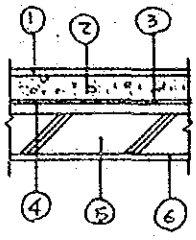
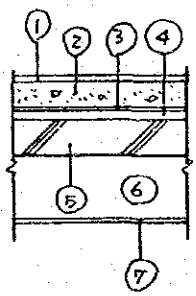
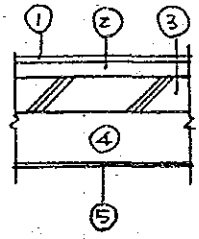
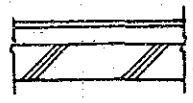
These figures are basing on medium color, outside air temperature at 42.2°C DB, inside air temperature at 24°C DB daily range of 16.7°C and specific weight of wall 300Kg/m^2.

8．3　熱貫流計算

3.HEAT TRANSMISSION : K-Value

TYPE OF STRUCTURE	MATERIALS	THICKNESS (mm)	RESISTANCE ($m^2H°C/Kcal$)	AIR FILM ($m^2H°C/Kcal$)	K-Value ($Kcal/m^2H°C$)
WALL 				$\gamma_0 = 0.05$	
	① CEMENT PLASTER	10	0.016		
	② BRICK	150	0.283		
	③ CEMENT PLASTER	10	0.016		
				$\gamma_i = 0.133$	
				(0.498)	$2.008 \Rightarrow 2.1$
PARTITION 1.				$\gamma_i = 0.133$	
	① CEMENT PLASTER	10	0.016		
DITTO	② BRICK	150	0.283		
	③ CEMENT PLASTER	10	0.016		
				$\gamma_i = 0.133$	
				(0.581)	$1.722 \Rightarrow 1.8$
PARTITION 2 				$\gamma_i = 0.133$	
	① CEMENT PLASTER	10	0.016		
	② CONCRETE	150	0.107		
	③ CEMENT PLASTER	10	0.016		
				$\gamma_i = 0.133$	
				(0.405)	$2.47 \Rightarrow 2.5$
DOOR (IN) 				$\gamma_i = 0.133$	
	① WOOD	12	0.092		
	② AIR SPACE		0.200		
	③ WOOD	12	0.092		
				$\gamma_i = 0.133$	
				(0.650)	$1.539 \Rightarrow 1.6$
WINDOW (OUT)					
	ORDINARY GLASS	3			5.1
WINDOW (IN)					
	ORDINARY GLASS	3			3.8

ADMINISTRATION BUILDING

TYPE OF STRUCTURE	MATERIALS	THICKNESS (mm)	RESISTANCE ($m^2H°C/Kcal$)	AIR FILM ($m^2H°C/Kcal$)	K-Value ($Kcal/m^2H°C$)
ROOF 1 				$Y_0 = 0.05$	
	① BLICK TILE	10	0.019		
	② SAND	30	0.057		
	③ POLYETHYLENE FILM	1	0.034		
	④ ROOFING	10	0.112		
	⑤ CONCRETE	150	0.107		
	⑥ CEMENT PLASTER	25	0.040		
				$Y_i = 0.189$	
				(0.608)	$1.645 \Rightarrow 1.7$
ROOF 2 				$Y_0 = 0.05$	
	① BLICK TILE	10	0.019		
	② SAND	30	0.057		
	③ POLYETHYLENE FILM	1	0.034		
	④ ROOFING	10	0.112		
	⑤ CONCRETE	150	0.107		
	⑥ AIR SPACE		0.200		
	⑦ ACOUSTICAL TILE BOARD	12	0.187		
				$Y_i = 0.189$	
				(0.955)	$1.048 \Rightarrow 1.1$
CEILING 1 				$Y_i = 0.189$	
	① TERRAZZO	30	0.020		
	② MORTAR	40	0.031		
	③ CONCRETE	150	0.107		
	④ AIR SPACE		0.200		
	⑤ ALUM SHEET	2	—		
				$Y_i = 0.189$	
				(0.736)	$1.359 \Rightarrow 1.4$
FLOOR 1 DITTO	DITTO	DITTO	DITTO	$Y_i = 0.125$ (0.608)	$1.645 \Rightarrow 1.7$
CEILING 2 				$Y_i = 0.189$	
	① TERRAZZO	30	0.020		
	② MORTAR	40	0.031		
	③ CONCRETE	150	0.107		
				$Y_i = 0.189$	
				(0.536)	$1.866 \Rightarrow 1.9$
FLOOR 2 DITTO	DITTO	DITTO	DITTO	$Y_i = 0.125$ (0.403)	$2.482 \Rightarrow 2.5$

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4. ROOM LOAD SUMMARY

4-1. PAC-1 (NW-SYSTEM)

1) ROOM PEAK LOAD (1)

NO	ROOM NAME	AREA (m²)	VOLUME (m³)	PEOPLE	PEAK LOAD R.S.H (kcal/H)	PEAK LOAD R.T.H (kcal/H)	INDICATED A.D.P(°c)	DEHUM AIR (m³/H)	OUT AIR (m³/H)
1F G02	ENTRANCE & ENTRANCE HALL	84.0	240.63	—	4967	5285	12.5	1.660	460
	SUB TOTAL	84.0	240.63	—	4967	5.285		1.660	460
2F F02	SECRATARY ROOM	16.0	40.0	2	1.593	1.736	12.3	530	50
F02	ASSISTANT SUPERINTENDENT RM.	42.25	126.75	4	6.610	6.895	12.6	2.210	100
F01	SUPERINTENDENT RM	84.5	253.5	8	10716	11.285	12.5	3580	200
F01	SECRATARY ROOM	24.0	60.0	4	1.856	2142	11.8	620	100
F07	TELCOMUNICATION ROOM	52.25	156.75	5	4.872	5.228	12.4	1.630	125
F04	CANTEEN	78.5	251.18	15	14403	16.360	11.9	4810	1.695
	SUB TOTAL	297.5	888.18	38	40.050	43.645		13.380	2270
3F S02	SECRATARY ROOM	16.0	40.0	2	927	1070	11.8	310	50
S02	ASSISTANT SUPERINTENDENT RM.	42.25	160.55	4	5.306	5591	12.5	1770	100
S01	SECRATARY ROOM	16.0	40.0	2	1.130	1.273	12.0	380	50
S01	ASSISTANT SUPERINTENDENT RM	42.25	160.55	4	4.239	4523	12.5	1.420	100
S03C	JUNIOR ENGINEER ROOM	68.25	225.55	6	4.976	5402	12.3	1.660	150
S03b	DITTO	68.25	225.55	6	5.196	5622	12.3	1.740	150
S039	DITTO	62.25	200.55	6	7.970	8397	12.5	2.660	150
	SUB TOTAL	315.25	1052.75	30	29.744	31.878		9.940	750

1103

1) ROOM PEAK LOAD (2)

NO.	ROOM NAME	AREA (m²)	VOLUME (m³)	PEOPLE	PEAK LOAD R.S.H (Kcal/H)	R.T.H (Kcal/H)	INDICATED A.D.P (°C)	DEHUIM AIR (m³/H)	OUT AIR (m³/H)
4F To1e	JUNIOR ENGINEER ROOM	68.25	225.55	6	9.579	10.005	12.6	3.200	150
To1d	DITTO	68.25	225.55	6	8.116	8.542	12.6	2.710	150
To1c	DITTO	68.25	225.55	6	7.979	8.405	12.6	2.660	150
To1b	DITTO	68.25	225.55	6	8.125	8.551	12.6	2.710	150
To1a	DITTO	60.25	205.55	6	10.916	11.343	12.6	3.640	150
	SUB TOTAL	333.25	1107.75	30	44.715	46.846		14.920	750
PAC-1	TOTAL	1030	3289.31	98	119.476	127.654	12.5	39.900	4.230
					SHF ≒ 0.94				

2). PEAK LOAD TIME (1)

NO.	ROOM NAME	3:00 E.R.S.H (Kcal/h)	3:00 E.R.T.H (Kcal/h)	5:00 E.R.S.H (Kcal/h)	5:00 E.R.T.H (Kcal/h)	6:00 E.R.S.H (Kcal/h)	6:00 E.R.T.H (Kcal/h)
1F. G02	ENTRANCE & ENTRANCE HALL	* 4.967	* 5.285	4706	5.021	4.428	4.740
	SUB TOTAL	4.967	5.285	4706	5.021	4.428	4.740
2F F02	SECRATARY ROOM	* 1.593	* 1.736	1.520	1.663	1.336	1.478
F02	ASSISTANT SUPERINTENDENT RM	6.184	6.468	* 6.610	* 6.895	6.417	6.700
F01	SUPERINTENDENT RM.	9.598	10.169	* 10.716	* 11.285	10.417	16.985
F01	SECRATARY ROOM	* 1.856	* 2.142	1.723	2.008	1.581	1.865
F07	TELCOMUNICATION ROOM	4.277	4.634	* 4872	* 5.228	4843	5.198
F04	CANTEEN PEAK 4:00	14.152	16.133	13.964	15.921	12.738	14.395
	SUB TOTAL	37.660	41.282	39.405	43.000	37.332	40.621
3F S02	SECRATARY ROOM	* 927	* 1.070	884	1027	840	982
S02	ASSISTANT SUPERINTENDENT RM.	4687	4.971	* 5306	* 5.591	5.304	5.587
S01	SECRATARY ROOM	* 1.130	* 1.273	1.067	1.210	1.003	1.145
S01	ASSISTANT SUPERINTENDENT RM.	3078	3.363	4.187	4.470	* 4.239	* 4.523
S03C	JUNIOR ENGINEER ROOM	3.823	4.251	4.928	5.355	* 4.976	* 5402
S03b	DITTO	4.095	4.523	4807	5.234	* 5.196	* 5.622
S039	DITTO	7.013	7441	* 7.970	* 8.397	7.559	7.985
	SUB TOTAL	24.753	26.892	29.149	31.284	29.117	31.246

S01

2). PEAK LOAD TIME (2)

NO.	ROOM NAME	3:00		5:00		6:00	
		E.R.S.H (Kcal/h)	E.R.T.H (Kcal/h)	E.R.S.H (Kcal/h)	E.R.T.H (Kcal/h)	E.R.S.H (Kcal/h)	E.R.T.H (Kcal/h)
4F To1e	JUNIOR ENGINEER ROOM	8083	8511	9.541	9.968	* 9.579	* 10.005
To1d	DITTO	6.465	6.893	7.990	8.417	* 8.116	* 8.542
To1c	DITTO	6.294	6.722	7.835	8.262	* 7.979	* 8.405
To1b	DITTO	6.475	6.903	7.999	8.426	* 8.125	* 8.551
To1a	DITTO	9.576	10.004	* 10.916	* 11.343	10.575	11.001
	SUB TOTAL	36.893	39.033	44.281	46.416	44.374	46.504
PAC-1	TOTAL	104.273	112.492	* 117.541	* 125.721	115.251	123.111

9201

4-2 PAC-2 (SE-SYSTEM)

