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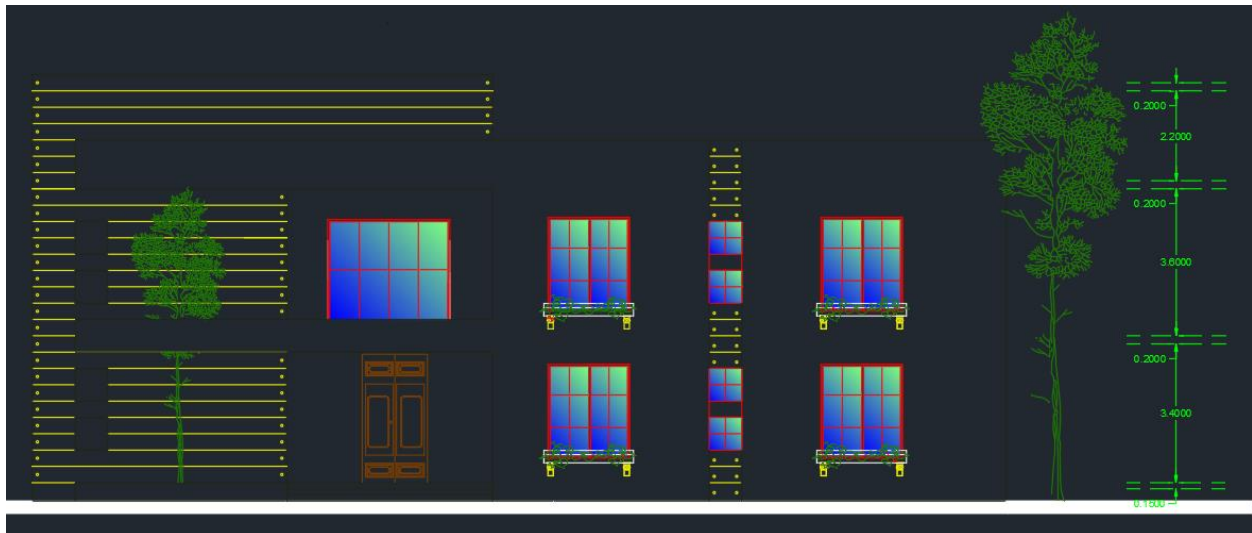
## I. Introduction:

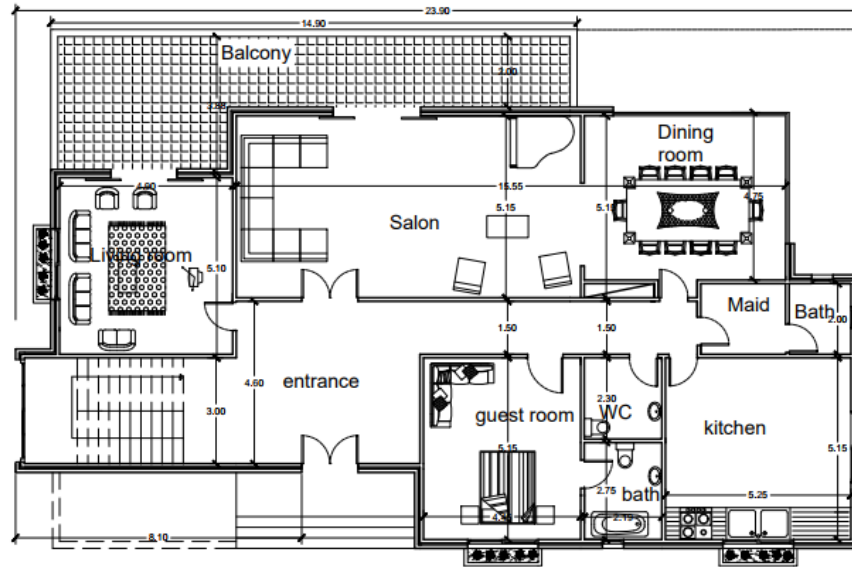
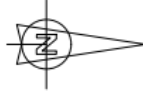
In this project we are responsible to determine the cooling load of a house, an appartement, a building...

For the case understudy, we should specify:

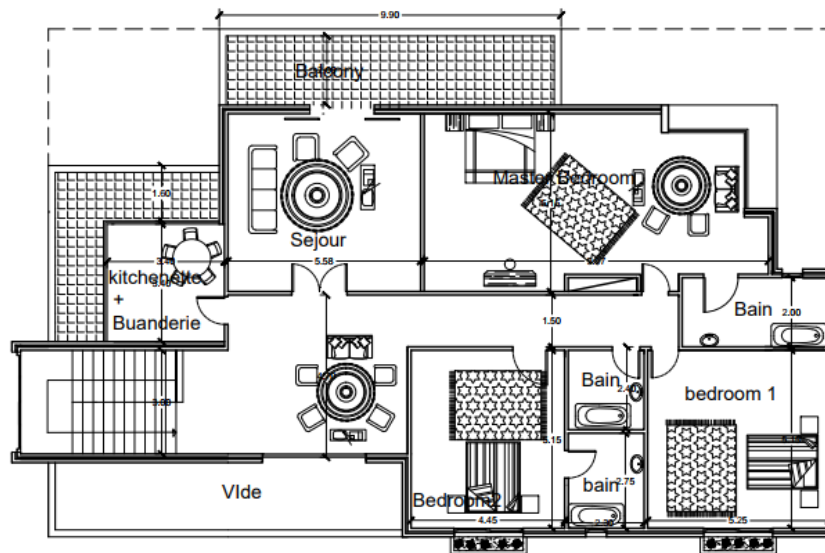
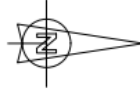
- Location, dimensions, wall construction, windows type (single, double glazing), doors...
- Type of lighting (fluorescent, vented, unvented...)
- Number of people and their activities
- Equipment (TV, computer, kitchen appliances...)
- The air change per hour (infiltration rate)

We choose a house that is formed by 2 floors.





R.D.C



1<sup>er</sup> etage

	F102	F103	F104	F105	F106	F107	F108	F109	F110	F111	F112	F113	F114	F115	F116	F117	F118	F119	F120	F121	F122	F123	F124	F125	F126	F127	F128	F129	F130	F131	F132	F133	F134	F135	F136	F137	F138	F139	F140	F141	F142	F143	F144	F145	F146	F147	F148	F149	F150	F151	F152	F153	F154	F155	F156	F157	F158	F159	F160	F161	F162	F163	F164	F165	F166	F167	F168	F169	F170	F171	F172	F173	F174	F175	F176	F177	F178	F179	F180	F181	F182	F183	F184	F185	F186	F187	F188	F189	F190	F191	F192	F193	F194	F195	F196	F197	F198	F199	F200	F201	F202	F203	F204	F205	F206	F207	F208	F209	F210	F211	F212	F213	F214	F215	F216	F217	F218	F219	F220	F221	F222	F223	F224	F225	F226	F227	F228	F229	F230	F231	F232	F233	F234	F235	F236	F237	F238	F239	F240	F241	F242	F243	F244	F245	F246	F247	F248	F249	F250	F251	F252	F253	F254	F255	F256	F257	F258	F259	F260	F261	F262	F263	F264	F265	F266	F267	F268	F269	F270	F271	F272	F273	F274	F275	F276	F277	F278	F279	F280	F281	F282	F283	F284	F285	F286	F287	F288	F289	F290	F291	F292	F293	F294	F295	F296	F297	F298	F299	F300	F301	F302	F303	F304	F305	F306	F307	F308	F309	F310	F311	F312	F313	F314	F315	F316	F317	F318	F319	F320	F321	F322	F323	F324	F325	F326	F327	F328	F329	F330	F331	F332	F333	F334	F335	F336	F337	F338	F339	F340	F341	F342	F343	F344	F345	F346	F347	F348	F349	F350	F351	F352	F353	F354	F355	F356	F357	F358	F359	F360	F361	F362	F363	F364	F365	F366	F367	F368	F369	F370	F371	F372	F373	F374	F375	F376	F377	F378	F379	F380	F381	F382	F383	F384	F385	F386	F387	F388	F389	F390	F391	F392	F393	F394	F395	F396	F397	F398	F399	F400	F401	F402	F403	F404	F405	F406	F407	F408	F409	F410	F411	F412	F413	F414	F415	F416	F417	F418	F419	F420	F421	F422	F423	F424	F425	F426	F427	F428	F429	F430	F431	F432	F433	F434	F435	F436	F437	F438	F439	F440	F441	F442	F443	F444	F445	F446	F447	F448	F449	F450	F451	F452	F453	F454	F455	F456	F457	F458	F459	F460	F461	F462	F463	F464	F465	F466	F467	F468	F469	F470	F471	F472	F473	F474	F475	F476	F477	F478	F479	F480	F481	F482	F483	F484	F485	F486	F487	F488	F489	F490	F491	F492	F493	F494	F495	F496	F497	F498	F499	F500	F501	F502	F503	F504	F505	F506	F507	F508	F509	F510	F511	F512	F513	F514	F515	F516	F517	F518	F519	F520	F521	F522	F523	F524	F525	F526	F527	F528	F529	F530	F531	F532	F533	F534	F535	F536	F537	F538	F539	F540	F541	F542	F543	F544	F545	F546	F547	F548	F549	F550	F551	F552	F553	F554	F555	F556	F557	F558	F559	F560	F561	F562	F563	F564	F565	F566	F567	F568	F569	F570	F571	F572	F573	F574	F575	F576	F577	F578	F579	F580	F581	F582	F583	F584	F585	F586	F587	F588	F589	F590	F591	F592	F593	F594	F595	F596	F597	F598	F599	F600	F601	F602	F603	F604	F605	F606	F607	F608	F609	F610	F611
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And for the Roof we have the roof number:16

Table 17 Roof Conduction Time Series (CTS)																				
Roof Number	Sloped Frame Roofs						Wood Deck		Metal Deck Roofs						Concrete Roofs					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
U-Factor, W/(m <sup>2</sup> ·K)	0.249	0.227	0.255	0.235	0.239	0.231	0.393	0.329	0.452	0.370	0.323	0.206	0.297	0.304	0.296	0.288	0.315	0.313	0.239	
Total R	4.0	4.4	3.9	4.2	4.2	4.3	2.5	3.0	2.2	2.7	3.1	4.9	3.4	3.3	3.4	3.5	3.2	3.2	4.2	
Mass, kg/m <sup>2</sup>	26.7	21.0	14.0	34.7	55.5	34.9	48.9	55.9	23.9	30.9	25.0	27.2	57.6	149.2	214.3	279.3	360.7	474.5	362.3	
Thermal Capacity, kJ/(m <sup>2</sup> ·K)	26.6	16.4	12.3	47.0	73.5	47.0	75.6	79.7	28.6	32.7	28.6	32.7	57.2	134.9	190.1	245.2	333.2	437.4	331.1	
Hour	Conduction Time Factors, %																			
0	6	10	27	1	1	1	0	1	18	4	8	1	0	1	2	2	2	3	1	
1	45	57	62	17	17	12	7	3	61	41	53	23	10	2	2	2	2	3	2	
2	33	27	10	31	34	25	18	8	18	35	30	38	22	8	3	3	5	3	6	
3	11	5	1	24	25	22	18	10	3	14	7	22	20	11	6	4	6	5	8	
4	3	1	0	14	13	15	15	10	0	4	2	10	14	11	7	5	7	6	8	
5	1	0	0	7	6	10	11	9	0	1	0	4	10	10	8	6	7	6	8	
6	1	0	0	4	3	6	8	8	0	1	0	2	7	9	8	6	6	6	7	
7	0	0	0	2	1	4	6	7	0	0	0	0	5	7	7	6	6	6	7	
8	0	0	0	0	0	2	5	6	0	0	0	0	4	6	7	6	6	6	6	
9	0	0	0	0	0	1	3	5	0	0	0	0	3	5	6	6	5	5	5	
10	0	0	0	0	0	1	3	5	0	0	0	0	2	5	5	6	5	5	5	
11	0	0	0	0	0	1	2	4	0	0	0	0	1	4	5	5	5	5	5	
12	0	0	0	0	0	0	1	4	0	0	0	0	1	3	5	5	4	5	4	
13	0	0	0	0	0	0	1	3	0	0	0	0	1	3	4	5	4	4	4	
14	0	0	0	0	0	0	1	3	0	0	0	0	0	3	4	4	4	4	3	
15	0	0	0	0	0	0	1	3	0	0	0	0	0	2	3	4	4	4	3	
16	0	0	0	0	0	0	0	2	0	0	0	0	0	2	3	4	3	4	3	
17	0	0	0	0	0	0	0	2	0	0	0	0	0	2	3	4	3	4	3	
18	0	0	0	0	0	0	0	2	0	0	0	0	0	1	3	3	3	3	2	
19	0	0	0	0	0	0	0	2	0	0	0	0	0	1	2	3	3	3	2	
20	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2	3	3	3	2	
21	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2	3	3	3	2	
22	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2	3	2	2	2	
23	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	2	2	2	
Layer ID from outdoors to indoors (see Table 19)	F01	F01	F01	F01	F01	F01	F01	F01	F01	F01	F01	F01	F01	F01	F01	F01	F01	F01	F01	
	F08	F08	F08	F12	F14	F15	F13	F13	F13	F13	F13	M17	F13	F13	F13	F13	F13	F13	F13	
	G03	G03	G03	G05	G05	G05	G03	G03	G03	G03	G03	F13	G03	G03	G03	G03	G03	G03	M14	
	F05	F05	F05	F05	F05	F05	J02	J02	J02	J02	J02	G03	I03	I03	I03	I03	I03	I03	F05	
	I05	I05	I05	I05	I05	I05	G06	G06	F08	F08	F08	I03	I03	M11	M12	M13	M14	M15	I05	
	G01	F05	F03	F05	F05	F05	F03	F05	F03	F05	F03	F08	F08	F03	F03	F03	F03	F03	F16	
F03	F16	—	G01	G01	G01	—	F16	—	F16	—	—	F03	—	—	—	—	—	—	F03	
—	F03	—	F03	F03	F03	—	F03	—	F03	—	—	—	—	—	—	—	—	—	—	
Roof Number Descriptions																				
1. Metal roof, batt insulation, gyp board										11. Membrane, sheathing, insulation board, metal deck										
2. Metal roof, batt insulation, suspended acoustical ceiling										12. Membrane, sheathing, plus insulation boards, metal deck										
3. Metal roof, batt insulation										13. 50 mm concrete roof ballast, membrane, sheathing, insulation board, metal deck										
4. Asphalt shingles, wood sheathing, batt insulation, gyp board										14. Membrane, sheathing, insulation board, 100 mm 1/W concrete										
5. Slate or tile, wood sheathing, batt insulation, gyp board										15. Membrane, sheathing, insulation board, 150 mm 1/W concrete										
6. Wood shingles, wood sheathing, batt insulation, gyp board										16. Membrane, sheathing, insulation board, 200 mm 1/W concrete										
7. Membrane, sheathing, insulation board, wood deck										17. Membrane, sheathing, insulation board, 150 mm 1/W concrete										
8. Membrane, sheathing, insulation board, wood deck, suspended acoustical ceiling										18. Membrane, sheathing, insulation board, 200 mm 1/W concrete										
9. Membrane, sheathing, insulation board, metal deck										19. Membrane, 150 mm 1/W concrete, batt insulation, suspended acoustical ceiling										
10. Membrane, sheathing, insulation board, metal deck, suspended acoustical ceiling																				

**Table 7-1 Solar Absorptances**

Surface	Absorptance
Brick, red (Purdue) <sup>a</sup>	0.63
Paint, cardinal red <sup>b</sup>	0.63
Paint, matte black <sup>b</sup>	0.94
Paint, sandstone <sup>b</sup>	0.50
Paint, white acrylic <sup>a</sup>	0.26
Sheet metal, galvanized, new <sup>a</sup>	0.65
Sheet metal, galvanized, weathered <sup>a</sup>	0.80
Shingles, aspen gray <sup>b</sup>	0.82
Shingles, autumn brown <sup>b</sup>	0.91
Shingles, onyx black <sup>b</sup>	0.97
Shingles, generic white <sup>b</sup>	0.75
Concrete <sup>a,c</sup>	0.60–0.83
Asphalt <sup>c</sup>	0.90–0.95
Grassland <sup>d</sup>	0.80–0.84
Deciduous forest <sup>d</sup>	0.80–0.85
Coniferous forest <sup>d</sup>	0.85–0.95
Snow, fresh fallen <sup>c</sup>	0.10–0.25
Snow, old <sup>c</sup>	0.30–0.55
Water, incidence angle 30°	0.98
Water, incidence angle 60°	0.94
Water, incidence angle 70°	0.87
Water, incidence angle 85°	0.42

We consider the solar absorptance is 0.75 (generic white).