1) ROOM PEAK LOAD

NO	ROOM NAME	AREA (m^2)	VOLUME (m^3)	PEOPLE	PEAK LOAD R.S.H (kcal/H)	PEAK LOAD R.T.H (kcal/H)	INDICATED A.D.P(℃)	DEHUM AIR (m^3/H)	OUT AIR (m^3/H)
2F F03	CONFERENCE ROOM	84.5	253.5	16	9658	10.792	12.1	3.220	400
F09	CORRIDOR	87.25	218.13	-	6.523	6523	13.2	2180	-
	SUB TOTAL	171.75	491.63	16	16.181	17315		5400	400
3F S05d	EXCUTIVE ENGINEER ROOM	21.13	80.29	2	1.926	2.069	12.3	640	50
S05c	DITTO	21.13	80.29	2	1.709	1.852	12.3	570	50
S05b	DITTO	21.13	80.29	2	1.709	1.852	12.3	570	50
S05a	DITTO	21.13	80.29	2	2010	2153	12.3	670	50
S04	PRAY ROOM	42.25	160.55	12	5809	6.664	11.8	1940	300
S06	CORRIDOR	101.5	253.75	-	5.102	5102	13.2	1700	-
	SUB TOTAL	228.27	735.46	20	18.265	19.692		6090	500
4F T03d	EXCUTIVE ENGINEER ROOM	21.13	80.29	2	2.770	2912	12.5	920	50
T03c	DITTO	21.13	80.29	2	2503	2646	12.5	840	50
T03b	DITTO	21.13	80.29	2	2503	2646	12.5	840	50
T03a	DITTO	21.13	80.29	2	2873	3015	12.5	960	50
T02	LIBRARY & STRAGE ROOM	42.25	160.55	4	7009	7293	12.6	2340	100
T04	CORRIDOR	101.5	253.95	-	7963	7963	13.2	2660	-
	SUB TOTAL	228.27	735.46	12	25621	26.475		8560	300
PAC-2 TOTAL		628.29	1942.55	48	60.067	63.482	SELCTED 12.5℃	20.050	1.200

SHF = 0.95

2). PEAK LOAD TIME

NO.	ROOM NAME	2:00 E.R.S.H (Kcal/h)	2:00 E.R.T.H (Kcal/h)	3:00 E.R.S.H (Kcal/h)	3:00 E.R.T.H (Kcal/h)	4:00 E.R.S.H (Kcal/h)	4:00 E.R.T.H (Kcal/h)
2F F03	CONFERENCE ROOM	* 9.658	* 10.792	9.616	10.752	9047	10.180
F09	CORRIDOR	6.378	6378	* 6.523	* 6.523	6.378	6.378
	SUB TOTAL	16.036	17.170	16.139	17.275	15.425	16.558
3F S05 d	EXCUTIVE(PEAK 12:00) ENGINEER ROOM	1.614	1.942	1.791	1.934	1.703	1.845
S05 c	DITTO (PEAK 12:00)	1.673	1.815	1.517	1.660	1.438	1.580
S05 b	DITTO (PEAK 12:00)	1.673	1.815	1.517	1.660	1.438	1.580
S05 a	DITTO	1.905	1.950	1.897	2.040	1808	1.950
S04	PRAY ROOM	5.652	6.502	* 5.809	* 6664	5.764	6.614
S06	CORRIDOR	4.969	4.969	* 5102	* 5102	5.038	5038
	SUB TOTAL	17.486	18.993	17.633	19.060	17.189	18.607
4F T03 d	EXCUTIVE ENGINEER ROOM	2.669	2.811	2.737	2880	* 2770	* 2.912
T03 c	DITTO	2.401	2.543	2463	2.606	* 2503	* 2646
T03 b	DITTO	2401	2.543	2463	2606	* 2503	* 2.646
T03 a	DITTO	2.772	2.914	2.843	2.986	* 2.878	* 3015
T02	LIBRARY & STRAGE ROOM	5.447	5.731	6.886	7172	* 7009	* 7293
T04	CORRIDOR	7.378	7.378	7.806	7806	* 7.963	* 7963
	SUB TOTAL	23.068	23.920	25.198	26.056	25.626	26.475
PAC-2 TOTAL		56.590	60.083	* 58.970	* 62.391	58.740	61.640

801

COOLING AND DEHUMIDIFYING ESTIMATE (METRIC)

INQUIRING NO. | INQUIRED BY | SHEET NO. 12
JOB NAME | ADDRESS | DATE ORIGINAL | REVISION | PERSON IN CHARGE
SPACE USED FOR ENTRANCE · ENTRANCE HALL (602) PAC-1 SYSTEM
SIZE m× m= 84.0 m² × m(H)= 240.63 m³

ITEM	AREA OR QUANTITY	SUN GAIN OR TEMP. DIFF.	FACTOR	Kcal/h MAX	3:00	5:00	6:00
SOLAR GAIN — GLASS						CORRECTION	
	m²×	×					
	m²×	×					
	m²×	×					
	m²×	×					
	m²×	×					
SOLAR & TRANS GAIN—WALLS & ROOF							
WALL	m²×	×					
	m²×	×					
	m²×	×					
	m²×	×					
ROOF—SUN	m²×	×					
ROOF—SHADED	m²×	×					
TRANS. GAIN—EXCEPT WALLS & ROOF							
GLASS	15.5 m²×	9.1 ×	3.8		536	486	433
CEILING	16.0 m²×	9.1 ×	1.4		204	185	165
~~DOOR~~ FLOOR	6.8 m²×	18.2 ×	1.6		198	180	160
PARTITION(1)	21.6 m²×	18.2 ×	1.8		708	642	572
(2)	3.2 m² ×	26.0 ×	1.8		150	150	150
(3)	30.0 m² ×	9.1 ×	2.5		683	619	552
INFILTRATION	CMH×	deg×	0.29				
INTERNAL HEAT							
PEOPLE	PEOPLE×						
KW	KW×	×	860				
LIGHTS	84.0 × 20	W×	1.08		1815	1815	1815
APPLIANCES ETC.							
CREDIT FOR THERMAL STORAGE	m²×	deg×		(−)		(−)	
			SUB TOTAL				
SAFETY FACTOR			%				
ROOM SENSIBLE HEAT SUB TOTAL					4294	4077	3841
SUPPLY DUCT HEAT GAIN	SUPPLY DUCT +LEAK LOSS	FAN +HP	=16%		430	408	385
BYPASS OUTSIDE AIR	460 CMH× 18.7 deg× 0.1 BF×0.29				243	221	196
EFFECTIVE ROOM SENSIBLE HEAT					4967	4706	4428
ROOM LATENT HEAT							
INFILTRATION	CMH×	g/kg×	0.72				
PEOPLE	1 PEOPLE×						
STEAM	kg/h×		540				
APPLIANCES ETC.							
VAPOR TRANS.							
			SUB TOTAL				
SAFETY FACTOR			%				
ROOM LATENT HEAT SUB TOTAL							
SUPPLY DUCT LEAKAGE LOSS			%				
BYPASS OUTSIDE AIR	460 CMH× 9.6 g/kg×0.1 BF×0.72				318	315	312
EFFECTIVE ROOM LATENT HEAT					318		
EFFECTIVE ROOM TOTAL HEAT					5285	5021	4740
OUTSIDE AIR HEAT					(63)		
SENSIBLE:	CMH× deg×(1− BF)×0.29						
LATENT:	CMH× g/kg×(1− BF)×0.72						
GRAND TOTAL HEAT SUB TOTAL							
RETURN DUCT HEAT GAIN + RETURN DUCT LEAK GAIN − PUMP H.P − PIPE GAIN			= %				
(U.S.R.T) GRAND TOTAL HEAT							

ESTIMATE FOR.	AM / PM	PEAK LOAD	AM / PM 3
HOURS OF OPERATION	Hour (	−	)

OUTSIDE DESIGN CONDITIONS	DB °C	WB °C	%RH	DP °C	g/kg
OUTSIDE	42.2	28.6	37		19.0
ROOM	24.0	17.1	50		9.4
DIFFERENCE	18.2	×××	×××	×××	9.6

BLIND	NON-EXISTENCE(OUTSIDE, INSIDE)	L M D
GLASS	ORDINARY. THICK. ABSORBENT.	%. DOUBLE
COLOR	LIGHT. MEDIUM. DARK.	
WEIGHT	kg/m²(FLOOR)	kg/m²(WALL)
INTERNAL HEAT	W/m²	m²/PEOPLE

INFILTRATION		
SWINGING		
REVOLVING DOORS	PEOPLE× CMH/PER.	
OPEN DOORS	DOORS× CMH/DOOR	
EXHAUST AIR		
CRACK	m× CMH/m	
INFILTRATION	CMH ■	
VENTILATION		
PEOPLE×	CMH/PER.	
m²×	CMH/m²	
VENTILATION	CMH ■	460

SENSIBLE HEAT FACTOR

E.S.H.F = 4967 (ERSH) / 5285 (ERTH) = 0.94 (12.5°C)

DEHUMIDIFIED AIR

APPARATUS DEWPOINT 12.5 °C

4967 (ERSH) = 1,660 CMH
(20 RM − 12.5 ADP)(1 − 0.1 BF)×0.29

NOTES.

· PARTITION
(1): 10.0 × 2.5 − 1.7 × 2.0 = 21.6
(2): 2.0 × 2.5 − 0.9 × 2.0 = 3.2
(3): 12.0 × 2.5 = 30.0

· GLASS (IN): 6.2 × 2.5 = 15.5
· DOOR (IN): 1.7 × 2.0 × 2 = 6.8
· CEILING: 4.0 × 4.0 + 6.0 = 22.0

· SR: 12.0 × 6.5 + 2.0 × 3.0 = 84.0
· VR: 6.5 × 3.5 × 2.5 + (8.5 × 6.5 + 2.0 × 3.0) × 3.0
= 240.63

FORM. E-20E

COOLING AND DEHUMIDIFYING ESTIMATE (METRIC)

Inquiring No. | Inquired By | Sheet No. 13
Job Name | Address | Date Original
Space Used For SECRATARY ROOM (F02) PAC-1 SYSTEM | Revision
Size 4.0 m × 4.0 m = 16.0 m² × 2.5 m(H) = 40 m³ | Person in Charge

Item	Area or Quantity	Sun Gain or Temp. Diff.	Factor	Kcal/h MAX	3:00	5:00	6:00
SOLAR GAIN — GLASS							
	m² ×	×					
	m² ×	×					
	m² ×	×					
	m² ×	×					
	m² ×	×					
SOLAR & TRANS GAIN—WALLS & ROOF							
Wall	m² ×	×					
	m² ×	×					
	m² ×	×					
	m² ×	×					
Roof—Sun	m² ×	×					
Roof—Shaded	m² ×	×					
TRANS. GAIN—EXCEPT WALLS & ROOF							
Glass	m² ×	×					
Ceiling	m² ×	×					
Floor	16.0 m² ×	13.2	× 2.5	528	508	388	
Partition (1)	10.2 m² ×	9.1	× 1.8	167	152	135	
(2)	12.0 m² ×	9.1	× 2.5	273	248	221	
Door	1.8 m² ×	9.1	× 1.6	27	24	22	
Infiltration	CMH ×	deg ×	0.29				
INTERNAL HEAT							
People	2 People × 41			82	82	82	
Kw	Kw ×	×	860				
Lights	16.0 × 20 W ×		1.08	346	346	346	
Appliances etc.							
Credit for Thermal Storage	m² ×	deg ×		(—)		(—)	
			Sub Total				
Safety Factor			%				
Room Sensible Heat Sub Total				1423	1360	1194	
Supply Duct Heat Gain	Supply Duct +Leak Loss	Fan +HP	=10%	143	136	120	
Bypass Outside Air	50 CMH × 18.2 deg × 0.1 BF × 0.29			27	24	22	
Effective Room Sensible Heat				1593	1520	1336	
ROOM LATENT HEAT							
Infiltration	CMH ×	g/kg ×	0.72				
People	2 People × 49			98	98	98	
Steam		kg/h ×	540				
Appliances etc.							
Vapor trans.							
			Sub Total	98	98	98	
Safety Factor			%				
Room Latent Heat Sub Total							
Supply Duct Leakage Loss			10%	10	10	10	
Bypass Outside Air	50 CMH × 9.6 g/kg × 0.1 BF × 0.72			35	35	34	
Effective Room Latent Heat				143	143	142	
Effective Room Total Heat				1736	1663	1478	
OUTSIDE AIR HEAT				(109)			
Sensible:	CMH ×	deg × (1 − BF) × 0.29					
Latent:	CMH ×	g/kg × (1 − BF) × 0.72					
Grand Total Heat Sub Total							
Return Duct Heat Gain +	Return Duct Leak Gain −	Pump H.P −	Pipe Gain = %				
(U.S.R.T) Grand Total Heat							

Estimate For.	AM / PM	Peak Load	AM / PM 3
Hours of Operation	Hour (	–	)

Outside Design Conditions	DB °C	WB °C	%RH	DP °C	COB °C WB g/kg
Outside	47.2	28.6	37		19.0
Room	24.0	17.1	50		9.4
Difference	18.2	×××	×××	×××	9.6

Blind	Non-existence (outside, inside)	L. M. D
Glass	Ordinary, Thick. Absorbent.	%. Double
Color	Light. Medium. Dark.	
Weight	kg/m² (Floor)	kg/m² (Wall)
Internal Heat	W/m²	m²/People

INFILTRATION

Swinging			
Revolving Doors	People ×	CMH/Per.	
Open Doors	Doors ×	CMH/Door	
Exhaust Air			
Crack	m ×	CMH/m	
Infiltration		CMH ■	

VENTILATION

2 People ×	25	CMH/Per.	50
m² ×		CMH/m²	
Ventilation		CMH ■	50

SENSIBLE HEAT FACTOR

E.S.H.F = 1.593 (ERSH) / 1736 (ERTH) = 0.92 (12.3°C)

DEHUMIDIFIED AIR

Apparatus Dewpoint 12.5 °C

1.593 (ERSH) / (1.24 RM − 1.25 ADP)(1 − BF) × 0.29 = 530 CMH

NOTES

- PARTITION :
  (1) : 4.0 × 3.0 − 1.8 = 10.2
  (2) : 4.0 × 3.0 = 12.0
- FLOOR : 4.0 × 4.0 = 16.0
- DOOR : 0.9 × 2.0 = 1.8

FORM E-20E

COOLING AND DEHUMIDIFYING ESTIMATE (METRIC)

Inquiring No. | Inquired By | Sheet No. 14
Job Name | Address | Date Original | Revision | Person in Charge
Space Used For ASSISTANT SUPERINTENDENT ROOM (F02) PAC-1 SYSTEM
Size 6.5 m × 6.5 m = 42.25 m² × 3.0 m (H) = 126.75 m³

Item	Area or Quantity	Sun Gain or Temp. Diff.	Factor	Kcal/h MAX 5:00	Correction 3:00	Correction 6:00
SOLAR GAIN — GLASS						
NE)	6.9 m²	× 366 × 0.13	× 1/6.85 × 0.94 × 0.65	236	291	200
NW)	5.4 m²	× 366 × 0.13	× 1/6.85 × 0.94 × 0.65	924	483	923
	m²	×	×			
	m²	×	×			
	m²	×	×			
SOLAR & TRANS GAIN—WALLS & ROOF						
Wall (NE)	19.1 m²	× 13.0	× 2.1	522	478	547
(NW)	20.6 m²	× 19.5	× 2.1	844	584	1004
	m²	×	×			
	m²	×	×			
Roof—Sun	m²	×	×			
Roof—Shaded	m²	×	×			
TRANS. GAIN—EXCEPT WALLS & ROOF						
Glass	12.3 m²	× 16.5	× 5.1	1035	1142	923
Ceiling	m²	×	×			
Floor	42.25 m²	× 11.5	× 2.5	1215	1395	1025
Partition	7.5 m²	× 8.25	× 1.8	112	123	100
Infiltration	CMH	× deg	× 0.29			
INTERNAL HEAT						
People	4 People	× 41		164	164	164
Kw	Kw	×	× 860			
Lights	42.25 × 20	W	× 1.08	913	913	913
Appliances etc.						
Credit for Thermal Storage	m²	× deg	×	(−)	(−)	
			Sub Total			
Safety Factor			%			
Room Sensible Heat Sub Total				5965	5573	5794
Supply Duct Heat Gain	Supply Duct ÷ Leak Loss	Fan ÷ HP	= 10%	597	558	580
Bypass outside air 100 CMH	× 16.5 deg	× 0.1 BF	× 0.29	48	53	43
Effective Room Sensible Heat ■				6610	6184	6417
ROOM LATENT HEAT						
Infiltration	CMH	× g/kg	× 0.72			
People	4 People	× 49		196	196	196
Steam	kg/h	×	× 540			
Appliances etc.						
Vapor trans.						
			Sub Total			
Safety Factor			%			
Room Latent Heat Sub Total						
Supply Duct Leakage Loss			10 %	20	20	20
Bypass Outside Air 100 CMH	× 9.5 g/kg	× 0.1 BF	× 0.72	69	70	68
Effective Room Latent Heat ■				285	284	283
Effective Room Total Heat ▣				6895	6468	6700
OUTSIDE AIR HEAT				(164)		
Sensible:	CMH	× deg	× (1 − BF) × 0.29			
Latent:	CMH	× g/kg	× (1 − BF) × 0.72			
Grand Total Heat Sub Total						
Return Duct Heat Gain + Return Duct Leak Gain		Pump H.P − Pipe Gain	= %			
(U.S.R.T) GRAND TOTAL HEAT ▣						

Estimate For.	AM / PM	Peak Load	AM / PM
Hours of Operation	Hour (~)		

Outside Design Conditions	°CDB	°CWB	%RH

Conditions	DB °C	WB °C	%RH	DP °C	g/kg
Outside	40.5	28.2	39		18.9
Room	24.0	17.1	50		9.4
Difference	16.5	×××	×××	×××	9.5

Blind: (Non-Existence | Outside, Inside) L. M. D
Glass: Ordinary, Thick, Absorbent, %, Double
Color: Light, Medium, Dark.
Weight: kg/m² (Floor) kg/m² (Wall)
Internal Heat: W/m² m²/People

INFILTRATION
Swinging
Revolving Doors People × CMH/Per.
Open Doors Doors × CMH/Door
Exhaust Air
Crack m × CMH/m
Infiltration CMH ■

VENTILATION
4 People × 25 CMH/Per. = 100
m² × CMH/m²
Ventilation CMH ■ 100

SENSIBLE HEAT FACTOR
E.S.H.F = 6610 (ERSH) / 6895 (ERTH) = 0.96 (12.5°C)

DEHUMIDIFIED AIR
Apparatus Dewpoint 12.5 °C
6,610 (ERSH) / (24 RM · 12. ADP)(1 − BF) × 0.29 = 2210 CMH

NOTES
- GLASS (NE): 1.5 × 1.8 + 1.5 × 2.8 = 6.9
  (NW): 1.5 × 1.8 × 2 = 5.4
- WALL (NE): 6.5 × 4.0 − 6.9 = 19.1
  (NW): 6.5 × 4.0 − 5.4 = 20.6
- PARTITION: 2.5 × 3.0 = 7.5
- FLOOR: SR

FORM E-20E

COOLING AND DEHUMIDIFYING ESTIMATE (METRIC)

Inquiring No. | Inquired By | Sheet No. 15
Job Name | Address | Date Original
Space Used For SUPERINTENDENT ROOM (E01) | PAC - 1 SYSTEM | Revision
Size 13.0 m × 6.5 m = 84.5 m² × 3.0 m(H) = 253.5 m³ | Person in Charge

Item	Area or Quantity	Sun Gain or Temp. Diff.	Factor	Kcal/h MAX 5:00	Correction 3:00	Correction 6:00
SOLAR GAIN — GLASS						
(NW) 12.3	m² × 366 × 0.65/0.85 ×		0.94 × 8.65	2104	1101	2072
	m² ×					
	m² ×					
	m² ×					
	m² ×					
	m² ×					
SOLAR & TRANS GAIN—WALLS & ROOF						
Wall (NW) 39.7	m² ×	19.5 ×	2.1	1626	1126	1935
	m² ×					
	m² ×					
	m² ×					
Roof—Sun	m² ×					
Roof—Shaded	m² ×					
TRANS. GAIN—EXCEPT WALLS & ROOF						
Glass 12.3	m² ×	16.5 ×	5.1	1053	1142	923
Ceiling	m² ×					
Floor 84.5	m² ×	11.5 ×	2.5	2430	2789	2050
Partition 17.7	m² ×	8.25 ×	1.8	263	290	235
Door 1.8	m² ×	8.25 ×	1.6	24	27	22
Infiltration	CMH ×	deg ×	0.29			
INTERNAL HEAT						
People	8 People ×	41		328	328	328
Kw	Kw ×		× 860			
Lights 84.5	× 20 W ×		1.08	1826	1826	1826
Appliances Etc.						
Credit for Thermal Storage	m² ×	deg ×		(−)	(−)	
			Sub Total			
Safety Factor			%			
Room Sensible Heat Sub Total				9654	8629	9391
Supply Duct Heat Gain	Supply Duct + Leak Loss	Fan − HP	=10%	966	863	940
Bypass Outside Air 200 CMH	× 16.5 deg × 0.1 B.F × 0.29			96	106	86
Effective Room Sensible Heat ■				10716	9598	10417
ROOM LATENT HEAT						
Infiltration	CMH ×	g/kg ×	0.72			
People	8 People ×	49		392		
Steam		kg/h ×	540			
Appliances Etc.						
Vapor Trans.						
			Sub Total			
Safety Factor			%			
Room Latent Heat Sub Total				392	392	392
Supply Duct Leakage Loss			10%	40	40	40
Bypass Outside Air 200 CMH	× 9.5 g/kg × 0.1 BF × 0.72			139	139	136
Effective Room Latent Heat ■				569	571	568
Effective Room Total Heat ▣				11285	10169	10985
OUTSIDE AIR HEAT				(134)		
Sensible:	CMH ×	deg × (1 − BF) × 0.29				
Latent:	CMH ×	g/kg × (1 − BF) × 0.72				
Grand Total Heat Sub Total						
Return Duct Heat Gain	+ Return Duct Leak Gain	− Pump H.P	+ Pipe Gain = %			
(U.S.R.T) Grand Total Heat ▣						

Estimate For.	AM / PM	Peak Load	AM / PM 5
Hours of Operation	Hour (	−	)
Outside Design Conditions	°CDB	°CWB	%RH
Conditions:	DB °C	WB °C	%RH	DP °C	g/kg
Outside	40.5	28.2	39		18.9
Room	24.0	17.1	50		9.4
Difference	16.5	×××	×××	×××	9.5
Blind	(NON-EXISTENCE)(OUTSIDE, INSIDE) L. M. D				
Glass	ORDINARY. THICK. ABSORBENT. % . DOUBLE				
Color	LIGHT. MEDIUM. DARK.				
Weight	kg/m²(FLOOR)			kg/m²(WALL)	
Internal Heat	W/m²			m²/PEOPLE	