### c. Windows:

We have 10 windows in the house (for the 2 floors)

So, we need to specify the dimension of windows, frame dimensions and it U-value ( $\text{W/m}^2 \cdot ^\circ\text{C}$ ), type of glazing and it U-value ( $\text{W/m}^2 \cdot ^\circ\text{C}$ ) and the Internal Attenuation Coefficient.

All these parameters can be determined from the tables:

**Table 7-3** Solar Heat Gain Coefficient (SHGC), Solar Transmittance ( $T$ ), Front Reflectance ( $R_f$ ), Back Reflectance ( $R_b$ ), and Layer Absorptances ( $A_{fi}$ ) for Glazing Window Systems

Glazing Systems				Center-of-Glazing Properties							Total Window SHGC at Normal Incidence			
				Incidence Angles							Aluminum		Other Frames	
				Normal 0.0	40.0	50.0	60.0	70.0	80.0	Diffuse	Operable	Fixed	Operable	Fixed
1a	1/8 (3.2)	Uncoated Single Glazing, CLR	SHGC	0.86	0.84	0.82	0.78	0.67	0.42	0.78	0.75	0.78	0.64	0.75
			T	0.83	0.82	0.80	0.75	0.64	0.39	0.75				
			$R_f$	0.08	0.08	0.10	0.14	0.25	0.51	0.14				
			$R_b$	0.08	0.08	0.10	0.14	0.25	0.51	0.14				
			$A_{fi}$	0.09	0.10	0.10	0.11	0.11	0.11	0.10				
5a	1/8 (3.2)	Uncoated Double Glazing, CLR CLR	SHGC	0.76	0.74	0.71	0.64	0.50	0.26	0.66	0.67	0.69	0.56	0.66
			T	0.70	0.68	0.65	0.58	0.44	0.21	0.60				
			$R_f$	0.13	0.14	0.16	0.23	0.36	0.61	0.21				
			$R_b$	0.13	0.14	0.16	0.23	0.36	0.61	0.21				
			$A_{fi}$	0.10	0.11	0.11	0.12	0.13	0.13	0.11				
5b	1/4 (6.4)	Uncoated Double Glazing, CLR CLR	SHGC	0.70	0.67	0.64	0.58	0.45	0.23	0.60	0.61	0.63	0.52	0.61
			T	0.61	0.58	0.55	0.48	0.36	0.17	0.51				
			$R_f$	0.11	0.12	0.15	0.20	0.33	0.57	0.18				
			$R_b$	0.11	0.12	0.15	0.20	0.33	0.57	0.18				
			$A_{fi}$	0.17	0.18	0.19	0.20	0.21	0.20	0.19				
21a	1/8 (3.2)	Low-e Double Glazing, e = 0.1 on surface 2, LE CLR	SHGC	0.65	0.64	0.62	0.56	0.43	0.23	0.57	0.48	0.50	0.41	0.47
			T	0.59	0.56	0.54	0.48	0.36	0.18	0.50				
			$R_f$	0.15	0.16	0.18	0.24	0.37	0.61	0.22				
			$R_b$	0.17	0.18	0.20	0.26	0.38	0.61	0.24				
			$A_{fi}$	0.20	0.21	0.21	0.21	0.20	0.16	0.20				
			$A_{fi}$	0.07	0.07	0.08	0.08	0.07	0.05	0.07				

### Representative Fenestration Frame U-Factors in $\text{W}/(\text{m}^2 \cdot \text{K})$

Product Type/Number of Glazing Layers							
Frame Material	Type of Spacer	Operable			Fixed		
		Single <sup>b</sup>	Double <sup>c</sup>	Triple <sup>d</sup>	Single <sup>b</sup>	Double <sup>c</sup>	Triple <sup>d</sup>
Aluminum without thermal break	All	13.51	12.89	12.49	10.90	10.22	9.88
Aluminum with thermal break <sup>a</sup>	Metal	6.81	5.22	4.71	7.49	6.42	6.30
	Insulated	n/a	5.00	4.37	n/a	5.91	5.79
Aluminum-clad wood/ reinforced vinyl	Metal	3.41	3.29	2.90	3.12	2.90	2.73
	Insulated	n/a	3.12	2.73	n/a	2.73	2.50
Wood /vinyl	Metal	3.12	2.90	2.73	3.12	2.73	2.38
	Insulated	n/a	2.78	2.27	n/a	2.38	1.99
Insulated fiberglass/ vinyl	Metal	2.10	1.87	1.82	2.10	1.87	1.82
	Insulated	n/a	1.82	1.48	n/a	1.82	1.48

**Table 5-5b** U-Factors for Various Fenestration Products, W/(m<sup>2</sup>-K) (Vertical Installation)<sup>a</sup>

	Frame: Glass Only		Operable (Including Sliding and Swinging Glass Doors)						Fixed
	Center of Glass	Edge of Glass	Aluminum without Thermal Break	Aluminum with Thermal Break	Reinforced Vinyl/ Aluminum- Clad Wood	Wood/ Vinyl	Insulated Fiberglass/ Vinyl	Insulated Fiberglass/ Vinyl	
<b>Single Glazing</b>									
3.2 mm glass	5.91	5.91	7.24	6.12	5.14	5.05	4.61	5.35	
6.4 mm acrylic/ polycarb	5.00	5.00	6.49	5.43	4.51	4.42	4.01	4.58	
3.2 mm acrylic/ polycarb	5.45	5.45	6.87	5.77	4.82	4.73	4.31	4.97	
<b>Double Glazing</b>									
6.4 mm air space	3.12	3.63	4.93	3.70	3.25	3.13	2.77	3.04	
12.7 mm air space	2.73	3.36	4.62	3.42	3.00	2.87	2.53	2.72	
6.4 mm argon space	2.90	3.48	4.75	3.54	3.11	2.98	2.63	2.85	
<b>Double Glazing, <math>\epsilon = 0.60</math> on surface 2 or 3</b>									
6.4 mm air space	2.95	3.52	4.80	3.58	3.14	3.02	2.67	2.90	
12.7 mm air space	2.50	3.20	4.45	3.26	2.85	2.73	2.39	2.54	
6.4 mm argon space	2.67	3.32	4.58	3.38	2.96	2.84	2.49	2.67	
<b>Double Glazing, <math>\epsilon = 0.10</math> on surface 2 or 3</b>									
6.4 mm air space	2.39	3.12	4.36	3.17	2.78	2.65	2.32	2.45	
12.7 mm air space	1.82	2.71	3.92	2.77	2.41	2.28	1.96	1.99	
6.4 mm argon space	1.99	2.83	4.05	2.89	2.52	2.39	2.07	2.13	

**Table 7-4** Interior Solar Attenuation Coefficients (IAC) for Single or Double Glazings Shaded by Interior Venetian Blinds or Roller Shades

Glazing System <sup>a</sup>	Nominal Thickness <sup>b</sup> Each Pane, in.	Glazing Solar Transmittance			IAC				
		Outer Pane	Single or Inner Pane	Glazing SHGC <sup>b</sup>	Venetian Blinds		Roller Shades		
					Medium	Light	Opaque Dark	Opaque White	Translucent Light
<b>Single Glazing Systems</b>									
Clear, residential	$\frac{1}{8}$ <sup>c</sup>		0.87 to 0.80	0.86	0.75 <sup>d</sup>	0.68 <sup>d</sup>	0.82	0.40	0.45
Clear, commercial	$\frac{1}{4}$ to $\frac{1}{2}$		0.80 to 0.71	0.82					
Clear, pattern	$\frac{1}{8}$ to $\frac{1}{2}$		0.87 to 0.79						
Tinted	$\frac{3}{16}$ , $\frac{7}{32}$		0.74, 0.71						
Above glazings, automated blinds <sup>e</sup>				0.86	0.64	0.59			
Above glazings, tightly closed vertical blinds				0.85	0.30	0.26			
Heat absorbing <sup>f</sup>	$\frac{1}{4}$		0.46	0.59	0.84	0.78	0.66	0.44	0.47
Reflective coated glass				0.26 to 0.52	0.83	0.75			
<b>Double Glazing Systems<sup>g</sup></b>									
Clear double, residential	$\frac{1}{8}$	0.87	0.87	0.76	0.71 <sup>d</sup>	0.66 <sup>d</sup>	0.81	0.40	0.46
Clear double, commercial	$\frac{1}{4}$	0.80	0.80	0.70					
Heat absorbing double <sup>f</sup>	$\frac{1}{4}$	0.46	0.80	0.47	0.72	0.66	0.74	0.41	0.55
Reflective double				0.17 to 0.35	0.90	0.86			
<b>Other Glazings (Approximate)</b>					0.83	0.77	0.74	0.45	0.52
<b>Range of Variation<sup>h</sup></b>					0.15	0.17	0.16	0.21	0.21

#### d. Internal gain:

- First, we need to specify the number of people then define the type of activity they do and the time they persist in the room.



- Specify the type of lighting, equipment and its radiative fraction.

**Table 11 Recommended Load Factors for Various Types of Offices**

Load Density of Office	Load Factor, W/m <sup>2</sup>	Description
Light	5.4	Assumes 15.5 m <sup>2</sup> /workstation (6.5 workstations per 100 m <sup>2</sup> ) with computer and monitor at each plus printer and fax. Computer, monitor, and fax diversity 0.67, printer diversity 0.33.
Medium	10.8	Assumes 11.6 m <sup>2</sup> /workstation (8.5 workstations per 100 m <sup>2</sup> ) with computer and monitor at each plus printer and fax. Computer, monitor, and fax diversity 0.75, printer diversity 0.50.
Medium/Heavy	16.1	Assumes 9.3 m <sup>2</sup> /workstation (11 workstations per 100 m <sup>2</sup> ) with computer and monitor at each plus printer and fax. Computer and monitor diversity 0.75, printer and fax diversity 0.50.
Heavy	21.5	Assumes 7.8 m <sup>2</sup> /workstation (13 workstations per 100 m <sup>2</sup> ) with computer and monitor at each plus printer and fax. Computer and monitor diversity 1.0, printer and fax diversity 0.50.

Source: Wilkins and McGaffin (1994).



**Table 12 Cooling Load Estimates for Various Office Load Densities**

	Num-ber	Each, W	Total, W	Diver-sity	Load, W
<b>Light Load Density<sup>a</sup></b>					
Computers	6	55	330	0.67	220
Monitors	6	55	330	0.67	220
Laser printer—small desk top	1	130	130	0.33	43
Fax machine	1	15	15	0.67	10
Total Area Load					494
Recommended equipment load factor = 5.4 W/m <sup>2</sup>					
<b>Medium Load Density<sup>a</sup></b>					
Computers	8	65	520	0.75	390
Monitors	8	70	560	0.75	420
Laser printer—desk	1	215	215	0.5	108
Fax machine	1	15	15	0.75	11
Total Area Load					929
Recommended equipment load factor = 10.8 W/m <sup>2</sup>					
<b>Medium/Heavy Load Density<sup>a</sup></b>					
Computers	10	65	650	1	650
Monitors	10	70	700	1	700
Laser printer—small office	1	320	320	0.5	160
Facsimile machine	1	30	30	0.5	15
Total Area Load					1525
Recommended equipment load factor = 16.1 W/m <sup>2</sup>					

### Recommended Radiative and Convective Fractions

Heat Gain Type	Recommended Radiative Fraction	Recommended Convective Fraction
Occupants	0.7	0.3
Lighting:		
Suspended fluorescent— unvented	0.67	0.33
Recessed fluorescent— vented to return air	0.59	0.41
Recessed fluorescent— vented to supply and return air	0.19	0.81
Incandescent	0.8	0.2
Equipment:		
General (applicable for equipment not internally cooled with fans)	0.7	0.3
Computers/electronic equipment with internal fans	0.2	0.8
Conduction heat gain through walls	0.63	0.37
Conduction heat gain through roofs	0.84	0.16
Transmitted solar radiation	1.0	0.0
Absorbed solar radiation	0.63	0.37
Infiltration	0.0	1.0



e. Infiltration:

From the design condition we can determine the outdoor humidity ratio, outdoor air specific volume, outdoor dew point temperature, indoor humidity ratio and indoor air latent heat.

For the calculation of infiltration rate, we use this formula:

$$\dot{Q} = (ACH).V/C_T$$

Where:  $V$ =gross space volume,  $m^3$

$$C_T = \text{constant} = 3600 \text{ (S.I)}$$

ACH=number of air change per hour

can be assumed between 0.5 to 2 depending on the quality of the construction (tight, good, leaky...)

f. Radiant time series:

For non-solar:

**Table 24 Representative Nonsolar RTS Values for Light to Heavy Construction**

Glass		Interior Zones																							
		Light						Medium						Heavy						Light		Medium		Heavy	
		With Carpet			No Carpet			With Carpet			No Carpet			With Carpet			No Carpet			With Carpet	No Carpet	With Carpet	No Carpet	With Carpet	No Carpet
		10%	50%	90%	10%	50%	90%	10%	50%	90%	10%	50%	90%	10%	50%	90%	10%	50%	90%						
Hour	Radiant Time Factor, %																								
0	47	50	53	41	43	46	46	49	52	31	33	35	34	38	42	22	25	28	46	40	46	31	33	21	
1	19	18	17	20	19	19	18	17	16	17	16	15	9	9	9	10	9	9	19	20	18	17	9	9	
2	11	10	9	12	11	11	10	9	8	11	10	10	6	6	5	6	6	6	11	12	10	11	6	6	
3	6	6	5	8	7	7	6	5	5	8	7	7	4	4	4	5	5	5	6	8	6	8	5	5	
4	4	4	3	5	5	5	4	3	3	6	5	5	4	4	4	5	5	4	4	5	3	6	4	5	
5	3	3	2	4	3	3	2	2	2	4	4	4	4	3	3	4	4	4	3	4	2	4	4	4	
6	2	2	2	3	3	2	2	2	2	4	3	3	3	3	3	4	4	4	2	3	2	4	3	4	
7	2	1	1	2	2	2	1	1	1	3	3	3	3	3	3	4	4	4	2	2	1	3	3	4	
8	1	1	1	1	1	1	1	1	1	3	2	2	3	3	3	4	3	3	1	1	1	3	3	4	
9	1	1	1	1	1	1	1	1	1	2	2	2	3	3	2	3	3	3	1	1	1	2	3	3	
10	1	1	1	1	1	1	1	1	1	2	2	2	3	2	2	3	3	3	1	1	1	2	3	3	
11	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	1	1	1	2	2	3	
12	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	3	3	3	1	1	1	1	2	3	
13	1	1	1	0	1	0	1	1	1	1	1	1	2	2	2	3	3	2	1	1	1	1	2	3	
14	0	0	1	0	1	0	1	1	1	1	1	1	2	2	2	3	2	2	1	0	1	1	2	3	
15	0	0	1	0	0	0	1	1	1	1	1	1	2	2	2	2	2	2	0	0	1	1	2	3	
16	0	0	0	0	0	0	1	1	1	1	1	1	2	2	2	2	2	2	0	0	1	1	2	3	
17	0	0	0	0	0	0	1	1	1	1	1	1	2	2	2	2	2	2	0	0	1	1	2	2	
18	0	0	0	0	0	0	1	1	1	1	1	1	2	2	1	2	2	2	0	0	1	1	2	2	
19	0	0	0	0	0	0	0	1	0	0	1	1	2	2	1	2	2	2	0	0	1	0	2	2	
20	0	0	0	0	0	0	0	0	0	0	1	1	2	1	1	2	2	2	0	0	0	0	2	2	
21	0	0	0	0	0	0	0	0	0	0	1	1	2	1	1	2	2	2	0	0	0	0	2	2	
22	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	2	2	2	0	0	0	0	1	2	
23	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	2	2	1	0	0	0	0	1	2	
	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	

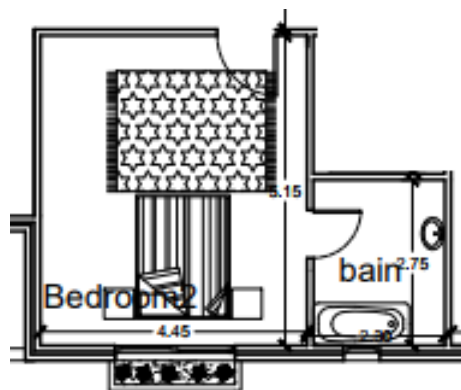
For solar:

**Table 25 Representative Solar RTS Values for Light to Heavy Construction**

% Glass	Light						Medium						Heavy					
	With Carpet			No Carpet			With Carpet			No Carpet			With Carpet			No Carpet		
	10%	50%	90%	10%	50%	90%	10%	50%	90%	10%	50%	90%	10%	50%	90%	10%	50%	90%
Hour	Radiant Time Factor, %																	
0	53	55	56	44	45	46	52	54	55	28	29	29	47	49	51	26	27	28
1	17	17	17	19	20	20	16	16	15	15	15	15	11	12	12	12	13	13
2	9	9	9	11	11	11	8	8	8	10	10	10	6	6	6	7	7	7
3	5	5	5	7	7	7	5	4	4	7	7	7	4	4	3	5	5	5
4	3	3	3	5	5	5	3	3	3	6	6	6	3	3	3	4	4	4
5	2	2	2	3	3	3	2	2	2	5	5	5	2	2	2	4	4	4
6	2	2	2	3	2	2	2	1	1	4	4	4	2	2	2	3	3	3
7	1	1	1	2	2	2	1	1	1	4	3	3	2	2	2	3	3	3
8	1	1	1	1	1	1	1	1	1	3	3	3	2	2	2	3	3	3
9	1	1	1	1	1	1	1	1	1	3	3	3	2	2	2	3	3	3
10	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3
11	1	1	1	1	1	1	1	1	1	2	2	2	2	2	1	3	3	2
12	1	1	1	1	1	0	1	1	1	2	2	2	2	1	1	2	2	2
13	1	1	0	1	0	0	1	1	1	2	2	2	2	1	1	2	2	2
14	1	0	0	0	0	0	1	1	1	1	1	1	2	1	1	2	2	2
15	1	0	0	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2
16	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2
17	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2
18	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2
19	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	2	2	2
20	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	2	2	2
21	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	2	2	2
22	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	2	1	1
23	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	2	1	1
	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

### III. Part B:

We will apply the RTSM for the cooling load calculations for a single room with outdoor walls. In this part all data is determined from the tables in the “Part A”.