INFILTRATION

Swinging		
Revolving Doors	People × CMH/PER.	
Open Doors	Doors × CMH/DOOR	
Exhaust Air		
Crack	m × CMH/m	
Infiltration	CMH ■	

VENTILATION

8 People ×	25 CMH/PER.	200
1 m² ×	CMH/m²	
Ventilation	CMH ■	200

SENSIBLE HEAT FACTOR

$$E.S.H.F = \frac{10716\ (ERSH)}{11285\ (ERTH)} = 0.95\ (12.5^{\circ}C)$$

DEHUMIDIFIED AIR

Apparatus Dewpoint 12.5 °C

$$\frac{10716\ (ERSH)}{(24\ RM - 12.5\ ADP)(1 - 0.1\ BF) \times 0.29} = 3580\ CMH$$

NOTES

- GLASS (NW) : 1.5 × 1.8 × 3 + 1.5 × 2.8 = 12.3
- WALL (NW) : 13.0 × 4.0 − 12.3 = 39.7
- PARTITION : 6.5 × 3.0 − 1.8 = 17.7
- DOOR : 0.9 × 2.0 = 1.8
- FLOOR : SR

E101

FORM E-20E

COOLING AND DEHUMIDIFYING ESTIMATE (METRIC)

Inquiring No. | Inquired By | Sheet No. 16
Job Name | Address | Date Original
Space Used For SECRATARY ROOM (F01) | PAC-1 System | Revision
Size m × m = 24.0 m² × 2.5 m High = 60 m³ | Person in Charge

Item	Area or Quantity	Sun Gain or Temp. Diff.	Factor	Kcal/h	Correction	
				MAX 3:00	5:00	6:00
SOLAR GAIN — GLASS						
m² ×		×				
m² ×		×				
m² ×	1	×				
m² ×		×				
m² ×		×				
SOLAR & TRANS GAIN—WALLS & ROOF						
Wall m² ×		×				
m² ×		×				
m² ×		×				
m² ×		×				
Roof—Sun m² ×		×				
Roof—Shaded m² ×		×				
TRANS. GAIN—EXCEPT WALLS & ROOF						
Glass m² ×		×				
Ceiling m² ×		×				
Floor 24.0 m² ×	13.2	×	2.5	792	690	582
Partition 10.0 m² ×	9.1	×	1.8	164	149	133
Infiltration CMH ×	deg ×		0.29			
INTERNAL HEAT						
People 4 People ×	41			164	164	164
Kw Kw ×	×		860			
Lights 24.0 × 20 W ×			1.08	519	519	519
Appliances Etc.						
Credit for Thermal Storage m² ×	deg ×			(—)	(—)	
Sub Total						
Safety Factor %						
Room Sensible Heat Sub Total				1639	1522	1398
Supply Duct Heat Gain	Supply Duct +Leak Loss	Fan +HP	=10%	164	153	140
Bypass Outside Air 100 CMH × 18.2 deg × 0.1 BF × 0.29				53	48	43
Effective Room Sensible Heat ■				1856	1723	1581
ROOM LATENT HEAT						
Infiltration CMH ×	g/kg ×		0.72			
People 4 People ×	49			196		
Steam kg/h ×			540			
Appliances Etc.						
Vapor Trans.						
Sub Total						
Safety Factor %						
Room Latent Heat Sub Total				196	196	196
Supply Duct Leakage Loss 10 %				20	20	20
Bypass Outside Air 100 CMH × 9.6 g/kg × 0.1 BF × 0.72				70	69	68
Effective Room Latent Heat ■				286	285	284
Effective Room Total Heat ◙				2142	2008	1865
OUTSIDE AIR HEAT				(89)		
Sensible: CMH ×	deg × (1 − BF) × 0.29					
Latent: CMH ×	g/kg × (1 − BF) × 0.72					
Grand Total Heat Sub Total						
Return Duct Heat Gain + Return Duct Leak Gain	Pump H.P + Pipe Gain		= %			
(U.S.R.T) Grand Total Heat ◙						

Estimate For	AM / PM	Peak Load	AM / PM
Hours of Operation	Hour (	–	)

Outside Design Conditions	DB °C	WB °C	%RH	DP °C	CDB CWB g/kg
Conditions					
Outside	42.2	28.6	39		19.0
Room	24.0	17.1	50		9.4
Difference	18.2	×××	×××	×××	9.6

Blind	Non-existence (outside. inside) L. M. D
Glass	Ordinary. Thick. Absorbent. %. Double
Color	Light. Medium. Dark.
Weight	kg/m² (floor) kg/m² (wall)
Internal Heat	W/m² m²/People

Infiltration

Swinging	
Revolving Doors	People × CMH/per.
Open Doors	Doors × CMH/door
Exhaust Air	
Crack m ×	CMH/m
Infiltration CMH ■	

Ventilation

4 People × 25	CMH/per.	100
m² ×	CMH/m²	
Ventilation CMH ■		100

Sensible Heat Factor

E.S.H.F = 1856 (ERSH) / 2142 (ERTH) = 0.87 (11.8°C)

Dehumidified Air

Apparatus Dewpoint 12.5 °C

1856 (ERSH) / (24 RM − 12. ADP)(1 − 0.9 BF) × 0.29 = 620 CMH

Notes

SR: 6.5 × 4.0 − 2.0 = 24.0
· PARTITION : 4.0 × 2.5 = 10.0
· FLOOR : SR.

FORM E-20E

COOLING AND DEHUMIDIFYING ESTIMATE(METRIC)

Inquiring No. | Inquired By | Sheet No. 17
Job Name | Address | Date Original
Space Used For TELECOMUNICATION ROOM (F07) PAC-1 SYSTEM | Revision
Size m× m= 52.25 m² × 3 m(H)= 156.75 m³ | Person in Charge

Item	Area or Quantity	Sun Gain or Temp. Diff	Factor	Kcal/h	Correction	
SOLAR GAIN — GLASS				MAX 5:00	3:00	6:00
(NW)	5.4 m²×	366 ×0.65/0.85	× 0.94 ×0.65	925	484	910
	m²×		×			
	m²×		×			
	m²×		×			
	m²×		×			
SOLAR & TRANS GAIN—WALLS & ROOF						
Wall (NW)	20.6 m²×	19.5	× 2.1	844	584	1004
	m²×		×			
	m²×		×			
	m²×		×			
Roof—Sun	m²×		×			
Roof—Shaded	m²×		×			
TRANS. GAIN—EXCEPT WALLS & ROOF						
Glass	m²×		×			
Ceiling	m²×		×			
Floor	19.5 m²×	11.5	× 2.5	561	644	473
Partition	45.4 m²×	8.25	× 1.8	675	744	601
Door	2.6 m²×	8.25	× 1.6	35	38	31
Infiltration	CMH×	deg×	0.29			
INTERNAL HEAT						
People		5 People× 41		205	205	205
Kw	Kw×	×	860			
Lights	52.25 × 20 W×		1.08	1129	1129	1129
Appliances Etc.						
Credit for Thermal Storage	m²×	deg×		(−)	(−)	
			Sub Total			
Safety Factor			%			
Room Sensible Heat Sub Total				4374	3828	4353
Supply Duct Heat Gain	Supply Duct +Leak Loss	Fan +HP	10 %	438	383	436
Bypass Outside Air	125 CMH× 16.5 deg× 0.1 BF×0.29			60	66	54
EFFECTIVE ROOM SENSIBLE HEAT			■	4872	4277	4843
ROOM LATENT HEAT						
Infiltration	CMH×	g/kg×	0.72			
People		5 People× 49		245	245	245
Steam		kg/h×	540			
Appliances etc.						
Vapor trans.						
			Sub Total			
Safety Factor			%			
Room Latent Heat Sub Total						
Supply Duct Leakage Loss			10 %	25	25	25
Bypass Outside Air	125 CMH× 9.5 g/kg×0.1 BF×0.72			86	87	85
EFFECTIVE ROOM LATENT HEAT			■	356	357	355
EFFECTIVE ROOM TOTAL HEAT			▣	5228	4634	5198
OUTSIDE AIR HEAT				(101)		
Sensible:	CMH×	deg×(1− BF)×0.29				
Latent:	CMH×	g/kg×(1− BF)×0.72				
Grand Total Heat Sub Total						
Return Duct Heat Gain + Return Duct Leak Gain − Pump H.P − Pipe Gain			= %			
(U.S.R.T) GRAND TOTAL HEAT			▣			

Estimate For: AM PM | Peak Load: AM PM 5

HOURS OF OPERATION Hour (~)

Outside Design Conditions °CDB °CWB %RH

Conditions	DB °C	WB °C	%RH	DP °C	g/kg
Outside	40.5	28.2	39		18.9
Room	24.0	17.1	50		6.4
Difference	16.5	×××	×××	×××	9.5

BLIND: NON-EXISTENCE (OUTSIDE, INSIDE) L. M. D
GLASS: ORDINARY. THICK. ABSORBENT. %. DOUBLE
COLOR: LIGHT. MEDIUM. DARK.
WEIGHT: kg/m²(FLOOR) kg/m²(WALL)
INTERNAL HEAT: W·m² m²/PEOPLE

INFILTRATION

Swinging	
Revolving Doors People× CMH/PER.	
Open Doors Doors× CMH/DOOR	
Exhaust Air	
Crack m× CMH/m	
Infiltration CMH ■	

VENTILATION

5 People× 25 CMH/PER.	125
m²× CMH/m²	
Ventilation CMH ■	125

SENSIBLE HEAT FACTOR

$E.S.H.F = \frac{4872 \text{ (ERSH)}}{5228 \text{ (ERTH)}} = 0.93$ (12.4°C)

DEHUMIDIFIED AIR

Apparatus Dewpoint 12.5 °C

$\frac{4872 \text{ (ERSH)}}{(24 \text{ RM} - (12.5 \text{ ADP}))(1 - 0.1 \text{ BF}) \times 0.29} = 1630$ CMH

NOTES

SR : 10.5 × 6.5 − 4.0×4.0 = 52.25

· GLASS (NW) : 1.5 × 1.8 × 2 = 5.4

· WALL (NW) : 6.5×4.0 − 5.4 = 20.6

· PARTITION : 16.0 × 3.0 − 2.6 = 45.4

· FLOOR : 3.0 × 6.5 = 19.5

· DOOR : 1.3 × 2.0 = 2.6

FORM E-208

101/4

COOLING AND DEHUMIDIFYING ESTIMATE (METRIC)

Inquiring No. | Inquired By | Sheet No. 18
Job Name | Address | Date Original
Space Used For CANTEEN (F04) | PAC-1 SYSTEM | Revision
Size m× m= 78.5 m² × 3.8, 2.5 m(H)= 251.18 m³ | Person in Charge

Item	Area or Quantity	Sun Gain or Temp. Diff.	Factor	Kcal/h MA 4:00	Correction 3:00	Correction 5:00
SOLAR GAIN — GLASS						
(NW)	5.4 m²	366	0.52/0.85 × 0.94 × 0.65	1739	484	925
(SW)	12.3 m²	252	0.64/0.85 × 0.94 × 0.65	1426	1560	1115
	m²		×			
	m²		×			(910)
	m²		×			(580)
SOLAR & TRANS GAIN—WALLS & ROOF						
Wall (NW)	20.6 m²	15.4	× 2.1	667	584	844
(SW)	39.7 m²	18.6	× 2.1	1551	1318	1601
	m²		×			
	m²		×			(1004)
Roof—Sun	m²		×			(1626)
Roof—Shaded	m²		×			
TRANS. GAIN—EXCEPT WALLS & ROOF						(1327)
Glass	17.7 m²	17.7	× 5.1	1598	1643	1490
Ceiling	m²		×			(1904)
Floor	78.5 m²	12.7	× 2.5	2493	2591	2257
Partition (1)	26.6 m²	8.85	× 1.8	424	436	395
(2)	24.7 m²	17.7	× 2.5	1093	1124	1019
						(1352)
Infiltration	CMH	deg	× 0.29			(908)
INTERNAL HEAT						
People	15 People	× 41		615	615	615
Kw	Kw	×	860			
Lights	78.5 × 20	W	× 1.08	1696	1696	1696
Appliances Etc.						
Credit for Thermal Storage	m²	deg	×	(—)	(—)	
			Sub Total			
Safety Factor			%			(10972)
Room Sensible Heat Sub Total				12302	12051	11957
Supply Duct Heat Gain	Supply Duct +Leak Loss	Fan +HP	=10%	1231	1206	(1093) 1196
Bypass Outside Air	1695 CMH	17.7 deg	× 0.1 B.F × 0.29	870	895	81
Effective Room Sensible Heat ■				14403	14152	13964
ROOM LATENT HEAT						(12738)
Infiltration	CMH	g/kg	× 0.72			
People	15 People	× 49		735		
Steam		kg/h	× 540			
Appliances etc.						
Vapor Trans.						
			Sub Total			
Safety Factor			%			
Room Latent Heat Sub Total				735	735	735
Supply Duct Leakage Loss			10 %	74	74	74
Bypass Outside Air	1695 CMH	9.4 g/kg	× 0.1 BF × 0.72	1148	1172	1148
Effective Room Latent Heat ■				1957	1981	1957
Effective Room Total Heat ▣				16360	16133	15921
OUTSIDE AIR HEAT				(209)		
Sensible:	CMH	deg	× (1 − BF) × 0.29			
Latent:	CMH	g/kg	× (1 − BF) × 0.72			
Grand Total Heat Sub Total						
Return Duct Heat Gain + Return Duct Leak Gain − Pump H.P ± Pipe Gain			= %			
(U.S.R.T) GRAND TOTAL HEAT ▣						

Estimate For: AM / PM | Peak Load: AM / PM 4

Hours of Operation	Hour (	–	)		
Outside Design Conditions	DB	WB	%RH	DP	g/kg
Conditions' DB °C	WB °C	%RH	DP °C	g/kg	
Outside	41.7	28.4	38		18.8
Room	24.0	17.1	50		9.4
Difference	17.7	×××	×××	×××	9.4

Blind: Non-Existence (Outside, Inside) L. M. D
Glass: Ordinary. Thick. Absorbent. %. Double
Color: Light. Medium. Dark.
Weight: kg/m² (Floor) kg/m² (Wall)
Internal Heat: W/m² m²/People

INFILTRATION
Swinging
Revolving Doors People× CMH/Per
Open Doors Doors× CMH/Door
Exhaust Air
Crack m× CMH/m
Infiltration CMH ■

VENTILATION
15 People× 2.5 CMH/Per.
m² × CMH/m²
Ventilation CMH ■ 1695

SENSIBLE HEAT FACTOR
E.S.H.F = 14403 (ERSH) / 16360 (ERTH) = 0.88 (11.9°C)

DEHUMIDIFIED AIR
Apparatus Dewpoint 12.5 °C
14403 (ERSH) / 24 RM − 12.5 ADP)(1 − BF) × 0.29 = 481.0 CMH

NOTES

SR: 13.0 × 6.5 − 1.5 × 4.0 = 78.5

• GLASS (NW): 1.5 × 1.8 × 2 = 5.4
(SW): 1.5 × 1.8 × 3 + 1.5 × 2.8 = 12.3

• WALL (NW): 6.5 × 4.0 − 5.4 = 20.6
(SW): 13.0 × 4.0 − 12.3 = 39.7

• PARTITION
(1): 7.0 × 3.8 = 26.6
(2): 6.5 × 3.8 = 24.7

• FLOOR: SR

VR = 6.5 × 6.5 × 3.8 + (6.5 × 6.5 − 1.5 × 4) × 2.5
= 251.18

(6:00): 14.395

FORM E-20E

COOLING AND DEHUMIDIFYING ESTIMATE (METRIC)

Inquiring No | Inquired By | Sheet No. 19
Job Name | Address | Date Original
Space Used For SECRATARY ROOM (502) | PAC - 1 SYSTEM | Revision
Size 4.0 m × 4.0 m = 16.0 m² × 2.5 m H = 40 m³ | Person in Charge

Item	Area or Quantity	Sun Gain or Temp. Diff.	Factor	Kcal/h MAX 3:00	Correction 5:00	Correction 6:00
SOLAR GAIN — GLASS						
	m² ×	×				
	m² ×	×				
	m² ×	×				
	m² ×	×				
	m² ×	×				
SOLAR & TRANS GAIN—WALLS & ROOF						
Wall	m² ×	×				
	m² ×	×				
	m² ×	×				
	m² ×	×				
Roof—Sun	m² ×	×				
Roof—Shaded	m² ×	×				
TRANS. GAIN—EXCEPT WALLS & ROOF						
Glass	m² ×	×				
Ceiling	m² ×	×				
Floor	m² ×	×				
Partition (1) 8.2	m² ×	9.1 ×	1.8	135	122	109
(2) 10.0	m² ×	9.1 ×	2.5	228	207	184
Door	1.8 m² ×	9.1 ×	1.6	27	24	22
Infiltration	CMH ×	deg ×	0.29			
INTERNAL HEAT						
People	Z People ×	41		82	82	82
Kw	Kw ×	×	860			
Lights	16.0 × 20 W ×		1.08	346	346	346
Appliances etc.						
Credit for Thermal Storage	m² ×	deg ×		(—)	(—)	
			Sub Total			
Safety Factor			%			
Room Sensible Heat Sub Total				818	781	743
Supply Duct Heat Gain	Supply Duct +Leak Loss	Fan −HP	=10%	82	79	75
Bypass Outside Air	50 CMH × 18.2 deg × 0.1 B.F × 0.29			27	24	22
EFFECTIVE ROOM SENSIBLE HEAT				927	884	840
ROOM LATENT HEAT						
Infiltration	CMH ×	g/kg ×	0.72			
People	Z People ×	49		98		
Steam	kg/h ×		540			
Appliances etc.						
Vapor Trans.						
			Sub Total			
Safety Factor			%			
Room Latent Heat Sub Total				98	98	98
Supply Duct Leakage Loss			10 %	10	10	10
Bypass Outside Air	50 CMH × 9.6 g/kg × 0.1 BF × 0.72			35	35	34
EFFECTIVE ROOM LATENT HEAT				143	143	142
EFFECTIVE ROOM TOTAL HEAT				1070	1027	982
OUTSIDE AIR HEAT				(67)		
Sensible:	CMH ×	deg × (1 − BF) × 0.29				
Latent:	CMH ×	g/kg × (1 − BF) × 0.72				
Grand Total Heat Sub Total						
Return Duct Heat Gain + Return Duct Leak Gain		Pump H.P	Pipe Gain = %			
(U.S.R.T) GRAND TOTAL HEAT						

Estimate For	AM / PM	Peak Load	AM / PM 3
Hours of Operation	Hour (	–	)

Outside Design Conditions	°CDB	°CWB	%RH
Conditions	DB °C	WB °C	%RH	DP °C	g/kg
Outside	42.2	28.6	37		19.0
Room	24.0	17.1	50		9.4
Difference		×××	×××	×××	9.6

Blind	Non-existence (outside, inside)	L. M. D
Glass	Ordinary, Thick, Absorbent.	%. Double
Color	Light, Medium, Dark.	
Weight	kg/m² (floor)	kg/m² (wall)
Internal Heat	W/m²	m²/People

Infiltration		
Swinging		
Revolving Doors	People × CMH/per	
Open Doors	Doors × CMH/door	
Exhaust Air		
Crack	m × CMH/m	
Infiltration	CMH ■	

Ventilation		
Z People ×	25 CMH/per	50
m² ×	CMH/m²	
Ventilation	CMH ■	50

Sensible Heat Factor

$$E.S.H.F = \frac{927\ (ERSH)}{1070\ (ERTH)} = 0.87\ (11.8°C)$$

Dehumidified Air

Apparatus Dewpoint 12.5 °C

$$\frac{927\ (ERSH)}{(1.2 \times RM - 12.5 \times ADP)(1 - 0.1\ BF) \times 0.29} = 310\ CMH$$

NOTES

- PARTITION
  (1) 4.0 × 2.5 − 1.8 = 8.2
  (2) 4.0 × 2.5 = 10.0
- Door : 0.9 × 2.0 = 1.8

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FORM E-20E

COOLING AND DEHUMIDIFYING ESTIMATE (METRIC)

INQUIRING NO | INQUIRED BY | SHEET NO. 20
JOB NAME | ADDRESS | DATE ORIGINAL | REVISION | PERSON IN CHARGE
SPACE USED FOR ASSISTANT SUPERINTENDENT ROOM (S02) PAC-1 SYSTEM
SIZE 6.5 m × 6.5 m = 42.25 m² × 3.8 m(H) = 160.55 m³

ITEM	AREA OR QUANTITY	SUN GAIN OR TEMP. DIFF.	FACTOR	Kcal/h MAX 5:00	CORRECTION 3:00	CORRECTION 6:00
SOLAR GAIN — GLASS						
(NE)	6.9 m²	× 366 × 0.13/0.85 × 0.94 × 0.65		236	291	200
(NW)	5.4 m²	× 366 × 0.65/0.85 × 0.94 × 0.65		925	484	910
	m²	×	×			
	m²	×	×			
	m²	×	×			
SOLAR & TRANS GAIN—WALLS & ROOF						
WALL (NE)	19.1 m²	× 13.0	× 2.1	522	478	542
(NW)	20.6 m²	× 19.5	× 2.1	844	584	1004
	m²	×	×			
	m²	×	×			
ROOF—SUN	m²	×	×			
ROOF—SHADED	m²	×	×			
TRANS. GAIN—EXCEPT WALLS & ROOF						
GLASS	17.3 m²	× 16.5	× 5.1	1035	1142	923
CEILING	m²	×	×			
FLOOR	m²	×	×			
PARTITION	9.5 m²	× 8.25	× 1.8	141	156	126
INFILTRATION	CMH ×	deg ×	0.29			
INTERNAL HEAT						
PEOPLE	4 PEOPLE × 41			164	164	164
KW	KW ×	×	860			
LIGHTS	42.25 × 20 W ×		1.08	913	913	913
APPLIANCES ETC.						
CREDIT FOR THERMAL STORAGE	m² ×	deg ×		(—)		(—)
			SUB TOTAL			
SAFETY FACTOR			%			
ROOM SENSIBLE HEAT SUB TOTAL				4780	4212	4787
SUPPLY DUCT HEAT GAIN	SUPPLY DUCT +LEAK LOSS	FAN −HP	=10%	478	422	479
BYPASS OUTSIDE AIR	100 CMH × 16.5 deg × 0.1 BF × 0.29			48	53	43
EFFECTIVE ROOM SENSIBLE HEAT ■				5306	4687	5304
ROOM LATENT HEAT						
INFILTRATION	CMH ×	g/kg ×	0.72			
PEOPLE	4 PEOPLE × 49			196		
STEAM	kg/h ×		540			
APPLIANCES ETC.						
VAPOR TRANS.						
			SUB TOTAL			
SAFETY FACTOR			%			
ROOM LATENT HEAT SUB TOTAL				196	196	196
SUPPLY DUCT LEAKAGE LOSS			10 %	20	20	20
BYPASS OUTSIDE AIR	100 CMH × 95 g/kg × 0.1 BF × 0.72			69	170	68
EFFECTIVE ROOM LATENT HEAT ■				285	284	283
EFFECTIVE ROOM TOTAL HEAT ▣				5591	4971	5587
OUTSIDE AIR HEAT				(133)		
SENSIBLE:	CMH ×	deg × (1 − BF) × 0.29				
LATENT:	CMH ×	g/kg × (1 − BF) × 0.72				
GRAND TOTAL HEAT SUB TOTAL						
RETURN DUCT HEAT GAIN + RETURN DUCT LEAK GAIN − PUMP H.P − PIPE GAIN = %						
(U.S.R.T) GRAND TOTAL HEAT ▣						