We have the design conditions as we define in the “Part A”.

a. Input:

i. Intermediate variables:

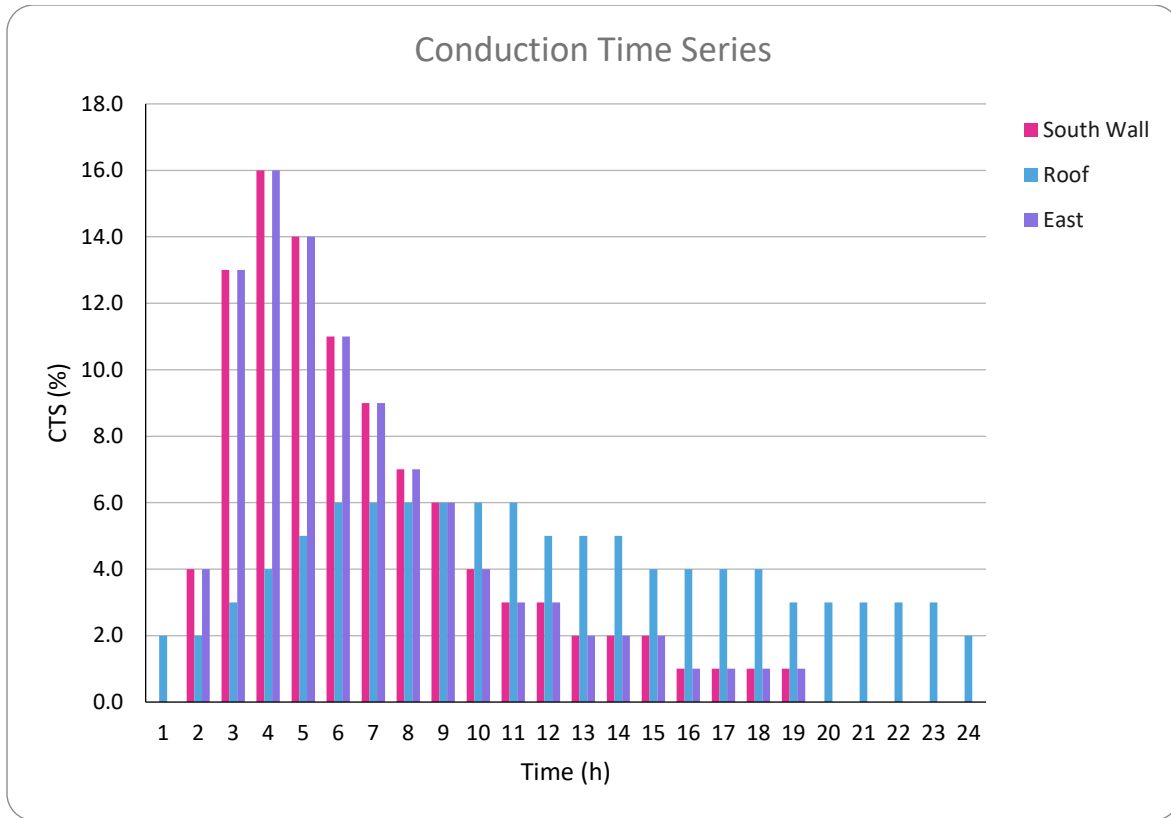
Day number	<b>233</b>	
EOT	<b>-2.7</b>	min
Std. Meridian	<b>30</b>	°
A	<b>1107</b>	
B	<b>0.182</b>	
C	<b>0.13</b>	
Decl.	<b>12.38</b>	°

ii. Surface data:

Surface Name	South	Roof	East
Surface Area	<b>7.74</b>	<b>29.2425</b>	24.3
Facing direction	<b>180</b>	<b>0</b>	90
Tilt angle	<b>90</b>	<b>0</b>	90
Solar absorptivity	<b>0.75</b>	<b>0.75</b>	0.75
U-value	<b>0.383</b>	<b>0.288</b>	0.383
Outside h (W/m2.C)	<b>22.7</b>	<b>22.7</b>	22.7

iii. Conduction Time Series:

Conduction Time Series			
Time (h)	South	Roof	East
1	0	2	0
2	4	2	4
3	13	3	13
4	16	4	16
5	14	5	14
6	11	6	11
7	9	6	9
8	7	6	7
9	6	6	6
10	4	6	4
11	3	6	3
12	3	5	3
13	2	5	2
14	2	5	2
15	2	4	2
16	1	4	1
17	1	4	1
18	1	4	1
19	1	3	1
20	0	3	0
21	0	3	0
22	0	3	0
23	0	3	0
24	0	2	0



#### iv. Windows:

Surface name	East	
Number of windows	1	
Width	2	m
Height	2.3	m
Set-back	0.0508	m
Overhang	0.203	m
Overhang distance over window	0	m
Frame width	0.0627	m
Glazing U-value	3.7	W/m2.C
Glazing T-SHGC (q=0°)	0.59	
Glazing T-SHGC (q=40°)	0.56	
Glazing T-SHGC (q=50°)	0.54	
Glazing T-SHGC (q=60°)	0.48	
Glazing T-SHGC (q=70°)	0.36	
Glazing T-SHGC (q=80°)	0.18	
Glazing T-SHGC (diffuse)	0.5	
Glazing A-SHGC (q=0°)	0.07	
Glazing A-SHGC (q=40°)	0.07	
Glazing A-SHGC (q=50°)	0.08	
Glazing A-SHGC (q=60°)	0.08	
Glazing A-SHGC (q=70°)	0.07	
Glazing A-SHGC (q=80°)	0.05	
Glazing A-SHGC (diffuse)	0.07	
Frame U-value	5.22	W/m2.C
Frame SHGC (q=0°)	0.472	
Internal Attenuation Coefficient	0.4	

## Transmission and Absorption of Fenestration Without Internal Shading, Simplified

$$SHGC_f = \alpha_f^s \left( \frac{U_f A_{frame}}{h_f A_{surf}} \right)$$

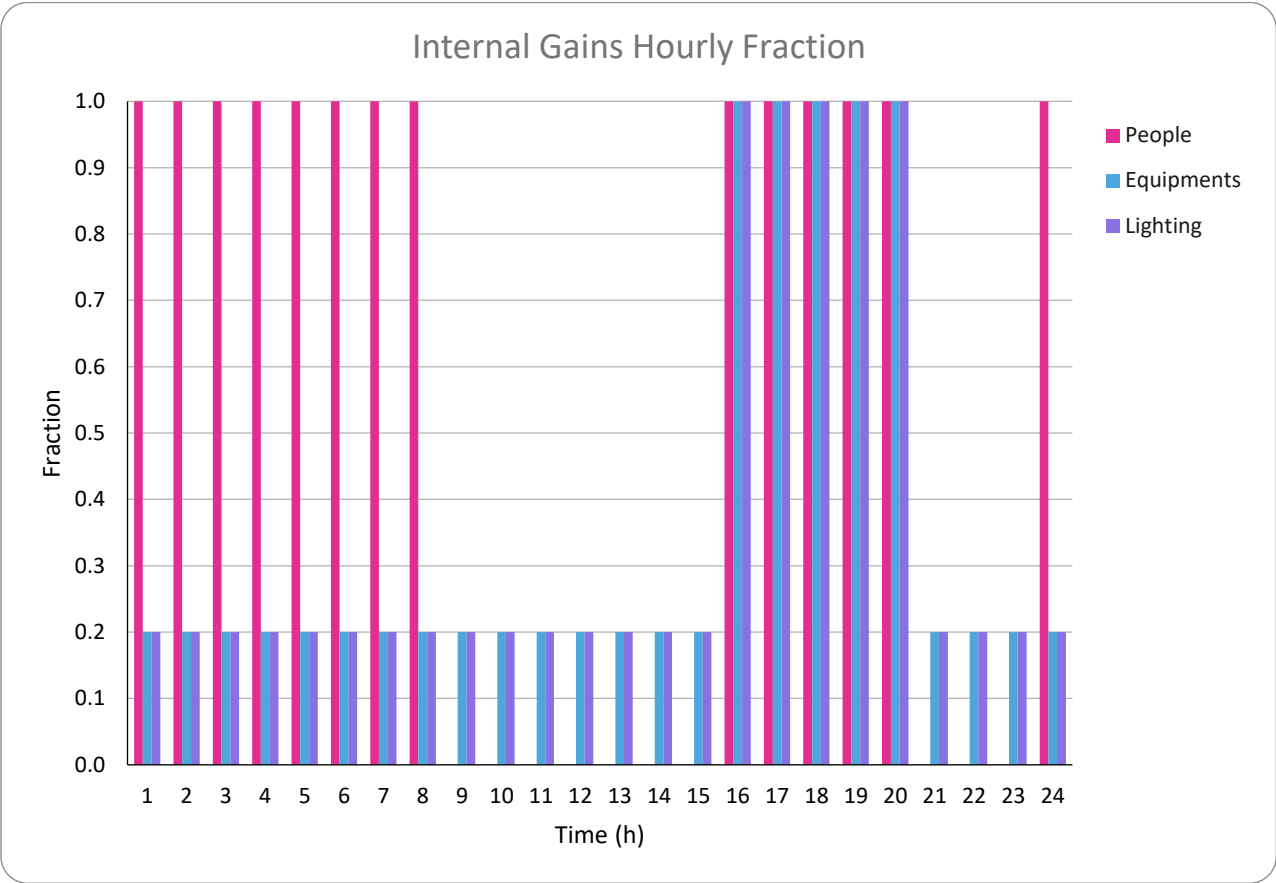
**Table 5-2a** Surface Unit Conductances and Unit Resistances for Air<sup>a</sup>

		Surface Emittances											
		$\epsilon = 0.9$				$\epsilon = 0.2$				$\epsilon = 0.05$			
		$h$		$R$		$h$		$R$		$h$		$R$	
		Btu hr-ft <sup>2</sup> -F	W m <sup>2</sup> -C	hr-ft <sup>2</sup> -F Btu W	m <sup>2</sup> -C	Btu hr-ft <sup>2</sup> -F	W m <sup>2</sup> -C	hr-ft <sup>2</sup> -F Btu W	m <sup>2</sup> -C	Btu hr-ft <sup>2</sup> -F	W m <sup>2</sup> -C	hr-ft <sup>2</sup> -F Btu W	m <sup>2</sup> -C
<b>Still Air</b>													
Horizontal	Upward	1.63	9.26	0.61	0.11	0.91	5.2	1.10	0.194	0.76	4.3	1.32	0.232
Sloping— 45 degrees	Upward	1.60	9.09	0.62	0.11	0.88	5.0	1.14	0.200	0.73	4.1	1.37	0.241
Vertical	Horizontal	1.46	8.29	0.68	0.12	0.74	4.2	1.35	0.238	0.59	3.4	1.70	0.298
Sloping— 45 degrees	Downward	1.32	7.50	0.76	0.13	0.60	3.4	1.67	0.294	0.45	2.6	2.22	0.391
Horizontal	Downward	1.08	6.13	0.92	0.16	0.37	2.1	2.70	0.476	0.22	1.3	4.55	0.800
<b>Moving Air</b>													
(any position)	Any	6.0	34.0	0.17	0.029								
Wind is 15 mph or 6.7 m/s (for winter)													
Wind is 7½ mph or 3.4 m/s (for summer)	Any	4.0	22.7	0.25	0.044								

### v. Internal gain:

<b>People</b>		
Number of people	<b>3</b>	
Sensible gain	<b>72</b>	W/person
Latent gain	<b>45</b>	W/person
Radiative fraction	<b>0.7</b>	
<b>Equipment</b>		
Maximum gain	<b>1.5</b>	W/m2
Radiative fraction	<b>0.2</b>	
<b>Lighting</b>		
Maximum gain	<b>15</b>	W/m2
Radiative fraction	<b>0.67</b>	

Hourly Fraction			
Time (h)	People	Equipments	Lighting
1	1	0.2	0.2
2	1	0.2	0.2
3	1	0.2	0.2
4	1	0.2	0.2
5	1	0.2	0.2
6	1	0.2	0.2
7	1	0.2	0.2
8	1	0.2	0.2
9	0	0.2	0.2
10	0	0.2	0.2
11	0	0.2	0.2
12	0	0.2	0.2
13	0	0.2	0.2
14	0	0.2	0.2
15	0	0.2	0.2
16	1	1	1
17	1	1	1
18	1	1	1
19	1	1	1
20	1	1	1
21	0	0.2	0.2
22	0	0.2	0.2
23	0	0.2	0.2
24	1	0.2	0.2



vi. Infiltration:

Infiltration rate	<b>30.1</b>	L/s
Outdoor Humidity Ratio	<b>0.0153</b>	kg/kgda
Outdoor Air Specific Volume	<b>0.884</b>	m <sup>3</sup> /kgda
Outdoor Dew Point Temperature	<b>20.63</b>	°C
Indoor Humidity Ratio	<b>0.0082</b>	kg/kgda
Indoor Air Latent Heat	<b>2449</b>	kJ/kg

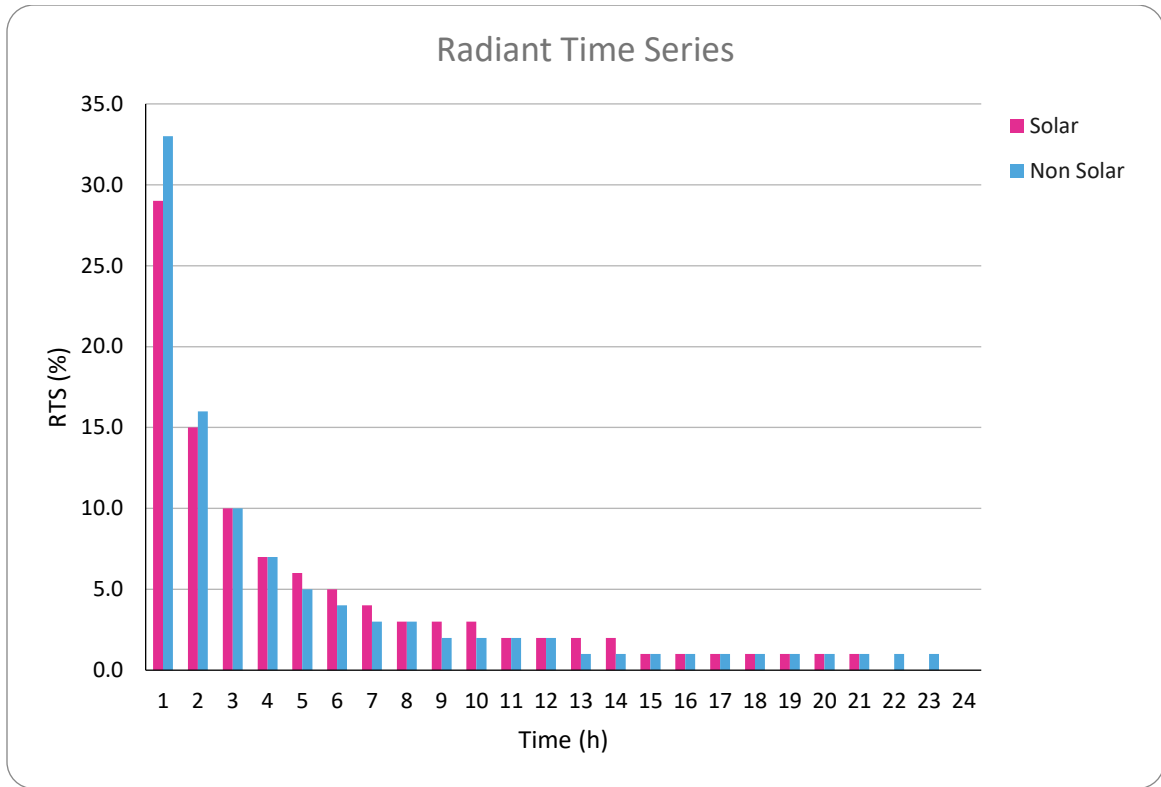
ACH=0.7 and V=154.56 m<sup>3</sup> so, Q=30.1 L/s

vii. Radiant time series:

Radiant Time Series		
Time (h)	Solar	Non Solar
1	29	33
2	15	16
3	10	10
4	7	7
5	6	5
6	5	4
7	4	3
8	3	3
9	3	2
10	3	2
11	2	2
12	2	2
13	2	1
14	2	1
15	1	1
16	1	1
17	1	1
18	1	1
19	1	1
20	1	1
21	1	1
22	0	1
23	0	1
24	0	0
	100	100

For medium, No Carpet (50%)

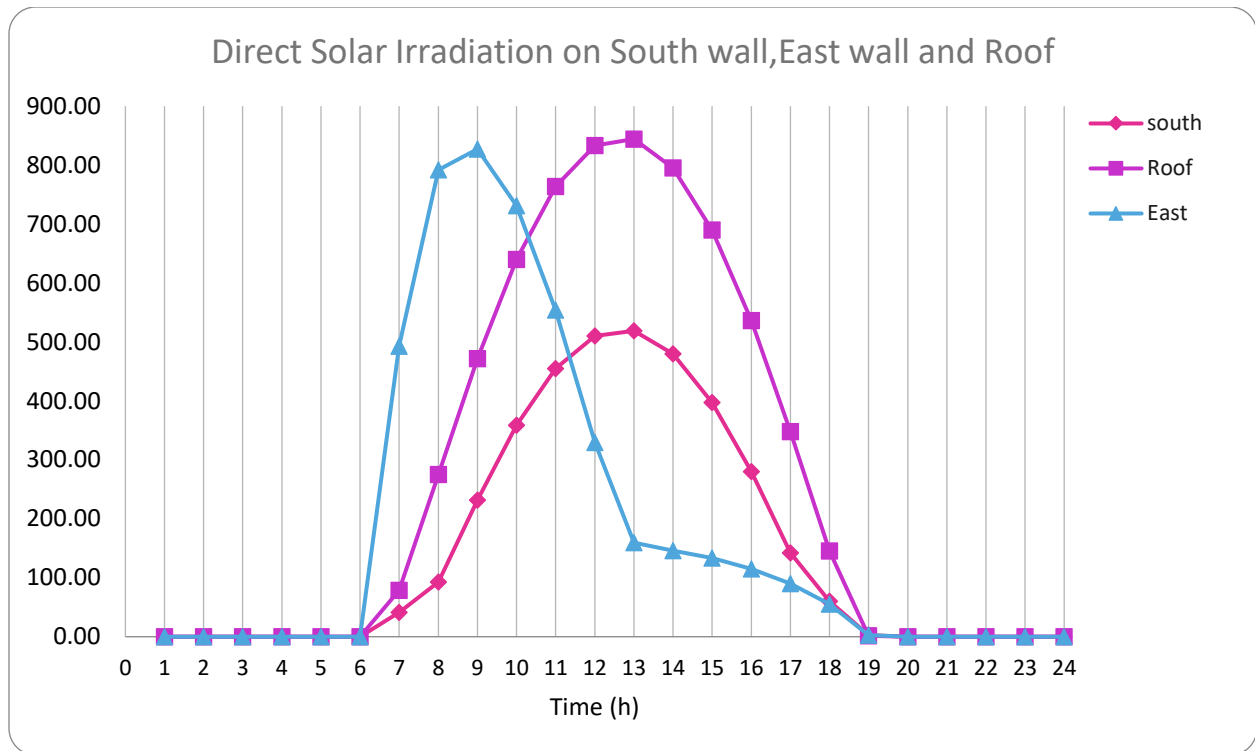




## b. Results:

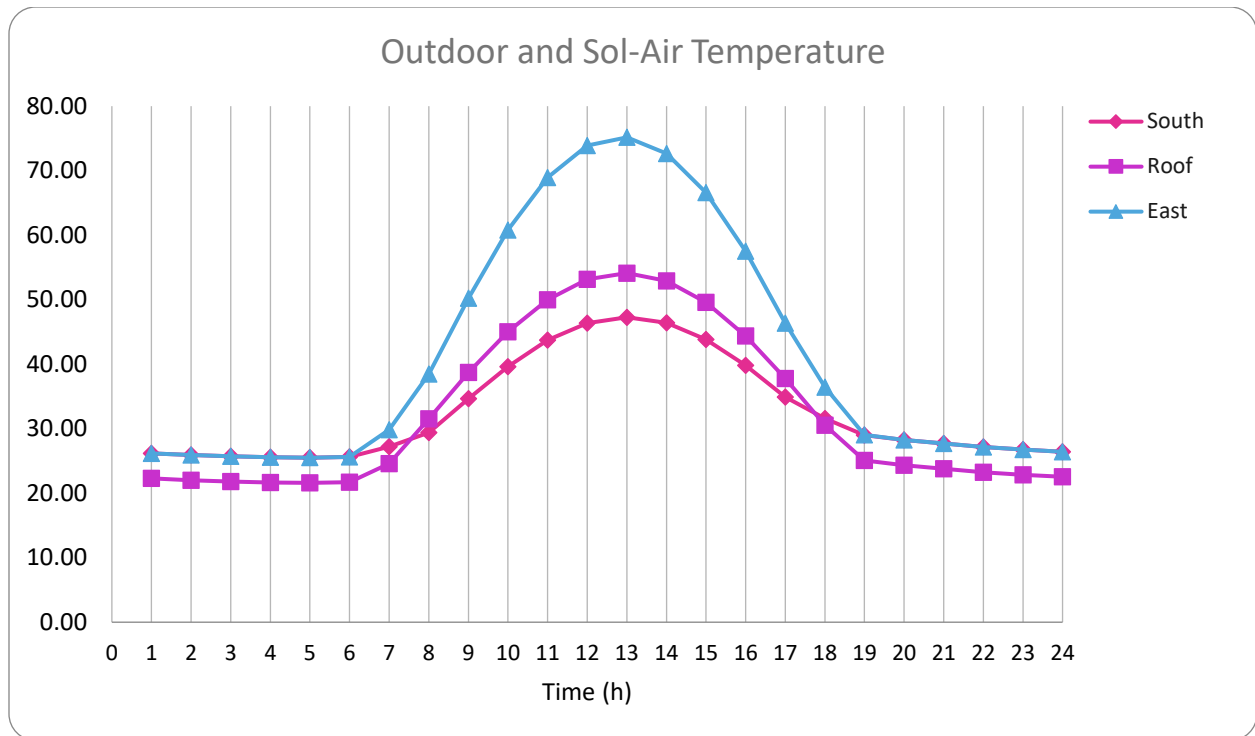
### i. Solar irradiation:

Time (h)	Solar Time	South			Roof	East		
		$G_D$	$G_d+G_R$	$G_t$	$G_t$	GD	Gd+GR	Gt
1	0.32	0.00	0.00	0.00	0.00	0	0	0
2	1.32	0.00	0.00	0.00	0.00	0	0	0
3	2.32	0.00	0.00	0.00	0.00	0	0	0
4	3.32	0.00	0.00	0.00	0.00	0	0	0
5	4.32	0.00	0.00	0.00	0.00	0	0	0
6	5.32	0.00	0.00	0.00	0.00	0	0	0
7	6.32	0.00	41.40	41.40	78.50	0	84.8757309	492.7039
8	7.32	4.26	88.54	92.79	275.12	0	150.544693	791.7336
9	8.32	107.08	124.59	231.67	471.83	0	177.617036	827.1881
10	9.32	205.24	153.41	358.65	639.70	0	185.713095	731.2214
11	10.32	280.69	174.39	455.08	763.51	0	182.517679	554.3932
12	11.32	324.08	186.25	510.33	833.46	0	172.752405	329.6779
13	12.32	330.83	188.10	518.93	844.29	0	159.571124	159.5711
14	13.32	300.28	179.76	480.04	795.19	0	145.905233	145.9052
15	14.32	235.55	161.91	397.46	689.83	0	133.697689	133.6977
16	15.32	144.08	135.77	279.84	536.35	0	115.109237	115.1092
17	16.32	39.88	102.38	142.26	347.76	0	89.9253619	89.92536
18	17.32	0.00	60.32	60.32	145.66	0	55.397486	55.39749
19	18.32	0.00	2.52	2.52	1.64	0	2.51610639	2.516106
20	19.32	0.00	0.00	0.00	0.00	0	0	0
21	20.32	0.00	0.00	0.00	0.00	0	0	0
22	21.32	0.00	0.00	0.00	0.00	0	0	0
23	22.32	0.00	0.00	0.00	0.00	0	0	0
24	23.32	0.00	0.00	0.00	0.00	0	0	0



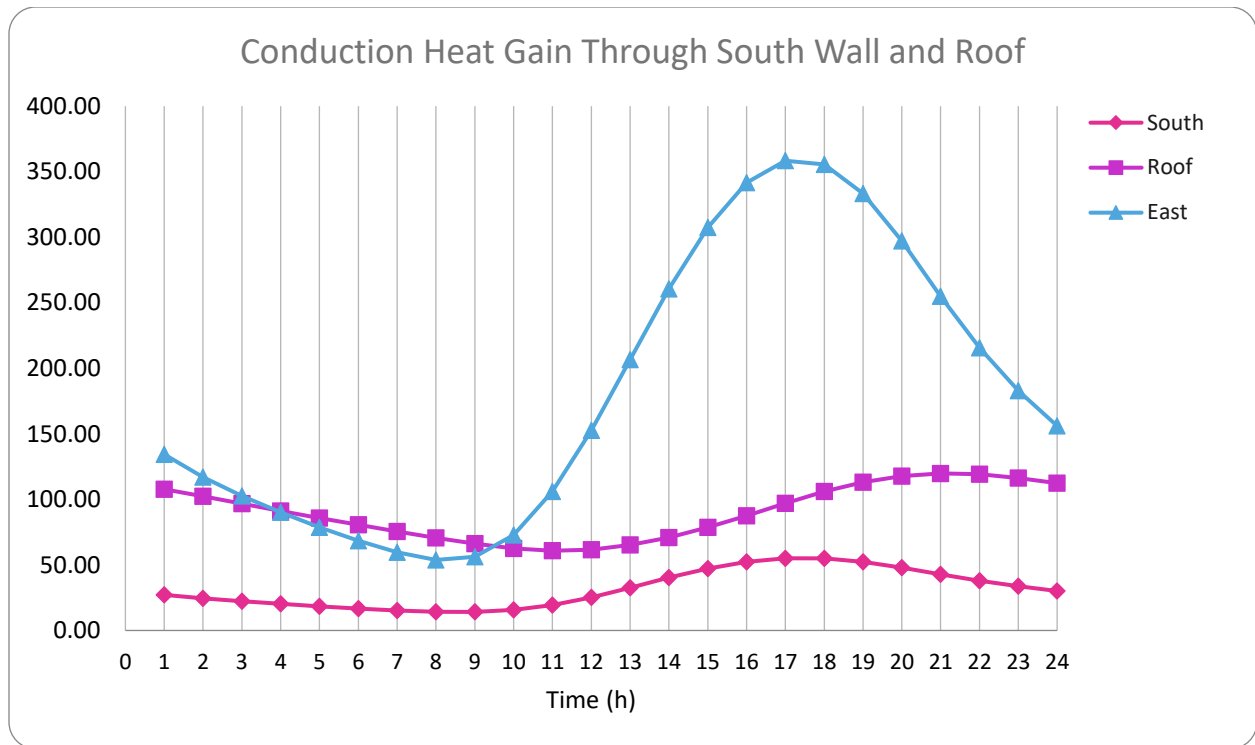
ii. Air and sol-air temperature:

Time (h)	Air Temp	Sol-Air Temperature		
		South	Roof	East
1	26.18	26.18	22.28	26.176
2	25.92	25.92	22.02	25.916
3	25.71	25.71	21.81	25.708
4	25.55	25.55	21.65	25.552
5	25.50	25.50	21.60	25.5
6	25.60	25.60	21.70	25.604
7	25.86	27.23	24.56	29.825394
8	26.33	29.40	31.52	38.487697
9	27.01	34.66	38.70	50.251468
10	27.79	39.64	45.02	60.773128
11	28.67	43.71	50.00	68.933653
12	29.50	46.37	53.14	73.902452
13	30.13	47.27	54.12	75.168228
14	30.54	46.40	52.92	72.677107
15	30.70	43.83	49.59	66.62366
16	30.54	39.79	44.36	57.5108
17	30.18	34.88	37.77	46.370074
18	29.61	31.60	30.52	36.413651
19	28.93	29.02	25.09	29.069252
20	28.26	28.26	24.36	28.256
21	27.68	27.68	23.78	27.684
22	27.16	27.16	23.26	27.164
23	26.75	26.75	22.85	26.748
24	26.44	26.44	22.54	26.436



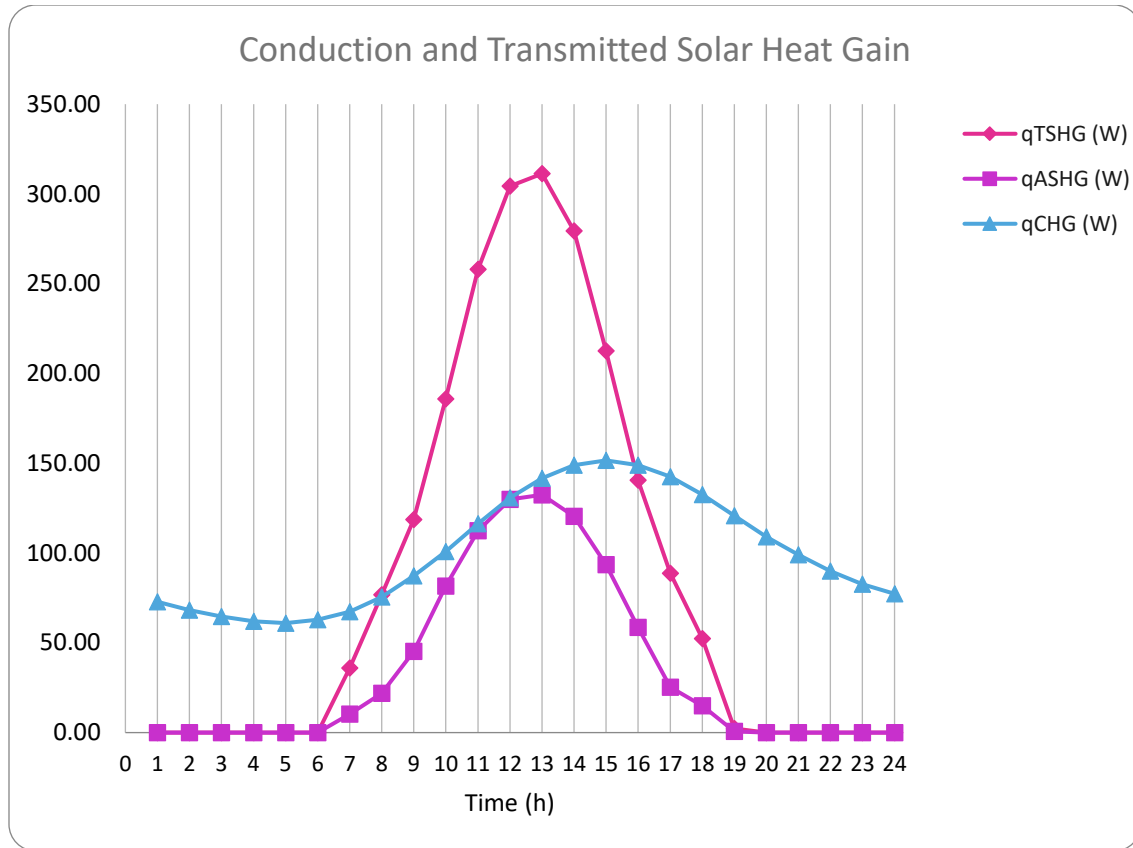
iii. Conduction heat gain:

Time (h)	South	Roof	East
1	27.08	107.81	134.4395775
2	24.49	102.45	117.0115459
3	22.26	96.73	102.5307134
4	20.25	91.04	90.06443256
5	18.41	85.72	78.7806018
6	16.70	80.71	68.50625294
7	15.23	75.60	59.65925304
8	14.22	70.62	53.7898822
9	14.13	66.12	56.1832984
10	15.61	62.57	72.85031951
11	19.37	60.82	105.9848591
12	25.33	61.63	152.6509136
13	32.66	65.20	206.5789639
14	40.28	70.97	260.5384946
15	47.14	78.57	307.4761159
16	52.28	87.46	341.5657776
17	55.05	96.96	358.3738368
18	54.99	105.99	355.450875
19	52.28	113.14	333.4449795
20	47.90	117.86	297.131341
21	42.84	119.80	254.9092756
22	38.01	119.11	215.7103601
23	33.80	116.39	182.8867243
24	30.17	112.46	156.0962215



iv. Windows solar heat gain:

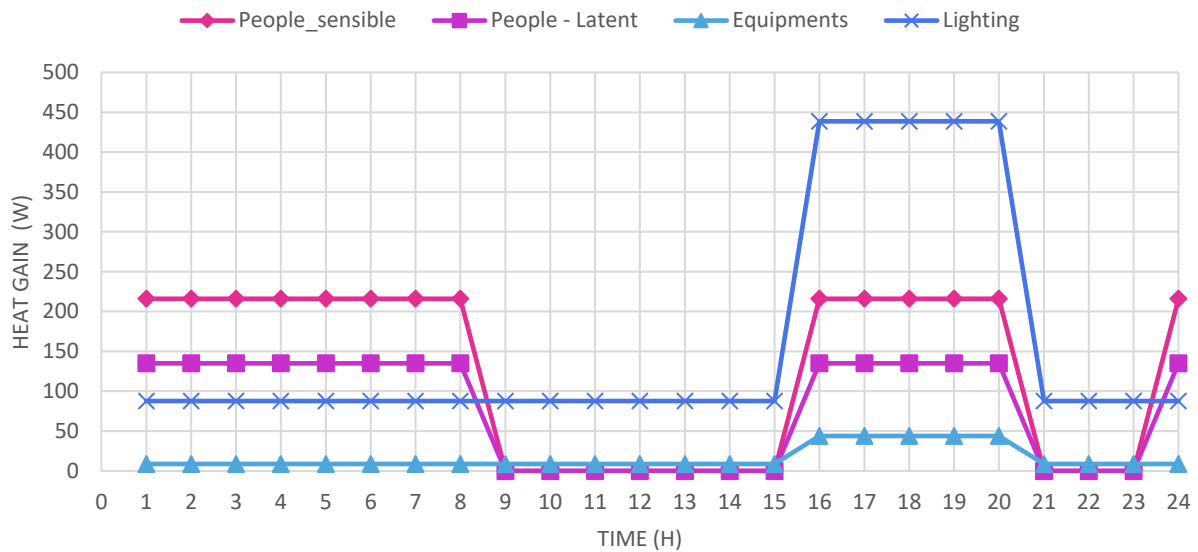
		South		A <sub>G</sub> (m <sup>2</sup> )	4.33	A <sub>F</sub> (m <sup>2</sup> )	0.27		
Time (h)	Solar Time	q (deg)	A <sub>SL,G</sub> (m <sup>2</sup> )	A <sub>SL,F</sub> (m <sup>2</sup> )	T-SHGC <sub>Dq</sub>	A-SHGC <sub>Dq</sub>	q <sub>TSHG</sub> (W)	q <sub>ASHG</sub> (W)	q <sub>CHG</sub> (W)
1	0.32	136.04	0.000	0.000	0.000	0.000	0.00	0.00	72.76
2	1.32	133.60	0.000	0.000	0.000	0.000	0.00	0.00	68.23
3	2.32	128.64	0.000	0.000	0.000	0.000	0.00	0.00	64.61
4	3.32	121.94	0.000	0.000	0.000	0.000	0.00	0.00	61.89
5	4.32	114.18	0.000	0.000	0.000	0.000	0.00	0.00	60.98
6	5.32	105.92	0.000	0.000	0.000	0.000	0.00	0.00	62.80
7	6.32	97.62	0.000	0.000	0.000	0.000	35.89	10.22	67.33
8	7.32	89.65	0.000	0.000	0.006	0.002	76.75	21.85	75.48
9	8.32	82.40	1.823	0.227	0.137	0.038	118.68	45.17	87.26
10	9.32	76.28	2.607	0.324	0.247	0.057	185.83	81.56	100.85
11	10.32	71.71	2.893	0.360	0.329	0.067	258.09	112.33	116.25
12	11.32	69.09	2.970	0.370	0.371	0.071	304.30	129.79	130.75
13	12.32	68.68	2.980	0.371	0.376	0.071	311.27	132.43	141.62
14	13.32	70.53	2.934	0.365	0.351	0.069	279.36	120.39	148.87
15	14.32	74.44	2.737	0.340	0.280	0.061	212.57	93.56	151.59
16	15.32	80.05	2.220	0.276	0.179	0.050	140.60	58.65	148.87
17	16.32	86.94	0.026	0.003	0.055	0.015	88.77	25.33	142.53
18	17.32	94.70	0.000	0.000	0.000	0.000	52.29	14.88	132.56
19	18.32	102.92	0.000	0.000	0.000	0.000	2.18	0.62	120.78
20	19.32	111.24	0.000	0.000	0.000	0.000	0.00	0.00	109.00
21	20.32	119.24	0.000	0.000	0.000	0.000	0.00	0.00	99.04
22	21.32	126.40	0.000	0.000	0.000	0.000	0.00	0.00	89.98
23	22.32	132.07	0.000	0.000	0.000	0.000	0.00	0.00	82.73
24	23.32	135.49	0.000	0.000	0.000	0.000	0.00	0.00	77.29



v. Internal heat gain:

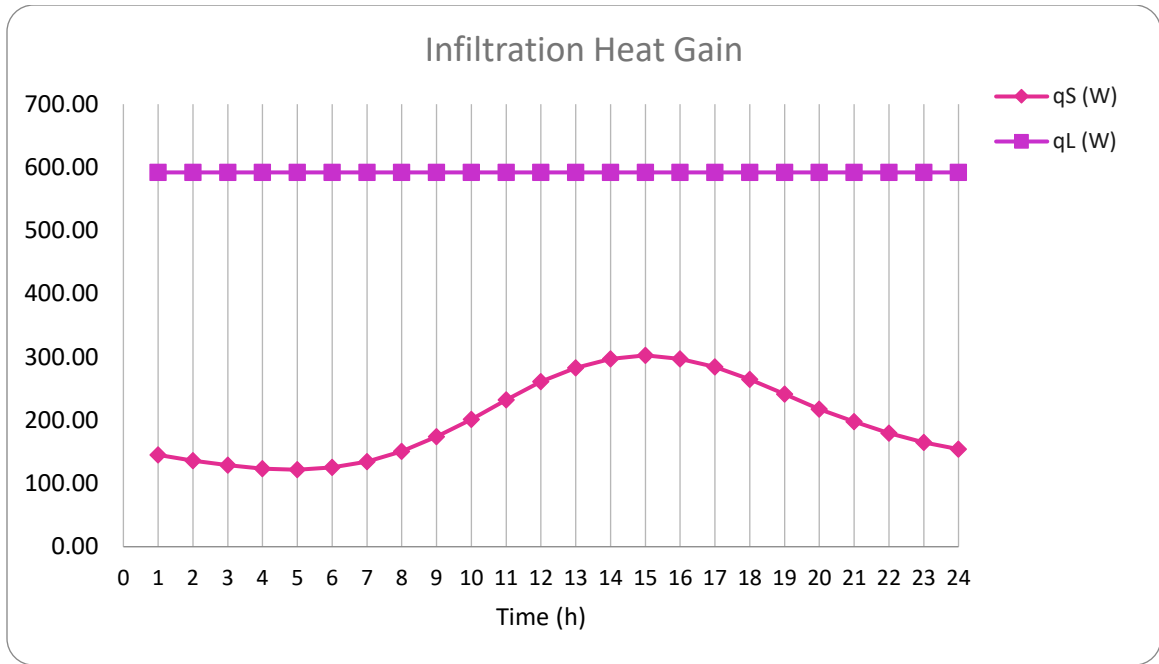
Time (h)	People		Equipment	Lighting
	q <sub>s</sub> (W)	q <sub>L</sub> (W)		
1	216	135	8.77275	87.7275
2	216	135	8.77275	87.7275
3	216	135	8.77275	87.7275
4	216	135	8.77275	87.7275
5	216	135	8.77275	87.7275
6	216	135	8.77275	87.7275
7	216	135	8.77275	87.7275
8	216	135	8.77275	87.7275
9	0	0	8.77275	87.7275
10	0	0	8.77275	87.7275
11	0	0	8.77275	87.7275
12	0	0	8.77275	87.7275
13	0	0	8.77275	87.7275
14	0	0	8.77275	87.7275
15	0	0	8.77275	87.7275
16	216	135	43.86375	438.6375
17	216	135	43.86375	438.6375
18	216	135	43.86375	438.6375
19	216	135	43.86375	438.6375
20	216	135	43.86375	438.6375
21	0	0	8.77275	87.7275
22	0	0	8.77275	87.7275
23	0	0	8.77275	87.7275
24	216	135	8.77275	87.7275

## INTERNAL HEAT GAINS



vi. Infiltration heat gain:

Time (h)	Air Temp	q <sub>s</sub> (W)	q <sub>L</sub> (W)
1	26.18	145.30	592.0540611
2	25.92	136.25	592.0540611
3	25.71	129.02	592.0540611
4	25.55	123.59	592.0540611
5	25.50	121.78	592.0540611
6	25.60	125.40	592.0540611
7	25.86	134.44	592.0540611
8	26.33	150.73	592.0540611
9	27.01	174.25	592.0540611
10	27.79	201.39	592.0540611
11	28.67	232.15	592.0540611
12	29.50	261.09	592.0540611
13	30.13	282.81	592.0540611
14	30.54	297.28	592.0540611
15	30.70	302.71	592.0540611
16	30.54	297.28	592.0540611
17	30.18	284.61	592.0540611
18	29.61	264.71	592.0540611
19	28.93	241.19	592.0540611
20	28.26	217.67	592.0540611
21	27.68	197.77	592.0540611
22	27.16	179.68	592.0540611
23	26.75	165.20	592.0540611
24	26.44	154.35	592.0540611



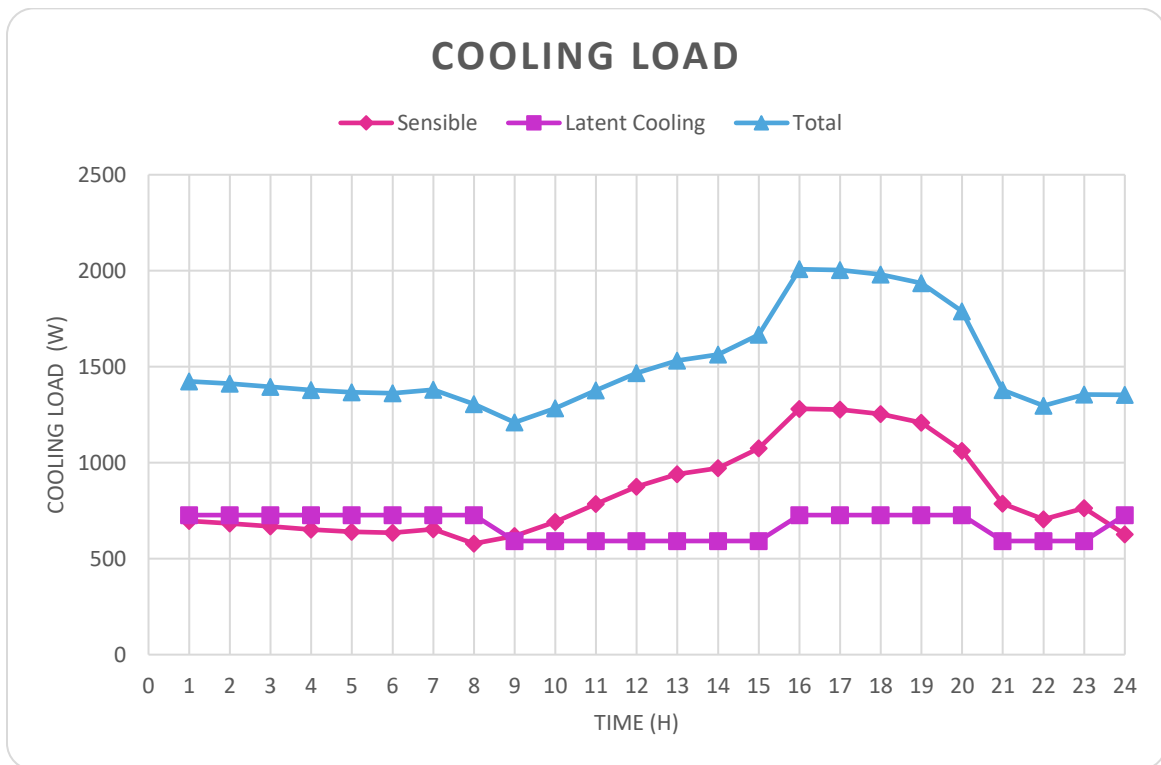
vii. Cooling Load components (W):

Time (h)	Sensible Cooling																Latent Cooling	
	South wall		Roof		Window Conduction		Solar - Absorbed		Solar Transmitted	People		Equipments		Lighting		Infiltration	People	Infiltration
	Convective	Radiative	Convective	Radiative	Convective	Radiative	Convective	Radiative		Convective	Radiative	Convective	Radiative	Convective	Radiative	Convective		
1	10.02	17.06	17.25	90.56	26.92	45.84	0.00	0.00	0.00	64.80	151.20	7.02	1.75	28.95	58.78	145.30	135.00	592.05
2	9.06	15.43	16.39	86.06	25.25	42.99	0.00	0.00	0.00	64.80	151.20	7.02	1.75	28.95	58.78	136.25	135.00	592.05
3	8.24	14.03	15.48	81.26	23.90	40.70	0.00	0.00	0.00	64.80	151.20	7.02	1.75	28.95	58.78	129.02	135.00	592.05
4	7.49	12.76	14.57	76.47	22.90	38.99	0.00	0.00	0.00	64.80	151.20	7.02	1.75	28.95	58.78	123.59	135.00	592.05
5	6.81	11.60	13.71	72.00	22.56	38.42	0.00	0.00	0.00	64.80	151.20	7.02	1.75	28.95	58.78	121.78	135.00	592.05
6	6.18	10.52	12.91	67.80	23.23	39.56	0.00	0.00	0.00	64.80	151.20	7.02	1.75	28.95	58.78	125.40	135.00	592.05
7	5.63	9.59	12.10	63.51	24.91	42.42	3.78	6.44	35.89	64.80	151.20	7.02	1.75	28.95	58.78	134.44	135.00	592.05
8	5.26	8.96	11.30	59.32	27.93	47.55	8.08	13.76	76.75	0.00	0.00	7.02	1.75	28.95	58.78	150.73	135.00	592.05
9	5.23	8.90	10.58	55.54	32.29	54.97	16.71	28.46	118.68	0.00	0.00	7.02	1.75	28.95	58.78	174.25	0.00	592.05
10	5.78	9.84	10.01	52.56	37.31	63.53	30.18	51.38	185.83	0.00	0.00	7.02	1.75	28.95	58.78	201.39	0.00	592.05
11	7.17	12.20	9.73	51.09	43.01	73.24	41.56	70.77	258.09	0.00	0.00	7.02	1.75	28.95	58.78	232.15	0.00	592.05
12	9.37	15.96	9.86	51.77	48.38	82.37	48.02	81.77	304.30	0.00	0.00	7.02	1.75	28.95	58.78	261.09	0.00	592.05
13	12.08	20.58	10.43	54.77	52.40	89.22	49.00	83.43	311.27	0.00	0.00	7.02	1.75	28.95	58.78	282.81	0.00	592.05
14	14.90	25.38	11.36	59.62	55.08	93.79	44.55	75.85	279.36	0.00	0.00	7.02	1.75	28.95	58.78	297.28	0.00	592.05
15	17.44	29.70	12.57	66.00	56.09	95.50	34.62	58.95	212.57	64.80	151.20	7.02	1.75	28.95	58.78	302.71	0.00	592.05
16	19.35	32.94	13.99	73.46	55.08	93.79	21.70	36.95	140.60	64.80	151.20	35.09	8.77	144.75	293.89	297.28	135.00	592.05
17	20.37	34.68	15.51	81.45	52.73	89.79	9.37	15.96	88.77	64.80	151.20	35.09	8.77	144.75	293.89	284.61	135.00	592.05
18	20.35	34.64	16.96	89.03	49.05	83.51	5.51	9.38	52.29	64.80	151.20	35.09	8.77	144.75	293.89	264.71	135.00	592.05
19	19.34	32.94	18.10	95.04	44.69	76.09	0.23	0.39	2.18	64.80	151.20	35.09	8.77	144.75	293.89	241.19	135.00	592.05
20	17.72	30.18	18.86	99.00	40.33	68.67	0.00	0.00	0.00	0.00	0.00	35.09	8.77	144.75	293.89	217.67	135.00	592.05
21	15.85	26.99	19.17	100.63	36.64	62.39	0.00	0.00	0.00	0.00	0.00	7.02	1.75	28.95	58.78	197.77	0.00	592.05
22	14.07	23.95	19.06	100.05	33.29	56.69	0.00	0.00	0.00	0.00	0.00	7.02	1.75	28.95	58.78	179.68	0.00	592.05
23	12.51	21.29	18.62	97.77	30.61	52.12	0.00	0.00	0.00	64.80	151.20	7.02	1.75	28.95	58.78	165.20	0.00	592.05
24	11.16	19.01	17.99	94.47	28.60	48.69	0.00	0.00	0.00	0.00	0.00	7.02	1.75	28.95	58.78	154.35	135.00	592.05



viii. Cooling Load:

Time (h)	Sensible Cooling					Latent Cooling	Total	SHF
	$\Sigma$ Convective	$\Sigma$ non-solar Radiative	Load Solar	Load Radiative	Cooling Load			
1	300.26	365.20	37.44	358.51	696.21	727.05	1423.26	0.489163
2	287.72	356.21	32.97	363.45	684.14	727.05	1411.20	0.484796
3	277.40	347.72	28.97	361.88	668.25	727.05	1395.30	0.478927
4	269.32	339.95	25.29	356.67	651.28	727.05	1378.33	0.472513
5	265.64	333.75	22.38	351.55	639.56	727.05	1366.62	0.46799
6	268.49	329.61	19.78	347.30	635.58	727.05	1362.63	0.466434
7	281.63	333.68	27.45	344.68	653.75	727.05	1380.81	0.473458
8	239.27	190.13	41.58	297.75	578.59	727.05	1305.64	0.443145
9	275.02	208.41	60.39	282.20	617.62	592.05	1209.67	0.510566
10	320.63	237.84	89.64	281.86	692.13	592.05	1284.19	0.538965
11	369.59	267.83	127.08	288.07	784.74	592.05	1376.79	0.569975
12	412.69	292.40	163.09	299.36	875.14	592.05	1467.19	0.596472
13	442.69	308.52	188.56	308.71	939.95	592.05	1532.01	0.613544
14	459.13	315.16	197.98	314.47	971.58	592.05	1563.63	0.621359
15	524.20	461.88	188.90	362.48	1075.58	592.05	1667.63	0.644974
16	652.04	691.00	167.92	460.86	1280.83	727.05	2007.88	0.6379
17	627.25	675.74	144.02	505.32	1276.58	727.05	2003.64	0.637133
18	601.21	670.42	121.05	531.80	1254.06	727.05	1981.11	0.633007
19	568.20	658.32	93.44	547.30	1208.94	727.05	1936.00	0.624455
20	474.42	500.51	76.56	511.14	1062.12	727.05	1789.18	0.593638
21	305.40	250.55	64.73	416.50	786.63	592.05	1378.68	0.570566
22	282.06	241.21	55.91	367.29	705.26	592.05	1297.31	0.543631
23	327.71	382.91	48.77	386.44	762.93	592.05	1354.98	0.563054
24	248.07	222.70	42.69	336.07	626.83	727.05	1353.88	0.462986



c. By using HAP software:

Air System Sizing Summary for Default System			
Project Name: Project_HVAC Prepared by: s		07/19/2021 09:26PM	
<b>Air System Information</b>			
Air System Name ..... Default System	Number of zones ..... 2		
Equipment Class ..... CW AHU	Floor Area ..... 422.2 m <sup>2</sup>		
Air System Type ..... VAV	Location ..... Beirut, Lebanon		
<b>Sizing Calculation Information</b>			
Calculation Months ..... Jan to Dec	Zone L/s Sizing ..... Peak zone sensible load		
Sizing Data ..... Calculated	Space L/s Sizing ..... Individual peak space loads		
<b>Central Cooling Coil Sizing Data</b>			
Total coil load ..... 269.6 kW	Load occurs at ..... Jul 1400		
Sensible coil load ..... 266.5 kW	OA DB / WB ..... 31.9 / 25.3 °C		
Coil L/s at Jul 1400 ..... 18644 L/s	Entering DB / WB ..... 24.7 / 16.6 °C		
Max block L/s at Jul 1400 ..... 19922 L/s	Leaving DB / WB ..... 12.8 / 12.0 °C		
Sum of peak zone L/s ..... 19924 L/s	Coil ADP ..... 11.5 °C		
Sensible heat ratio ..... 0.988	Bypass Factor ..... 0.100		
m <sup>2</sup> /kW ..... 1.6	Resulting RH ..... 44 %		
W/m <sup>2</sup> ..... 638.6	Design supply temp. .... 12.8 °C		
Water flow @ 5.6 °K rise ..... 11.62 L/s	Zone T-stat Check ..... 2 of 2 OK		
	Max zone temperature deviation ..... 0.0 °K		
<b>Preheat Coil Sizing Data</b>			
No heating coil loads occurred during this calculation.			
<b>Supply Fan Sizing Data</b>			
Actual max L/s at Jul 1400 ..... 19922 L/s	Fan motor BHP ..... 0.00 BHP		
Standard L/s ..... 19842 L/s	Fan motor kW ..... 0.00 kW		
Actual max L/(s-m <sup>2</sup> ) ..... 47.19 L/(s-m <sup>2</sup> )	Fan static ..... 0 Pa		
<b>Return Fan Sizing Data</b>			
Actual max L/s at Jul 1400 ..... 19922 L/s	Fan motor BHP ..... 0.00 BHP		
Standard L/s ..... 19842 L/s	Fan motor kW ..... 0.00 kW		
Actual max L/(s-m <sup>2</sup> ) ..... 47.19 L/(s-m <sup>2</sup> )	Fan static ..... 0 Pa		
<b>Outdoor Ventilation Air Data</b>			
Design airflow L/s ..... 0 L/s	L/s/person ..... 0.00 L/s/person		
L/(s-m <sup>2</sup> ) ..... 0.00 L/(s-m <sup>2</sup> )			

## Zone Sizing Summary for Default System

Project Name: Project\_HVAC  
Prepared by: s

07/19/2021  
09:26PM

### Air System Information

Air System Name ..... Default System  
Equipment Class ..... CW AHU  
Air System Type ..... VAV

Number of zones ..... 2  
Floor Area ..... 422.2 m<sup>2</sup>  
Location ..... Beirut, Lebanon

### Sizing Calculation Information

Calculation Months ..... Jan to Dec  
Sizing Data ..... Calculated

Zone L/s Sizing ..... Peak zone sensible load  
Space L/s Sizing ..... Individual peak space loads

### Zone Sizing Data

Zone Name	Maximum Cooling Sensible (kW)	Design Airflow (L/s)	Minimum Airflow (L/s)	Time of Peak Load	Maximum Heating Load (kW)	Zone Floor Area (m <sup>2</sup> )	Zone L/(s-m <sup>2</sup> )
Zone 1	145.3	10955	110	Jul 1400	14.0	305.8	35.82
Zone 2	119.8	8970	90	Jun 1400	5.9	116.4	77.06

### Zone Terminal Sizing Data

Zone Name	Reheat Coil Load (kW)	Reheat Coil Water L/s @ 11.1 °K	Zone Htg Coil Load (kW)	Zone Htg Water L/s @ 11.1 °K	Mixing Box Fan Airflow (L/s)
Zone 1	14.0	0.30	0.0	0.00	0
Zone 2	5.9	0.13	0.0	0.00	0

### Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (kW)	Time of Load	Air Flow (L/s)	Heating Load (kW)	Floor Area (m <sup>2</sup> )	Space L/(s-m <sup>2</sup> )
<b>Zone 1</b>							
Bedroom1	1	4.8	Jun 1400	357	1.3	27.0	13.24
Bedroom2	1	7.7	Jul 0500	577	1.2	29.2	19.75
entrance	1	39.3	Oct 1100	2942	2.3	53.7	54.79
Entrance2	1	39.8	Oct 1100	2979	2.4	53.7	55.47
Guest room	1	7.4	Jul 0500	553	1.1	29.0	19.08
Living room	1	15.8	Oct 1100	1182	1.2	24.7	47.85
Maid	1	2.3	Jul 1900	173	0.6	8.5	20.33
Master room	1	18.9	Jun 1400	1411	2.3	51.3	27.51
Sejour	1	12.9	Jun 0500	966	1.8	28.7	33.64
<b>Zone 2</b>							
Kitchen	1	26.9	Jun 1400	2011	1.3	27.0	74.47
kitchenette	1	7.1	Feb 1100	530	1.5	11.6	45.73
Salon	1	87.1	Jun 1400	6523	3.1	77.8	83.85

### 1. Summary

Ventilation Sizing Method ..... ASHRAE Std 62.1-2007  
Design Condition ..... Minimum flow (cooling) |  
Occupant Diversity (D) ..... 1.000  
Uncorrected Outdoor Air Intake (Vou) ..... 0 L/s  
System Ventilation Efficiency (Ev) ..... 1.000  
Outdoor Air Intake (Vot) ..... 0 L/s

### 2. Space Ventilation Analysis Table

Zone Name / Space Name	Mult.	Minimum Supply Air (L/s) (Vpz)	Space Floor Area (m <sup>2</sup> ) (Az)	Area Outdoor Air Rate (L/(s-m <sup>2</sup> )) (Ra)	Time Averaged Occupancy (Occupants) (Pz)	People Outdoor Air Rate (L/s/person) (Rp)	Air Distribution Effectiveness (Ez)	Space Outdoor Air (L/s) (Voz)	Breathing Zone Outdoor Air (L/s) (Vbz)	Space Ventilation Efficiency (Evz)
<b>Zone 1</b>										
Bedroom1	1	0	27.0	0.00	1.0	0.00	1.00	0	0	1.000
Bedroom2	1	0	29.2	0.00	1.0	0.00	1.00	0	0	1.000
entrance	1	0	53.7	0.00	5.0	0.00	1.00	0	0	1.000
Entrance2	1	0	53.7	0.00	5.0	0.00	1.00	0	0	1.000
Guest room	1	0	29.0	0.00	1.0	0.00	1.00	0	0	1.000
Living room	1	0	24.7	0.00	6.0	0.00	1.00	0	0	1.000
Maid	1	0	8.5	0.00	1.0	0.00	1.00	0	0	1.000
Master room	1	0	51.3	0.00	2.0	0.00	1.00	0	0	1.000
Sejour	1	0	28.7	0.00	7.0	0.00	1.00	0	0	1.000
<b>Zone 2</b>										
Kitchen	1	0	27.0	0.00	6.0	0.00	1.00	0	0	1.000
kitchenette	1	0	11.6	0.00	7.0	0.00	1.00	0	0	1.000
Salon	1	0	77.8	0.00	10.0	0.00	1.00	0	0	1.000
<b>Totals (incl. Space Multipliers)</b>		<b>0</b>							<b>0</b>	<b>1.000</b>

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 31.9 °C / 25.3 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 5.6 °C / 1.8 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	140 m²	16375	-	140 m²	-	-
Wall Transmission	849 m²	3855	-	849 m²	6977	-
Roof Transmission	422 m²	2977	-	422 m²	3978	-
Window Transmission	140 m²	3068	-	140 m²	7252	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	58 m²	2563	-	58 m²	1714	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	65955 W	61959	-	0	0	-
Task Lighting	152450 W	147314	-	0	0	-
Electric Equipment	25128 W	24448	-	0	0	-
People	52	3590	3209	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	-	266148	3209	-	19921	0
Zone Conditioning	-	266462	3209	-	18182	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	18644 L/s	0	-	199 L/s	0	-
Ventilation Load	0 L/s	0	0	0 L/s	0	0
Supply Fan Load	18644 L/s	0	-	199 L/s	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	266462	3209	-	18182	0
Central Cooling Coil	-	266462	3168	-	-1739	0
Preheat Coil	-	0	-	-	0	-
Terminal Reheat Coils	-	0	-	-	19921	-
>> Total Conditioning	-	266462	3168	-	18182	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400			HEATING DATA AT DES HTG		
	COOLING OA DB / WB 31.9 °C / 25.3 °C			HEATING OA DB / WB 5.6 °C / 1.8 °C		
	OCCUPIED T-STAT 23.9 °C			OCCUPIED T-STAT 21.1 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	78 m²	7540	-	78 m²	-	-
Wall Transmission	679 m²	3079	-	679 m²	5583	-
Roof Transmission	306 m²	2156	-	306 m²	2881	-
Window Transmission	78 m²	1723	-	78 m²	4074	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	48 m²	2459	-	48 m²	1470	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	19115 W	17957	-	0	0	-
Task Lighting	109690 W	105995	-	0	0	-
Electric Equipment	3720 W	3619	-	0	0	-
People	29	1820	1065	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	-	146348	1065	-	14009	0

Zone 2	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jun 1400			HEATING DATA AT DES HTG		
	COOLING OA DB / WB 31.3 °C / 25.3 °C			HEATING OA DB / WB 5.6 °C / 1.8 °C		
	OCCUPIED T-STAT 23.9 °C			OCCUPIED T-STAT 21.1 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	61 m²	9053	-	61 m²	-	-
Wall Transmission	170 m²	723	-	170 m²	1394	-
Roof Transmission	116 m²	810	-	116 m²	1097	-
Window Transmission	61 m²	1231	-	61 m²	3178	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	9 m²	94	-	9 m²	244	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	46840 W	44002	-	0	0	-
Task Lighting	42760 W	41320	-	0	0	-
Electric Equipment	21408 W	20829	-	0	0	-
People	23	1770	2145	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	-	119832	2145	-	5912	0

TABLE 1.1.A. COMPONENT LOADS FOR SPACE " Bedroom1 " IN ZONE " Zone 1 "						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jun 1400 COOLING OA DB / WB 31.3 °C / 25.3 °C OCCUPIED T-STAT 23.9 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 5.6 °C / 1.8 °C OCCUPIED T-STAT 21.1 °C		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	Details	(W)	(W)	Details	(W)	(W)
Window & Skylight Solar Loads	9 m²	947	-	9 m²	-	-
Wall Transmission	60 m²	243	-	60 m²	494	-
Roof Transmission	27 m²	188	-	27 m²	254	-
Window Transmission	9 m²	185	-	9 m²	478	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	2 m²	15	-	2 m²	40	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	0 W	0	-	0	0	-
Task Lighting	2700 W	2809	-	0	0	-
Electric Equipment	540 W	525	-	0	0	-
People	1	62	35	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	-	4775	35	-	1266	0

TABLE 1.1.B. ENVELOPE LOADS FOR SPACE " Bedroom1 " IN ZONE " Zone 1 "						
	Area	U-Value	Shade	COOLING	COOLING	HEATING
	(m²)	(W/(m²·°K))	Coeff.	TRANS	SOLAR	TRANS
				(W)	(W)	(W)
<b>N EXPOSURE</b>						
WALL	13	0.529	-	38	-	108
WINDOW 1	5	3.339	0.811	93	374	239
<b>E EXPOSURE</b>						
WALL	13	0.529	-	65	-	108
WINDOW 1	5	3.339	0.811	93	574	239
<b>S EXPOSURE</b>						
WALL	18	0.529	-	61	-	144
<b>W EXPOSURE</b>						
WALL	16	0.529	-	79	-	135
DOOR	2	1.703	-	15	-	40
<b>H EXPOSURE</b>						
ROOF	27	0.606	-	188	-	254