ESTIMATE FOR	AM / PM	PEAK LOAD	AM / PM 5
HOURS OF OPERATION	HOUR (	~	)

OUTSIDE DESIGN CONDITIONS	°CDB	°CWB	%RH

CONDITIONS	DB °C	WB °C	%RH	DP °C	g/kg
OUTSIDE	40.5	28.2	39		19.0
ROOM	24.0	17.1	50		9.4
DIFFERENCE	16.5	×××	×××	×××	9.6

BLIND: NON-EXISTENCE (OUTSIDE, INSIDE) L. M. D
GLASS: ORDINARY, THICK, ABSORBENT, % DOUBLE
COLOR: LIGHT, MEDIUM, DARK
WEIGHT: kg/m²(FLOOR) kg/m²(WALL)
INTERNAL HEAT: W/m² m²/PEOPLE

INFILTRATION

SWINGING		
REVOLVING DOORS	PEOPLE × CMH/PER	
OPEN DOORS	DOORS × CMH/DOOR	
EXHAUST AIR		
CRACK	m × CMH/m	
INFILTRATION	CMH ■	

VENTILATION

4 PEOPLE ×	25 CMH/PER.	100
m² ×	CMH/m²	
VENTILATION	CMH ■	100

SENSIBLE HEAT FACTOR

E.S.H.F = 5306 (ERSH) / 5591 (ERTH) = 0.95 (12.5°C)

DEHUMIDIFIED AIR

APPARATUS DEWPOINT 12.5 °C

5306 (ERSH) / (24 RM − 12.5 ADP)(1 − 0.1 BF) × 0.29 = 1770 CMH

NOTES

- GLASS (NE): 1.5 × 1.8 + 1.5 × 2.8 = 6.9
  (NW): 1.5 × 1.8 × 2 = 5.4
- WALL (NE): 6.5 × 4.0 − 6.9 = 19.1
  (NW): 6.5 × 4.0 − 5.4 = 20.6
- PARTITION: 2.5 × 3.8 = 9.5

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FORM E-20E

COOLING AND DEHUMIDIFYING ESTIMATE (METRIC)

INQUIRING NO. | INQUIRED BY | SHEET NO. 21
JOB NAME | ADDRESS | DATE ORIGINAL
SPACE USED FOR SECRATARY ROOM (S01) | PAC-1 SYSTEM | REVISION
SIZE 4.0 m × 4.0 m = 16.0 m² × 2.5 m H = 40 m³ | PERSON IN CHARGE

ITEM	AREA OR QUANTITY	SUN GAIN OR TEMP. DIFF.	FACTOR	Kcal/h MAX 3:00	CORRECTION 5:00	CORRECTION 6:00
SOLAR GAIN — GLASS						
	m² ×		×			
	m² ×		×			
	m² ×		×			
	m² ×		×			
	m² ×		×			
SOLAR & TRANS GAIN—WALLS & ROOF						
WALL	m² ×		×			
	m² ×		×			
	m² ×		×			
	m² ×		×			
ROOF—SUN	m² ×		×			
ROOF—SHADED	m² ×		×			
TRANS. GAIN—EXCEPT WALLS & ROOF						
GLASS	m² ×		×			
CEILING	m² ×		×			
FLOOR	16.0 m² ×	9.1	× 1.7	248	225	200
PARTITION	18.2 m² ×	9.1	× 1.8	299	271	241
DOOR	1.8 m² ×	9.1	× 1.6	27	24	22
INFILTRATION	CMH ×	deg ×	0.29			
INTERNAL HEAT						
PEOPLE	2 PEOPLE ×	41		82	82	82
KW	KW ×		× 860			
LIGHTS	16.0 × 20	W ×	1.08	346	346	346
APPLIANCES ETC.						
CREDIT FOR THERMAL STORAGE	m² ×	deg ×		—	—	
			SUB TOTAL			
SAFETY FACTOR			%			
ROOM SENSIBLE HEAT SUB TOTAL				1002	948	891
SUPPLY DUCT HEAT GAIN	SUPPLY DUCT ÷ LEAK LOSS	FAN − HP	=10%	101	95	90
BYPASS OUTSIDE AIR	50 CMH × (18.2 deg − 9.1)	BF × 0.29		27	24	22
EFFECTIVE ROOM SENSIBLE HEAT ■				1130	1067	1003
ROOM LATENT HEAT						
INFILTRATION	CMH ×	g/kg ×	0.72			
PEOPLE	2 PEOPLE ×	49		98		
STEAM		kg/h ×	540			
APPLIANCES ETC.						
VAPOR TRANS.						
			SUB TOTAL			
SAFETY FACTOR			%			
ROOM LATENT HEAT SUB TOTAL				98	98	98
SUPPLY DUCT LEAKAGE LOSS			10 %	10	10	10
BYPASS OUTSIDE AIR	50 CMH × 9.6 g/kg ×	9.1 BF × 0.72		35	35	34
EFFECTIVE ROOM LATENT HEAT ■				143	143	142
EFFECTIVE ROOM TOTAL HEAT ▣				1273	1210	1145
OUTSIDE AIR HEAT				(80)		
SENSIBLE:	CMH ×	deg × (1 −	BF) × 0.29			
LATENT:	CMH ×	g/kg × (1 −	BF) × 0.72			
GRAND TOTAL HEAT SUB TOTAL						
RETURN DUCT HEAT GAIN ÷ RETURN DUCT LEAK GAIN − PUMP H.P − PIPE GAIN = %						
(U.S.R.T) GRAND TOTAL HEAT ▣						

ESTIMATE FOR.	AM / PM	PEAK LOAD	AM / PM
HOURS OF OPERATION	HOUR (	~	)

OUTSIDE DESIGN CONDITIONS	°CDB	°CWB	%RH

CONDITIONS	DB °C	WB °C	%RH	DP °C	g/kg
OUTSIDE	42.2	28.6	37		19.0
ROOM	24.0	17.1	50		9.4
DIFFERENCE	18.2	×××	×××	×××	9.6

BLIND (NON-EXISTENCE/OUTSIDE, INSIDE) L M D
GLASS (ORDINARY, THICK, ABSORBENT, %, DOUBLE)
COLOR (LIGHT, MEDIUM, DARK)
WEIGHT kg/m²(FLOOR) kg/m²(WALL)
INTERNAL HEAT W/m² m²/PEOPLE

INFILTRATION
SWINGING
REVOLVING DOORS PEOPLE × CMH/PER.
OPEN DOORS DOORS × CMH/DOOR
EXHAUST AIR
CRACK m × CMH/m
INFILTRATION CMH ■

VENTILATION
2 PEOPLE × 25 CMH/PER. = 50
m² × CMH/m²
VENTILATION CMH ■ 50

SENSIBLE HEAT FACTOR
E.S.H.F = 1.130 (ERSH) / 1.273 (ERTH) = 0.89 (12.0)

DEHUMIDIFIED AIR
APPARATUS DEWPOINT 12.5 °C
1130 (ERSH) / (24RM + 12.5ADP)(1 − 1.1BF) × 0.29 = 380 CMH

NOTES
- PARTITION: 8.0 × 2.5 − 1.8 = 18.2
- DOOR : 0.9 × 2.0 = 1.8
- FLOOR : SR

FORM E-20E

COOLING AND DEHUMIDIFYING ESTIMATE (METRIC)

Inquiring No | Inquired By | Sheet No. 22
Job Name | Address | Date Original | Revision | Person in Charge
Space Used For ASSISTANT SUPERINTENDENT ROOM (501) PAC-1 SYSTEM
Size 6.5 m × 6.5 m = 42.25 m² × 3.8 m(H) = 160.55 m³

Item	Area or Quantity	Sun Gain or Temp. Diff.	Factor	Kcal/h MAX 6:00	Correction 3:00	Correction 5:00
SOLAR GAIN — GLASS						
(NW)	6.9 m²	× 366 × 0.64/0.85	× 0.94 × 0.65	1162	618	1180
	m²	×	×			
	m²	×	×			
	m²	×	×			
	m²	×	×			
SOLAR & TRANS GAIN—WALLS & ROOF						
Wall (NW)	19.1 m²	× 23.2	× 2.1	931	258	783
	m²	×	×			
	m²	×	×			
	m²	×	×			
Roof—Sun	m²	×	×			
Roof—Shaded	m²	×	×			
TRANS. GAIN—EXCEPT WALLS & ROOF						
Glass	6.9 m²	× 14.7	× 5.1	518	641	581
Ceiling	m²	×	×			
Floor	m²	×	×			
Partition	9.5 m²	× 7.35	× 1.8	126	156	141
Infiltration	CMH ×	deg ×	0.29			
INTERNAL HEAT						
People	4 People × 41			164	164	164
Kw	Kw ×	×	860			
Lights	42.25 × 20	W ×	1.08	913	913	913
Appliances etc.						
Credit for Thermal Storage	m² ×	deg ×		(—)		(—)
			Sub Total			
Safety Factor			%			
Room Sensible Heat Sub Total				3814	2750	3962
Supply Duct Heat Gain	Supply Duct +Leak Loss	Fan +HP	= 10%	382	275	377
Bypass Outside Air	100 CMH × 14.7 deg × 0.1 BF × 0.29			43	53	48
Effective Room Sensible Heat ■				4239	3078	4187
ROOM LATENT HEAT						
Infiltration	CMH ×	g/kg ×	0.72			
People	4 People × 49			196		
Steam		kg/h ×	540			
Appliances etc.						
Vapor Trans.						
			Sub Total			
Safety Factor			%			
Room Latent Heat Sub Total				196	196	196
Supply Duct Leakage Loss			10 %	20	20	20
Bypass Outside Air	100 CMH × 9.4 g/kg × 0.1 BF × 0.72			68	70	69
Effective Room Latent Heat ■				284	285	283
Effective Room Total Heat ▣				4523	3363	4470
OUTSIDE AIR HEAT				(107)		
Sensible:	CMH ×	deg × (1 − BF) × 0.29				
Latent:	CMH ×	g/kg × (1 − BF) × 0.72				
Grand Total Heat Sub Total						
Return Duct Heat Gain + Return Duct Leak Gain + Pump H.P + Pipe Gain			= %			
(U.S.R.T) Grand Total Heat ▣						