TABLE 1.2.A. COMPONENT LOADS FOR SPACE " Bedroom2 " IN ZONE " Zone 1 "						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 0500 COOLING OA DB / WB 24.5 °C / 23.4 °C OCCUPIED T-STAT 23.9 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 5.6 °C / 1.8 °C OCCUPIED T-STAT 21.1 °C		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	Details	(W)	(W)	Details	(W)	(W)
Window & Skylight Solar Loads	5 m²	1074	-	5 m²	-	-
Wall Transmission	65 m²	217	-	65 m²	534	-
Roof Transmission	29 m²	107	-	29 m²	275	-
Window Transmission	5 m²	29	-	5 m²	264	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	3 m²	9	-	3 m²	79	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	0 W	0	-	0	0	-
Task Lighting	5840 W	5838	-	0	0	-
Electric Equipment	584 W	588	-	0	0	-
People	1	82	35	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	-	7704	35	-	1152	0

TABLE 1.2.B. ENVELOPE LOADS FOR SPACE " Bedroom2 " IN ZONE " Zone 1 "						
	Area	U-Value	Shade	COOLING	COOLING	HEATING
	(m²)	(W/(m²·°K))	Coeff.	TRANS	SOLAR	TRANS
				(W)	(W)	(W)
N EXPOSURE						
WALL	16	0.529	-	48	-	132
DOOR	2	1.703	-	4	-	40
E EXPOSURE						
WALL	11	0.529	-	41	-	88
WINDOW 1	5	3.339	0.811	26	973	239
S EXPOSURE						
WALL	18	0.529	-	51	-	144
W EXPOSURE						
WALL	14	0.529	-	49	-	112
DOOR	2	1.703	-	4	-	40
E EXPOSURE						
WALL	7	0.529	-	29	-	60
WINDOW 1	0	3.339	0.811	3	101	25
H EXPOSURE						
ROOF	29	0.606	-	107	-	275



	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Oct 1100 COOLING OA DB / WB 25.9 °C / 23.1 °C OCCUPIED T-STAT 23.9 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 5.6 °C / 1.8 °C OCCUPIED T-STAT 21.1 °C		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	Details	(W)	(W)	Details	(W)	(W)
Window & Skylight Solar Loads	9 m²	2278	-	9 m²	-	-
Wall Transmission	116 m²	299	-	116 m²	957	-
Roof Transmission	54 m²	103	-	54 m²	508	-
Window Transmission	9 m²	48	-	9 m²	452	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	15 m²	43	-	15 m²	403	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	0 W	0	-	0	0	-
Task Lighting	37590 W	36229	-	0	0	-
Electric Equipment	0 W	0	-	0	0	-
People	5	310	176	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	-	39309	176	-	2318	0

TABLE 1.3.B. ENVELOPE LOADS FOR SPACE "entrance" IN ZONE "Zone 1"						
	Area	U-Value	Shade	COOLING	COOLING	HEATING
	(m²)	(W/(m²·°K))	Coeff.	TRANS	SOLAR	TRANS
				(W)	(W)	(W)
N EXPOSURE						
WALL	4	0.529	-	3	-	30
DOOR	2	1.703	-	4	-	40
N EXPOSURE						
WALL	10	0.529	-	9	-	88
S EXPOSURE						
WALL	2	0.529	-	8	-	12
WINDOW 1	9	3.339	0.811	48	2278	452
E EXPOSURE						
WALL	22	0.529	-	76	-	183
DOOR	5	1.703	-	13	-	119
E EXPOSURE						
WALL	35	0.529	-	119	-	288
DOOR	3	1.703	-	9	-	82
S EXPOSURE						
WALL	4	0.529	-	20	-	32
DOOR	2	1.703	-	4	-	40
W EXPOSURE						
WALL	30	0.529	-	48	-	250
DOOR	3	1.703	-	9	-	82
W EXPOSURE						
WALL	9	0.529	-	15	-	77
DOOR	2	1.703	-	4	-	40
H EXPOSURE						
ROOF	54	0.606	-	103	-	508

TABLE 1.4.A. COMPONENT LOADS FOR SPACE " Entrance2 " IN ZONE " Zone 1 "						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Oct 1100 COOLING OA DB / WB 25.9 °C / 23.1 °C OCCUPIED T-STAT 23.9 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 5.6 °C / 1.8 °C OCCUPIED T-STAT 21.1 °C		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	Details	(W)	(W)	Details	(W)	(W)
Window & Skylight Solar Loads	13 m²	2757	-	13 m²	-	-
Wall Transmission	116 m²	295	-	116 m²	957	-
Roof Transmission	54 m²	103	-	54 m²	508	-
Window Transmission	13 m²	74	-	13 m²	691	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	11 m²	30	-	11 m²	281	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	0 W	0	-	0	0	-
Task Lighting	37590 W	36229	-	0	0	-
Electric Equipment	0 W	0	-	0	0	-
People	5	310	176	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	-	39796	176	-	2435	0

TABLE 1.4.B. ENVELOPE LOADS FOR SPACE " Entrance2 " IN ZONE " Zone 1 "						
	Area	U-Value	Shade	COOLING	COOLING	HEATING
	(m²)	(W/(m²·°K))	Coeff.	TRANS	SOLAR	TRANS
				(W)	(W)	(W)
N EXPOSURE						
WALL	5	0.529	-	5	-	42
N EXPOSURE						
WALL	10	0.529	-	9	-	88
S EXPOSURE						
WALL	2	0.529	-	8	-	12
WMNDOW 1	9	3.339	0.811	48	2278	452
E EXPOSURE						
WALL	22	0.529	-	78	-	183
DOOR	5	1.703	-	13	-	119
E EXPOSURE						
WALL	34	0.529	-	114	-	275
WMNDOW 2	5	3.339	0.811	25	478	239
S EXPOSURE						
WALL	4	0.529	-	20	-	32
DOOR	2	1.703	-	4	-	40
W EXPOSURE						
WALL	30	0.529	-	48	-	250
DOOR	3	1.703	-	9	-	82
W EXPOSURE						
WALL	9	0.529	-	15	-	77
DOOR	2	1.703	-	4	-	40
H EXPOSURE						
ROOF	54	0.608	-	103	-	508

TABLE 1.5.A. COMPONENT LOADS FOR SPACE " Guest room " IN ZONE " Zone 1 "						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 0500 COOLING OA DB / WB 24.5 °C / 23.4 °C OCCUPIED T-STAT 23.9 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 5.6 °C / 1.8 °C OCCUPIED T-STAT 21.1 °C		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	Details	(W)	(W)	Details	(W)	(W)
Window & Skylight Solar Loads	5 m²	973	-	5 m²	-	-
Wall Transmission	57 m²	187	-	57 m²	470	-
Roof Transmission	29 m²	108	-	29 m²	273	-
Window Transmission	5 m²	28	-	5 m²	239	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	3 m²	9	-	3 m²	79	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	0 W	0	-	0	0	-
Task Lighting	5800 W	5599	-	0	0	-
Electric Equipment	435 W	423	-	0	0	-
People	1	62	35	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	-	7385	35	-	1062	0

TABLE 1.5.B. ENVELOPE LOADS FOR SPACE " Guest room " IN ZONE " Zone 1 "						
	Area	U-Value	Shade	COOLING	COOLING	HEATING
	(m²)	(W/(m²·°K))	Coeff.	TRANS	SOLAR	TRANS
				(W)	(W)	(W)
<b>N EXPOSURE</b>						
WALL	16	0.529	-	47	-	130
DOOR	2	1.703	-	4	-	40
<b>E EXPOSURE</b>						
WALL	11	0.529	-	41	-	86
WINDOW 1	5	3.339	0.811	28	973	239
<b>S EXPOSURE</b>						
WALL	17	0.529	-	50	-	142
<b>W EXPOSURE</b>						
WALL	14	0.529	-	49	-	112
DOOR	2	1.703	-	4	-	40
<b>H EXPOSURE</b>						
ROOF	29	0.606	-	108	-	273

TABLE 1.6.A. COMPONENT LOADS FOR SPACE " Living room " IN ZONE " Zone 1 "						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Oct 1100 COOLING OA DB / WB 25.9 °C / 23.1 °C OCCUPIED T-STAT 23.9 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 5.6 °C / 1.8 °C OCCUPIED T-STAT 21.1 °C		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	Details	(W)	(W)	Details	(W)	(W)
Window & Skylight Solar Loads	5 m²	1205	-	5 m²	-	-
Wall Transmission	58 m²	158	-	58 m²	478	-
Roof Transmission	25 m²	47	-	25 m²	233	-
Window Transmission	5 m²	25	-	5 m²	239	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	5 m²	731	-	5 m²	234	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	11115 W	10391	-	0	0	-
Task Lighting	2470 W	2381	-	0	0	-
Electric Equipment	494 W	480	-	0	0	-
People	6	372	211	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	-	15789	211	-	1184	0

TABLE 1.6.B. ENVELOPE LOADS FOR SPACE " Living room " IN ZONE " Zone 1 "						
	Area	U-Value	Shade	COOLING	COOLING	HEATING
	(m²)	(W/(m²·°K))	Coeff.	TRANS	SOLAR	TRANS
				(W)	(W)	(W)
N EXPOSURE						
WALL	16	0.529	-	14	-	130
DOOR	2	1.703	-	4	-	40
E EXPOSURE						
WALL	17	0.529	-	57	-	137
S EXPOSURE						
WALL	13	0.529	-	66	-	104
WINDOW 1	5	3.339	0.811	25	1205	239
W EXPOSURE						
WALL	13	0.529	-	20	-	108
DOOR GLASS	4	3.293	0.880	21	708	195
H EXPOSURE						
ROOF	25	0.608	-	47	-	233

TABLE 1.7.A. COMPONENT LOADS FOR SPACE " Maid " IN ZONE " Zone 1 "						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1900 COOLING OA DB / WB 31.0 °C / 25.1 °C OCCUPIED T-STAT 23.9 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 5.6 °C / 1.8 °C OCCUPIED T-STAT 21.1 °C		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	Details	(W)	(W)	Details	(W)	(W)
Window & Skylight Solar Loads	1 m²	78	-	1 m²	-	-
Wall Transmission	45 m²	230	-	45 m²	370	-
Roof Transmission	9 m²	63	-	9 m²	80	-
Window Transmission	1 m²	21	-	1 m²	50	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	3 m²	33	-	3 m²	79	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	0 W	0	-	0	0	-
Task Lighting	1700 W	1638	-	0	0	-
Electric Equipment	128 W	124	-	0	0	-
People	1	75	79	0	0	0
Infiltration	-	48	152	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	-	2309	231	-	580	0

TABLE 1.7.B. ENVELOPE LOADS FOR SPACE " Maid " IN ZONE " Zone 1 "						
	Area	U-Value	Shade	COOLING	COOLING	HEATING
	(m²)	(W/(m²·°K))	Coeff.	TRANS	SOLAR	TRANS
				(W)	(W)	(W)
N EXPOSURE						
WALL	6	0.529	-	25	-	52
WINDOW 1	0	3.339	0.811	10	19	25
N EXPOSURE						
WALL	5	0.529	-	21	-	44
DOOR	2	1.703	-	16	-	40
E EXPOSURE						
WALL	15	0.529	-	71	-	119
S EXPOSURE						
WALL	5	0.529	-	23	-	44
DOOR	2	1.703	-	16	-	40
W EXPOSURE						
WALL	5	0.529	-	36	-	45
WINDOW 1	0	3.339	0.811	10	57	25
W EXPOSURE						
WALL	8	0.529	-	54	-	67
H EXPOSURE						
ROOF	9	0.606	-	63	-	80

TABLE 1.8.A. COMPONENT LOADS FOR SPACE " Master room " IN ZONE " Zone 1 "						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jun 1400 COOLING OA DB / WB 31.3 °C / 25.3 °C OCCUPIED T-STAT 23.9 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 5.6 °C / 1.8 °C OCCUPIED T-STAT 21.1 °C		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	Details	(W)	(W)	Details	(W)	(W)
Window & Skylight Solar Loads	15 m²	1324	-	15 m²	-	-
Wall Transmission	108 m²	473	-	108 m²	890	-
Roof Transmission	51 m²	357	-	51 m²	483	-
Window Transmission	15 m²	311	-	15 m²	802	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	3 m²	31	-	3 m²	79	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	5130 W	4819	-	0	0	-
Task Lighting	10260 W	9914	-	0	0	-
Electric Equipment	1539 W	1497	-	0	0	-
People	2	125	70	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	-	18852	70	-	2255	0

TABLE 1.8.B. ENVELOPE LOADS FOR SPACE " Master room " IN ZONE " Zone 1 "						
	Area	U-Value	Shade	COOLING	COOLING	HEATING
	(m²)	(W/(m²·°K))	Coeff.	TRANS	SOLAR	TRANS
				(W)	(W)	(W)
N EXPOSURE						
WALL	3	0.529	-	8	-	21
WINDOW 1	15	3.339	0.811	301	1215	777
N EXPOSURE						
WALL	7	0.529	-	20	-	56
E EXPOSURE						
WALL	24	0.529	-	114	-	194
DOOR	2	1.703	-	15	-	40
W EXPOSURE						
WALL	13	0.529	-	60	-	103
WINDOW 1	0	3.339	0.811	10	109	25
DOOR	2	1.703	-	15	-	40
S EXPOSURE						
WALL	7	0.529	-	24	-	56
S EXPOSURE						
WALL	18	0.529	-	81	-	144
W EXPOSURE						
WALL	24	0.529	-	116	-	197
E EXPOSURE						
WALL	15	0.529	-	70	-	119
H EXPOSURE						
ROOF	51	0.606	-	357	-	483

TABLE 1.9.A. COMPONENT LOADS FOR SPACE " Sejour " IN ZONE " Zone 1 "						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jun 0500			HEATING DATA AT DES HTG		
	COOLING OA DB / WB 24.0 °C / 23.4 °C			HEATING OA DB / WB 5.6 °C / 1.8 °C		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	Details	(W)	(W)	Details	(W)	(W)
Window & Skylight Solar Loads	17 m²	3549	-	17 m²	-	-
Wall Transmission	53 m²	155	-	53 m²	433	-
Roof Transmission	29 m²	99	-	29 m²	270	-
Window Transmission	17 m²	64	-	17 m²	860	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	4 m²	365	-	4 m²	195	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	2870 W	2691	-	0	0	-
Task Lighting	5740 W	5541	-	0	0	-
Electric Equipment	0 W	0	-	0	0	-
People	7	435	246	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	-	12899	246	-	1758	0

TABLE 1.9.B. ENVELOPE LOADS FOR SPACE " Sejour " IN ZONE " Zone 1 "						
	Area (m²)	U-Value (W/(m²·°K))	Shade Coeff.	COOLING	COOLING	HEATING
				TRANS (W)	SOLAR (W)	TRANS (W)
N EXPOSURE						
WALL	18	0.529	-	50	-	144
E EXPOSURE						
WALL	2	0.529	-	9	-	20
WINDOW 1	17	3.339	0.811	64	3549	860
S EXPOSURE						
WALL	18	0.529	-	45	-	144
W EXPOSURE						
WALL	15	0.529	-	51	-	125
DOOR GLASS	4	3.293	0.880	15	350	195
H EXPOSURE						
ROOF	29	0.608	-	99	-	270



TABLE 2.1.A. COMPONENT LOADS FOR SPACE " Kitchen " IN ZONE " Zone 2 "						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jun 1400 COOLING OA DB / WB 31.3 °C / 25.3 °C OCCUPIED T-STAT 23.9 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 5.6 °C / 1.8 °C OCCUPIED T-STAT 21.1 °C		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	Details	(W)	(W)	Details	(W)	(W)
Window & Skylight Solar Loads	9 m²	947	-	9 m²	-	-
Wall Transmission	60 m²	243	-	60 m²	494	-
Roof Transmission	27 m²	188	-	27 m²	254	-
Window Transmission	9 m²	185	-	9 m²	478	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	2 m²	15	-	2 m²	40	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	4050 W	3805	-	0	0	-
Task Lighting	2700 W	2609	-	0	0	-
Electric Equipment	18900 W	18389	-	0	0	-
People	6	480	800	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	-	26861	800	-	1266	0

TABLE 2.1.B. ENVELOPE LOADS FOR SPACE " Kitchen " IN ZONE " Zone 2 "						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(m²)	(W/(m²·°K))	Coeff.	(W)	(W)	(W)
<b>N EXPOSURE</b>						
WALL	13	0.529	-	38	-	108
WINDOW 1	5	3.339	0.811	93	374	239
<b>E EXPOSURE</b>						
WALL	13	0.529	-	65	-	109
WINDOW 1	5	3.339	0.811	93	574	239
<b>S EXPOSURE</b>						
WALL	18	0.529	-	61	-	144
<b>W EXPOSURE</b>						
WALL	16	0.529	-	79	-	135
DOOR	2	1.703	-	15	-	40
<b>H EXPOSURE</b>						
ROOF	27	0.606	-	188	-	254