Estimate For.	AM / PM	Peak Load	AM / PM 6
Hours of Operation	Hour (~)		

Outside Design Conditions	°DB	°WB	%RH	DP °C	g/kg
Conditions	DB °C	WB °C	%RH	DP °C	g/kg
Outside	38.7	27.6	43		18.8
Room	24.0	17.1	50		9.4
Difference	14.7	×××	×××	×××	9.4

Blind	Non-existence (outside, inside)	L. M. D
Glass	Ordinary. Thick. Absorbent.	%. Double
Color	Light. Medium. Dark.	
Weight	kg/m²(Floor)	kg/m²(Wall)
Internal Heat	W/m²	m²/People

INFILTRATION

Swinging			
Revolving Doors	People ×	CMH/Per.	
Open Doors	Doors ×	CMH/Door	
Exhaust Air			
Crack	m ×	CMH/m	
Infiltration	CMH ■		

VENTILATION

4 People ×	25	CMH/Per.	100
m² ×		CMH/m²	
Ventilation	CMH ■		100

SENSIBLE HEAT FACTOR

E.S.H.F = $\frac{4239\ (ERSH)}{4523\ (ERTH)}$ = 0.94 (12.5°C)

DEHUMIDIFIED AIR

Apparatus Dewpoint 12.5 °C

$\frac{4239\ (ERSH)}{(24\ RM - 12.5\ ADP)(1 - 0.1\ BF) \times 0.29}$ = 1420 CMH

NOTES
- GLASS (NW): 1.5 × 1.8 + 1.5 × 2.8 = 6.9
- WALL (NW): 6.5 × 4.0 − 6.9 = 19.1
- PARTITION: 2.5 × 3.8 = 9.5

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FORM E-20E

COOLING AND DEHUMIDIFYING ESTIMATE (METRIC)

Inquiring No. | Inquired By | Sheet No. 23
Job Name | Address | Date Original | Revision | Person in Charge
Space Used For: JUNIOR ENGINEER ROOM (S03C) PAC-1 SYSTEM
Size: 10.5 m × 6.5 m = 68.25 m² × 3.8, 2.5 m(H) = 225.55 m³

Item	Area or Quantity	Sun Gain or Temp. Diff.	Factor	Kcal/h	Correction		
SOLAR GAIN — GLASS				MAX 6:00	3:00	5:00
(NW) 6.9	m² × 366	× 0.64/0.85	× 0.94 × 0.65	1162	618	1180
	m² ×	×				
	m² ×	×				
	m² ×	×				
	m² ×	×				
SOLAR & TRANS GAIN—WALLS & ROOF						
Wall (NW) 19.1	m² × 23.2	×	2.1	931	258	783
	m² ×	×				
	m² ×	×				
	m² ×	×				
	m² ×	×				
Roof—Sun	m² ×	×				
Roof—Shaded	m² ×	×				
TRANS. GAIN—EXCEPT WALLS & ROOF						
Glass 6.9	m² × 14.7	×	5.1	518	641	581
Ceiling	m² ×	×				
Floor	m² ×	×				
Partition 10.0	m² × 7.35	×	1.8	133	164	149
Infiltration	CMH ×	deg ×	0.29			
INTERNAL HEAT						
People	6 People × 41			246	246	246
Kw	Kw ×	×	860			
Lights	68.25 × 20	W ×	1.08	1475	1475	1475
Appliances Etc.						
Credit for Thermal Storage	m² ×	deg ×		(-)	(-)	
			Sub Total			
Safety Factor			%			
Room Sensible Heat Sub Total				4465	3402	4414
Supply Duct Heat Gain	Supply Duct +Leak Loss	Fan −HP	=10%	447	341	442
Bypass Outside Air	150 CMH × 14.7 deg × 0.1 B.F × 0.29			64	80	72
Effective Room Sensible Heat ■				4976	3823	4928
ROOM LATENT HEAT						
Infiltration	CMH ×	g/kg ×	0.72			
People	6 People × 49			294		
Steam		kg/h ×	540			
Appliances Etc.						
Vapor Trans.						
			Sub Total			
Safety Factor			%			
Room Latent Heat Sub Total				294	294	294
Supply Duct Leakage Loss			10%	30	30	30
Bypass Outside Air 158 CMH × 9.4 g/kg × 0.1 BF × 0.72				102	104	103
Effective Room Latent Heat ■				426	428	427
Effective Room Total Heat ▣				5402	4251	5355
OUTSIDE AIR HEAT						
Sensible:	CMH ×	deg × (1 − BF) × 0.29				
Latent:	CMH ×	g/kg × (1 − BF) × 0.72				
Grand Total Heat Sub Total						
Return Duct Heat Gain	+ Return Duct Leak Gain	− Pump H.P	+ Pipe Gain = %			
(U.S.R.T) GRAND TOTAL HEAT ▣						

Estimate For	AM / PM	Peak Load	AM / PM
Hours of Operation		Hour (	–)

Outside Design Conditions	°CDB	°CWB	%RH

Conditions	DB °C	WB °C	%RH	DP °C	g/kg
Outside	38.7	27.6	43		18.8
Room	24.0	17.1	50		9.4
Difference	14.7	×××	×××	×××	9.4

Blind | (Non-Existence) (Outside, Inside) L. M. D
Glass | (Ordinary, Thick, Absorbent,) %, Double
Color | (Light, Medium, Dark)
Weight | kg/m²(Floor) | kg/m²(Wall)
Internal Heat | W/m² | m²/People

Infiltration
Swinging
Revolving Doors People × CMH/Per.
Open Doors Doors × CMH/Door
Exhaust Air
Crack m × CMH/m
Infiltration CMH ■

Ventilation
6 People × 25 CMH/Per. = 150
m² × CMH/m²
Ventilation CMH ■ 150

Sensible Heat Factor
E.S.H.F = 4.976 (ERSH) / 5402 (ERTH) = 0.92 (12.3°C)

Dehumidified Air
Apparatus Dewpoint 12.5 °C
4.977 (ERSH) / (24RM − 12.5ADP)(1 − BF) × 0.29 = 1,660 CMH

Notes
VR = 6.5 × 6.5 × 3.8 + 6.5 × 4.0 × 2.5
= 225.55
- GLASS (NW): 1.5 × 1.8 + 1.5 × 2.8 = 6.9
- WALL (NW): 6.5 × 4.0 − 6.9 = 19.1
- PARTITION: 4.0 × 2.5 = 10.0

FORM E-20

COOLING AND DEHUMIDIFYING ESTIMATE (METRIC)

INQUIRING NO. | INQUIRED BY | SHEET NO. 24
JOB NAME | ADDRESS | DATE ORIGINAL
SPACE USED FOR JUNIOR ENGINEER ROOM (503 b) PAC-1 SYSTEM | REVISION
SIZE m× m= 68.25 m² × 3.8, 2.5 m(H)= 225.55 m³ | PERSON IN CHARGE

ITEM	AREA OR QUANTITY	SUN GAIN OR TEMP. DIFF.	FACTOR	Kcal/h MAX 6:00	CORRECTION 3:00	CORRECTION 5:00
SOLAR GAIN — GLASS						
(NW) 6.9	m²× 366 × 0.64/0.85 ×		× 0.94 × 0.65	1162	618	1180
	m²×		×			
	m²×		×			
	m²×		×			
	m²×		×			
SOLAR & TRANS GAIN—WALLS & ROOF						
WALL (NW) 19.1	m²×	23.2	× 2.1	931	258	783
	m²×		×			
	m²×		×			
	m²×		×			
ROOF—SUN	m²×		×			
ROOF—SHADED	m²×		×			
TRANS. GAIN—EXCEPT WALLS & ROOF						
GLASS 6.9	m²×	14.7	× 5.1	518	641	246
CEILING	m²×		×			
FLOOR 16.0	m²×	7.35	× 1.7	200	248	225
PARTITION 10.0	m²×	7.35	× 1.8	133	164	149
INFILTRATION	CMH×	deg×	0.29			
INTERNAL HEAT						
PEOPLE	6 PEOPLE×	41		246	246	246
KW	KW×		× 860			
LIGHTS	68.25 × 20 W×		1.08	1475	1475	1475
APPLIANCES ETC.						
CREDIT FOR THERMAL STORAGE	m²×	deg×		(—)	(—)	
			SUB TOTAL			
SAFETY FACTOR			%			
ROOM SENSIBLE HEAT SUB TOTAL				4665	3650	4304
SUPPLY DUCT HEAT GAIN	SUPPLY DUCT +LEAK LOSS	FAN −HP	=10%	467	365	431
BYPASS OUTSIDE AIR	150 CMH× 14.7 deg× 0.1 BF×0.29			64	80	72
EFFECTIVE ROOM SENSIBLE HEAT ■				5196	4095	4807
ROOM LATENT HEAT						
INFILTRATION	CMH×	g/kg×	0.72			
PEOPLE	6 PEOPLE×	49		294		
STEAM	kg/h×		540			
APPLIANCES ETC.						
VAPOR TRANS.						
			SUB TOTAL			
SAFETY FACTOR			%			
ROOM LATENT HEAT SUB TOTAL				294	294	294
SUPPLY DUCT LEAKAGE LOSS			10 %	30	30	30
BYPASS OUTSIDE AIR	150 CMH× 9.4 g/kg× 0.1 BF×0.72			102	104	103
EFFECTIVE ROOM LATENT HEAT ■				426	428	427
EFFECTIVE ROOM TOTAL HEAT ▣				5622	4523	5234
OUTSIDE AIR HEAT						
SENSIBLE:	CMH×	deg×(1− BF)×0.29				
LATENT:	CMH×	g/kg×(1− BF)×0.72				
GRAND TOTAL HEAT SUB TOTAL						
RETURN DUCT HEAT GAIN	+ RETURN DUCT LEAK GAIN	− PUMP H.P	− PIPE GAIN = %			
(U.S.R.T) GRAND TOTAL HEAT ▣						

ESTIMATE FOR.	AM / PM	PEAK LOAD	AM / PM 6
HOURS OF OPERATION	HOUR (~)		

OUTSIDE DESIGN CONDITIONS	DB °C	WB °C	%RH	DP °C	g/kg
OUTSIDE	38.7	27.6	43		18.8
ROOM	24.0	17.1	50		9.4
DIFFERENCE	14.7	×××	×××	×××	9.4

BLIND	NON-EXISTENCE (OUTSIDE, INSIDE)	L. M. D
GLASS	ORDINARY. THICK. ABSORBENT.	%. DOUBLE
COLOR	LIGHT. MEDIUM. DARK.	
WEIGHT	kg/m²(FLOOR)	kg/m²(WALL)
INTERNAL HEAT	W/m²	m³/PEOPLE

INFILTRATION		
SWINGING		
REVOLVING DOORS	PEOPLE× CMH/PER.	
OPEN DOORS	DOORS× CMH/DOOR	
EXHAUST AIR		
CRACK	m× CMH/m	
INFILTRATION	CMH ■	
VENTILATION		
6 PEOPLE×	25 CMH/PER.	150
1 m²×	CMH/m²	
VENTILATION	CMH ■	150

SENSIBLE HEAT FACTOR

E.S.H.F = 5196 (ERSH) / 5622 (ERTH) = 0.92 (12.3°C)

DEHUMIDIFIED AIR

APPARATUS DEWPOINT 12.5 °C

5196 (ERSH) / (24RM − 12.5 ADP)(1 − 0 BF)×0.29 = 1740 CMH

NOTES

- VR = 6.5×6.5×3.8 + 6.5×4.0×2.5 = 225.55
- GLASS (NW): 1.5×1.8 + 1.5×2.8 = 6.9
- WALL (NW): 6.5×4.0 − 6.9 = 19.1
- PARTITION: 4.0×2.5 = 10.0
- FLOOR: 4.0×4.0 = 16.0

FORM E-20E

COOLING AND DEHUMIDIFYING ESTIMATE (METRIC)

Inquiring No. | Inquired By | Sheet No. 25
Job Name | Address | Date Original
Space Used For JUNIOR ENGINEER ROOM (503a) | PAC-1 SYSTEM | Revision
Size m× m= 62.25 m² ×3.8, 2.5 m(H)= 200.55 m³ | Person in Charge

Item	Area or Quantity	Sun Gain or Temp. Diff.	Factor	Kcal/h MAX 5:00	Correction 3:00	Correction 6:00
SOLAR GAIN — GLASS						
(NN) 6.9	m²×	366 × 0.65/0.85 × 0.94 × 0.65		1180	618	1162
(SW) 8.1	m²×	252 × 0.50/0.85 × 0.94 × 0.65		734	1028	382
	m²×	×				
	m²×	×				
	m²×	×				
SOLAR & TRANS GAIN—WALLS & ROOF						
Wall (NW) 19.1	m²×	19.5	× 2.1	783	258	931
(SW) 33.9	m²×	19.2	× 2.1	1367	1125	1389
	m²×	×				
	m²×	×				
Roof—Sun	m²×	×				
Roof—Shaded	m²×	×				
TRANS. GAIN—EXCEPT WALLS & ROOF						
Glass 15.0	m²×	16.5	× 5.1	1263	1393	1125
Ceiling	m²×	×				
Floor	m²×	×				
Partition 17.6	m²×	8.25	× 1.8	262	289	233
Infiltration	CMH×	deg×	0.29			
INTERNAL HEAT						
People	6 People×	41		246	246	246
Kw	Kw×	×	860			
Lights	62.25 × 20	W×	1.08	1345	1345	1345
Appliances etc.						
Credit for Thermal Storage	m²×	deg×		(—)	(—)	
			Sub Total			
Safety Factor			%			
Room Sensible Heat Sub Total				7180	6302	6813
Supply Duct Heat Gain	Supply Duct ÷Leak Loss	Fan −HP	=10%	718	631	682
Bypass outside air 150	CMH× 16.5 deg× 0.1 BF×0.29			72	80	64
Effective Room Sensible Heat ■				7970	7013	7559
ROOM LATENT HEAT						
Infiltration	CMH×	g/kg×	0.72			
People	6 People×	49		294		
Steam		kg/h×	540			
Appliances etc.						
Vapor Trans.						
			Sub Total			
Safety Factor			%			
Room Latent Heat Sub Total				294	294	294
Supply Duct Leakage Loss			10 %	30	30	30
Bypass Outside Air 150	CMH× 9.5 g/kg×0.1 BF×0.72			103	104	102
Effective Room Latent Heat ■				427	428	426
Effective Room Total Heat ■				8397	7441	7985
OUTSIDE AIR HEAT				(135)		
Sensible:	CMH×	deg×(1− BF)×0.29				
Latent:	CMH×	g/kg×(1− BF)×0.72				
Grand Total Heat Sub Total						
Return Duct Heat Gain ÷ Return Duct Leak Gain	Pump −H.P	Pipe Gain	= %			
(U.S.R.T) GRAND TOTAL HEAT ■						

Estimate For: AM / PM — Peak Load — AM / PM 5

Hours of Operation Hour (–)

Outside Design Conditions	DB °C	WB °C	%RH	DP °C	g/kg
Outside	40.5	28.2	39		18.9
Room	24.0	17.1	50		9.4
Difference	16.5	×××	×××	×××	9.5

Blind (Non-Existence (Outside. Inside) L. M. D
Glass Ordinary. Thick. Absorbent. %. Double
Color Light. Medium. Dark.
Weight kg/m²(Floor) kg/m²(Wall)
Internal Heat W/m² m²/People

INFILTRATION
Swinging
Revolving Doors People× CMH/Per.
Open Doors Doors× CMH/Door
Exhaust Air
Crack m× CMH/m
Infiltration CMH ■

VENTILATION
6 People× 25 CMH/Per. 150
m²× CMH/m²
Ventilation CMH ■ 150

SENSIBLE HEAT FACTOR
E.S.H.F = 7970 (ERSH) / 8397 (ERTH) = 0.95 (12.5°C)

DEHUMIDIFIED AIR
Apparatus Dewpoint 12.5 °C

7970 (ERSH) / (24RM − 12.5ADP)(1 − 0.1 BF)×0.29 = 2,660 CMH

NOTES

SR = 6.5 × 10.5 − 1.5 × 4 = 62.25

VR = 6.5 × 6.5 × 3.8 + 4.0 × 4.0 × 2.5 = 200.55

- GLASS
  (NW) = 1.5 × 1.8 + 1.5 × 2.8 = 6.9
  (SW) = 1.5 × 1.8 × 3 = 8.1
- WALL
  (NW): 6.5 × 4.0 − 6.9 = 19.1
  (SW): 10.5 × 4.0 − 8.1 = 33.9
- PARTITION: 4.0 × 2.5 + 2.0 × 3.8 = 17.6

FORM E-20E

COOLING AND DEHUMIDIFYING ESTIMATE (METRIC)

INQUIRING NO. | INQUIRED BY | SHEET NO. 26
JOB NAME | ADDRESS | DATE ORIGINAL | REVISION | PERSON IN CHARGE
SPACE USED FOR JUNIOR ENGINEER ROOM (Toilet) | PAC - 1 SYSTEM
SIZE 10.5 m × 6.5 m = 68.25 m² × 2.5, 3.8 m(H) = 225.55 m³

ITEM	AREA OR QUANTITY	SUN GAIN OR TEMP. DIFF.	FACTOR	Kcal/h MAX 6:00	CORRECTION 3:00	CORRECTION 5:00
SOLAR GAIN — GLASS						
(NE)	5.4 m²	366	0.11/0.85 × 0.94 × 0.65	157	228	185
(NW)	6.9 m²	366	0.14/0.85 × 0.94 × 0.65	1162	618	1180
	m² ×		×			
	m² ×		×			
	m² ×		×			
SOLAR & TRANS GAIN—WALLS & ROOF						
WALL (NE)	20.6 m² ×	13.5	× 2.1	584	515	563
(NW)	19.1 m² ×	23.2	× 2.1	931	258	783
	m² ×		×			
	m² ×		×			
ROOF—SUN	42.25 m² ×	28.5	× 1.7	2047	1724	1997
ROOF — ~~SHADED~~	26.0 m² ×	28.5	× 1.1	816	687	795
TRANS. GAIN—EXCEPT WALLS & ROOF						
GLASS	12.3 m² ×	14.7	× 5.1	923	1142	1036
CEILING	m² ×		×			
FLOOR	10.0 m² ×	7.35	× 1.7	125	155	141
PARTITION	10.0 m² ×	7.35	× 2.5	184	228	207
INFILTRATION	CMH ×	deg ×	0.29			
INTERNAL HEAT						
PEOPLE	6 PEOPLE × 41			246	246	246
KW	KW ×		× 860			
LIGHTS	68.25 × 20 W ×		1.08	1475	1475	1475
APPLIANCES ETC.						
CREDIT FOR THERMAL STORAGE	m² ×	deg ×		(—)		(—)
			SUB TOTAL			
SAFETY FACTOR			%			
ROOM SENSIBLE HEAT SUB TOTAL				8650	7275	8608
SUPPLY DUCT HEAT GAIN	SUPPLY DUCT +LEAK LOSS	FAN -HP	=10%	865	728	861
BYPASS OUTSIDE AIR	150 CMH × 14.7 deg × 0.1 BF × 0.29			64	80	72
EFFECTIVE ROOM SENSIBLE HEAT				9579	8083	9541
ROOM LATENT HEAT						
INFILTRATION	CMH ×	g/kg ×	0.72			
PEOPLE	6 PEOPLE × 49			294		
STEAM	kg/h ×		540			
APPLIANCES ETC.						
VAPOR TRANS.						
			SUB TOTAL			
SAFETY FACTOR			%			
ROOM LATENT HEAT SUB TOTAL				294	294	294
SUPPLY DUCT LEAKAGE LOSS			10 %	30	30	30
BYPASS OUTSIDE AIR	150 CMH × 9.4 g/kg × 0.1 BF × 0.72			102	104	103
EFFECTIVE ROOM LATENT HEAT				426	428	427
EFFECTIVE ROOM TOTAL HEAT				10005	8511	9968
OUTSIDE AIR HEAT				(147)		
SENSIBLE:	CMH ×	deg × (1 − BF) × 0.29				
LATENT:	CMH ×	g/kg × (1 − BF) × 0.72				
GRAND TOTAL HEAT SUB TOTAL						
RETURN DUCT HEAT GAIN + RETURN DUCT LEAK GAIN	PUMP H.P	PIPE GAIN	= %			
(U.S.R.T) GRAND TOTAL HEAT						

ESTIMATE FOR	AM / PM	PEAK LOAD	AM / PM 6
HOURS OF OPERATION	HOUR (	~)	
OUTSIDE DESIGN CONDITIONS	°CDB	°CWB	%RH
CONDITIONS	DB °C	WB °C	% RH	DP °C	g/kg
OUTSIDE	38.7	27.6	43		18.8
ROOM	24.0	17.1	50		9.4
DIFFERENCE	14.7	×××	×××	×××	9.4
BLIND	NON-EXISTENCE (OUTSIDE, INSIDE) L. M. D				
GLASS	ORDINARY, THICK, ABSORBENT, % DOUBLE				
COLOR	LIGHT, MEDIUM, DARK,				
WEIGHT	kg/m² (FLOOR)		kg/m² (WALL)		
INTERNAL HEAT	W/m²		m²/PEOPLE		

INFILTRATION

SWINGING		
REVOLVING DOORS	PEOPLE × CMH/PER.	
OPEN DOORS	DOORS × CMH/DOOR	
EXHAUST AIR		
CRACK	m × CMH/m	
INFILTRATION	CMH ■	

VENTILATION

6 PEOPLE ×	25 CMH/PER.	150
m² ×	CMH/m²	
VENTILATION	CMH ■	150

SENSIBLE HEAT FACTOR

E.S.H.F = 9579 (ERSH) / 10.005 (ERTH) = 0.96 (12.6°C)

DEHUMIDIFIED AIR

APPARATUS DEWPOINT 12.5 °C

9579 (ERSH) / (24-RM-12.5ADP)(1 − 0.1 BF) × 0.29 = 3,200 CMH

NOTES

GLASS (NE): 1.5 × 1.8 × 2 = 5.4
(NW): 1.5 × 1.8 + 1.5 × 2.8 = 6.9

WALL (NE): 6.5 × 4.0 − 5.4 = 20.6
(NW): 6.5 × 4.0 − 6.9 = 19.1

PARTITION: 4.0 × 2.5 = 10.0

FLOOR: 4.0 × 2.5 = 10.0

ROOF (1): 4.0 × 6.5 = 26.0
(2): 6.5 × 6.5 = 42.25

VR: 6.5 × 4.0 × 2.5 + 6.5 × 6.5 × 3.8 = 225.55

1223

FORM E-20