TABLE 2.2.A. COMPONENT LOADS FOR SPACE " kitchenette " IN ZONE " Zone 2 "						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Feb 1100 COOLING OA DB / WB 25.1 °C / 21.6 °C OCCUPIED T-STAT 23.9 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 5.6 °C / 1.8 °C OCCUPIED T-STAT 21.1 °C		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	Details	(W)	(W)	Details	(W)	(W)
Window & Skylight Solar Loads	23 m²	5208	-	23 m²	-	-
Wall Transmission	22 m²	22	-	22 m²	179	-
Roof Transmission	12 m²	10	-	12 m²	109	-
Window Transmission	23 m²	33	-	23 m²	1201	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	2 m²	1	-	2 m²	40	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	0 W	0	-	0	0	-
Task Lighting	1160 W	1118	-	0	0	-
Electric Equipment	174 W	169	-	0	0	-
People	7	528	554	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	-	7087	554	-	1529	0

TABLE 2.2.B. ENVELOPE LOADS FOR SPACE " kitchenette " IN ZONE " Zone 2 "						
	Area	U-Value	Shade	COOLING	COOLING	HEATING
	(m²)	(W/(m²·°K))	Coeff.	TRANS	SOLAR	TRANS
				(W)	(W)	(W)
<b>N EXPOSURE</b>						
WALL	10	0.529	-	-3	-	83
DOOR	2	1.703	-	1	-	40
<b>E EXPOSURE</b>						
WALL	12	0.529	-	25	-	95
<b>S EXPOSURE</b>						
WALL	0	0.529	-	0	-	0
WINDOW 1	12	3.339	0.811	16	3014	600
<b>W EXPOSURE</b>						
WALL	0	0.529	-	0	-	0
WINDOW 1	12	3.339	0.811	16	2192	600
<b>H EXPOSURE</b>						
ROOF	12	0.606	-	10	-	109

TABLE 2.3.A. COMPONENT LOADS FOR SPACE " Salon " IN ZONE " Zone 2 "						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jun 1400 COOLING OA DB / WB 31.3 °C / 25.3 °C OCCUPIED T-STAT 23.9 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 5.6 °C / 1.8 °C OCCUPIED T-STAT 21.1 °C		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	Details	(W)	(W)	Details	(W)	(W)
Window & Skylight Solar Loads	29 m²	4753	-	29 m²	-	-
Wall Transmission	88 m²	394	-	88 m²	721	-
Roof Transmission	78 m²	541	-	78 m²	733	-
Window Transmission	29 m²	581	-	29 m²	1499	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	6 m²	64	-	6 m²	164	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	42790 W	40197	-	0	0	-
Task Lighting	38900 W	37590	-	0	0	-
Electric Equipment	2334 W	2271	-	0	0	-
People	10	759	791	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	-	87149	791	-	3117	0

TABLE 2.3.B. ENVELOPE LOADS FOR SPACE " Salon " IN ZONE " Zone 2 "						
	Area	U-Value	Shade	COOLING	COOLING	HEATING
	(m²)	(W/(m²·°K))	Coeff.	TRANS	SOLAR	TRANS
				(W)	(W)	(W)
N EXPOSURE						
WALL	4	0.529	-	12	-	32
WINDOW 2	12	3.339	0.811	248	1000	639
E EXPOSURE						
WALL	47	0.529	-	226	-	384
DOOR	6	1.703	-	64	-	164
S EXPOSURE						
WALL	17	0.529	-	60	-	142
W EXPOSURE						
WALL	20	0.529	-	95	-	162
WINDOW 2	17	3.339	0.811	333	3753	860
H EXPOSURE						
ROOF	78	0.606	-	541	-	733

DESIGN MONTH: JUNE										
Hour	OA TEMP (°C)	SUPPLY AIRFLOW (L/s)	CENTRAL COOLING SENSIBLE (kW)	CENTRAL COOLING TOTAL (kW)	CENTRAL HEATING COIL (kW)	PRECOOL COIL (kW)	PREHEAT COIL (kW)	TERMINAL COOLING (kW)	TERMINAL HEATING (kW)	ZONE HEATING UNIT (kW)
0000	25.9	16758	237.8	240.8	0.0	0.0	0.0	0.0	0.0	0.0
0100	25.4	16829	235.9	238.8	0.0	0.0	0.0	0.0	0.0	0.0
0200	25.0	17910	255.3	258.5	0.0	0.0	0.0	0.0	0.0	0.0
0300	24.6	14893	206.9	209.1	0.0	0.0	0.0	0.0	0.0	0.0
0400	24.2	16841	239.1	242.0	0.0	0.0	0.0	0.0	0.0	0.0
0500	24.0	18105	258.2	261.4	0.0	0.0	0.0	0.0	0.0	0.0
0600	23.9	14220	199.9	202.0	0.0	0.0	0.0	0.0	0.0	0.0
0700	24.1	18068	257.7	260.7	0.0	0.0	0.0	0.0	0.0	0.0
0800	24.5	16885	239.7	242.6	0.0	0.0	0.0	0.0	0.0	0.0
0900	25.2	12859	179.8	181.7	0.0	0.0	0.0	0.0	0.0	0.0
1000	26.3	14053	244.4	255.4	0.0	0.0	0.0	0.0	0.0	0.0
1100	27.6	18442	263.4	266.6	0.0	0.0	0.0	0.0	0.0	0.0
1200	29.0	15532	219.4	221.9	0.0	0.0	0.0	0.0	0.0	0.0
1300	30.3	18584	265.5	268.7	0.0	0.0	0.0	0.0	0.0	0.0
1400	31.3	18628	266.2	269.4	0.0	0.0	0.0	0.0	0.0	0.0
1500	32.0	18458	263.6	266.7	0.0	0.0	0.0	0.0	0.0	0.0
1600	32.2	18448	263.5	266.6	0.0	0.0	0.0	0.0	0.0	0.0
1700	32.0	14726	207.4	209.8	0.0	0.0	0.0	0.0	0.0	0.0
1800	31.4	13189	184.7	186.5	0.0	0.0	0.0	0.0	0.0	0.0
1900	30.5	14049	244.4	255.4	0.0	0.0	0.0	0.0	0.0	0.0
2000	29.4	12819	179.3	181.3	0.0	0.0	0.0	0.0	0.0	0.0
2100	28.3	13841	240.6	251.7	0.0	0.0	0.0	0.0	0.0	0.0
2200	27.4	11609	200.5	211.0	0.0	0.0	0.0	0.0	0.0	0.0
2300	26.6	13789	239.7	250.6	0.0	0.0	0.0	0.0	0.0	0.0

DESIGN MONTH: JULY										
Hour	OA TEMP (°C)	SUPPLY AIRFLOW (L/s)	CENTRAL COOLING SENSIBLE (kW)	CENTRAL COOLING TOTAL (kW)	CENTRAL HEATING COIL (kW)	PRECOOL COIL (kW)	PREHEAT COIL (kW)	TERMINAL COOLING (kW)	TERMINAL HEATING (kW)	ZONE HEATING UNIT (kW)
0000	26.4	16793	238.3	241.3	0.0	0.0	0.0	0.0	0.0	0.0
0100	25.9	16665	236.4	239.3	0.0	0.0	0.0	0.0	0.0	0.0
0200	25.5	17882	254.8	258.0	0.0	0.0	0.0	0.0	0.0	0.0
0300	25.1	14888	206.8	209.0	0.0	0.0	0.0	0.0	0.0	0.0
0400	24.8	16846	239.1	242.1	0.0	0.0	0.0	0.0	0.0	0.0
0500	24.5	18121	258.5	261.6	0.0	0.0	0.0	0.0	0.0	0.0
0600	24.4	14247	200.3	202.4	0.0	0.0	0.0	0.0	0.0	0.0
0700	24.6	18103	258.2	261.2	0.0	0.0	0.0	0.0	0.0	0.0
0800	25.0	16922	240.3	243.2	0.0	0.0	0.0	0.0	0.0	0.0
0900	25.8	12897	180.4	182.2	0.0	0.0	0.0	0.0	0.0	0.0
1000	26.9	14096	245.2	256.0	0.0	0.0	0.0	0.0	0.0	0.0
1100	28.1	18481	264.0	267.2	0.0	0.0	0.0	0.0	0.0	0.0
1200	29.5	15565	219.9	222.4	0.0	0.0	0.0	0.0	0.0	0.0
1300	30.9	18608	265.9	269.1	0.0	0.0	0.0	0.0	0.0	0.0
1400	31.9	18644	266.5	269.6	0.0	0.0	0.0	0.0	0.0	0.0
1500	32.5	18473	263.8	267.0	0.0	0.0	0.0	0.0	0.0	0.0
1600	32.8	18475	263.9	267.0	0.0	0.0	0.0	0.0	0.0	0.0
1700	32.5	14753	207.8	210.2	0.0	0.0	0.0	0.0	0.0	0.0
1800	31.9	13218	185.1	186.9	0.0	0.0	0.0	0.0	0.0	0.0
1900	31.0	14083	245.0	255.8	0.0	0.0	0.0	0.0	0.0	0.0
2000	29.9	12850	179.7	181.8	0.0	0.0	0.0	0.0	0.0	0.0
2100	28.9	13878	241.3	252.1	0.0	0.0	0.0	0.0	0.0	0.0
2200	27.9	11647	201.2	211.5	0.0	0.0	0.0	0.0	0.0	0.0
2300	27.1	13828	240.4	251.1	0.0	0.0	0.0	0.0	0.0	0.0

DESIGN MONTH: AUGUST										
Hour	OA TEMP (°C)	SUPPLY AIRFLOW (L/s)	CENTRAL COOLING SENSIBLE (kW)	CENTRAL COOLING TOTAL (kW)	CENTRAL HEATING COIL (kW)	PRECOOL COIL (kW)	PREHEAT COIL (kW)	TERMINAL COOLING (kW)	TERMINAL HEATING (kW)	ZONE HEATING UNIT (kW)
0000	26.4	16768	238.0	240.9	0.0	0.0	0.0	0.0	0.0	0.0
0100	25.9	16642	236.1	239.0	0.0	0.0	0.0	0.0	0.0	0.0
0200	25.5	17748	252.8	256.0	0.0	0.0	0.0	0.0	0.0	0.0
0300	25.1	14589	205.4	207.5	0.0	0.0	0.0	0.0	0.0	0.0
0400	24.8	16777	238.1	241.0	0.0	0.0	0.0	0.0	0.0	0.0
0500	24.5	18079	257.8	261.0	0.0	0.0	0.0	0.0	0.0	0.0
0600	24.4	14222	199.9	202.0	0.0	0.0	0.0	0.0	0.0	0.0
0700	24.6	18093	258.0	261.0	0.0	0.0	0.0	0.0	0.0	0.0
0800	25.0	16923	240.3	243.2	0.0	0.0	0.0	0.0	0.0	0.0
0900	25.8	12916	180.7	182.5	0.0	0.0	0.0	0.0	0.0	0.0
1000	26.9	14121	245.7	256.5	0.0	0.0	0.0	0.0	0.0	0.0
1100	28.1	18509	264.4	267.6	0.0	0.0	0.0	0.0	0.0	0.0
1200	29.5	15577	220.1	222.6	0.0	0.0	0.0	0.0	0.0	0.0
1300	30.9	18579	265.5	268.6	0.0	0.0	0.0	0.0	0.0	0.0
1400	31.9	18539	264.8	268.0	0.0	0.0	0.0	0.0	0.0	0.0
1500	32.5	18437	263.3	266.5	0.0	0.0	0.0	0.0	0.0	0.0
1600	32.8	18440	263.3	266.5	0.0	0.0	0.0	0.0	0.0	0.0
1700	32.5	14714	207.2	209.6	0.0	0.0	0.0	0.0	0.0	0.0
1800	31.9	13178	184.5	186.3	0.0	0.0	0.0	0.0	0.0	0.0
1900	31.0	14052	244.4	255.3	0.0	0.0	0.0	0.0	0.0	0.0
2000	29.9	12814	179.2	181.3	0.0	0.0	0.0	0.0	0.0	0.0
2100	28.9	13851	240.8	251.7	0.0	0.0	0.0	0.0	0.0	0.0
2200	27.9	11621	200.7	211.0	0.0	0.0	0.0	0.0	0.0	0.0
2300	27.1	13805	239.9	250.7	0.0	0.0	0.0	0.0	0.0	0.0

DESIGN MONTH: SEPTEMBER										
Hour	OA TEMP (°C)	SUPPLY AIRFLOW (L/s)	CENTRAL COOLING SENSIBLE (kW)	CENTRAL COOLING TOTAL (kW)	CENTRAL HEATING COIL (kW)	PRECOOL COIL (kW)	PREHEAT COIL (kW)	TERMINAL COOLING (kW)	TERMINAL HEATING (kW)	ZONE HEATING UNIT (kW)
0000	25.3	16642	236.1	239.0	0.0	0.0	0.0	0.0	0.0	0.0
0100	24.8	16519	234.2	237.1	0.0	0.0	0.0	0.0	0.0	0.0
0200	24.4	17578	250.2	253.4	0.0	0.0	0.0	0.0	0.0	0.0
0300	24.0	14416	202.8	204.9	0.0	0.0	0.0	0.0	0.0	0.0
0400	23.7	16659	236.3	239.2	0.0	0.0	0.0	0.0	0.0	0.0
0500	23.4	17989	256.5	259.6	0.0	0.0	0.0	0.0	0.0	0.0
0600	23.3	14143	198.7	200.8	0.0	0.0	0.0	0.0	0.0	0.0
0700	23.5	18021	257.0	260.0	0.0	0.0	0.0	0.0	0.0	0.0
0800	23.9	16987	239.5	242.4	0.0	0.0	0.0	0.0	0.0	0.0
0900	24.7	12888	180.3	182.1	0.0	0.0	0.0	0.0	0.0	0.0
1000	25.8	14086	245.0	255.4	0.0	0.0	0.0	0.0	0.0	0.0
1100	27.0	18489	264.1	267.3	0.0	0.0	0.0	0.0	0.0	0.0
1200	28.4	15527	219.3	221.9	0.0	0.0	0.0	0.0	0.0	0.0
1300	29.8	18448	263.5	266.6	0.0	0.0	0.0	0.0	0.0	0.0
1400	30.8	18299	261.2	264.3	0.0	0.0	0.0	0.0	0.0	0.0
1500	31.4	18308	261.3	264.5	0.0	0.0	0.0	0.0	0.0	0.0
1600	31.7	18304	261.3	264.4	0.0	0.0	0.0	0.0	0.0	0.0
1700	31.4	14570	205.1	207.4	0.0	0.0	0.0	0.0	0.0	0.0
1800	30.8	13031	182.4	184.2	0.0	0.0	0.0	0.0	0.0	0.0
1900	29.9	13913	241.9	252.4	0.0	0.0	0.0	0.0	0.0	0.0
2000	28.8	12672	177.1	179.2	0.0	0.0	0.0	0.0	0.0	0.0
2100	27.8	13717	238.4	248.9	0.0	0.0	0.0	0.0	0.0	0.0
2200	26.8	11489	198.3	208.3	0.0	0.0	0.0	0.0	0.0	0.0
2300	26.0	13677	237.6	248.0	0.0	0.0	0.0	0.0	0.0	0.0

ZONE: Zone 1 DESIGN MONTH: JUNE									
Hour	OA TEMP (°C)	ZONE TEMP (°C)	RH (%)	ZONE AIRFLOW (L/s)	ZONE SENSIBLE LOAD (W)	ZONE COND (W)	TERMINAL COOLING COIL (W)	TERMINAL HEATING COIL (W)	ZONE HEATING UNIT (W)
0000	25.9	24.6	44	9254.8	129077.2	131368.1	0.0	0.0	0.0
0100	25.4	24.6	44	9171.8	128471.7	130116.6	0.0	0.0	0.0
0200	25.0	24.6	44	9920.2	140247.6	141456.1	0.0	0.0	0.0
0300	24.6	24.5	44	8166.5	113374.6	115084.6	0.0	0.0	0.0
0400	24.2	24.6	44	9382.6	132226.6	133299.2	0.0	0.0	0.0
0500	24.0	24.7	44	10096.3	143437.6	144142.1	0.0	0.0	0.0
0600	23.9	24.5	44	7926.3	110133.3	111498.8	0.0	0.0	0.0
0700	24.1	24.6	44	10058.7	143125.0	143568.8	0.0	0.0	0.0
0800	24.5	24.6	44	9375.1	132562.5	133185.9	0.0	0.0	0.0
0900	25.2	24.4	45	7115.6	98248.7	99547.1	0.0	0.0	0.0
1000	26.3	27.2	38	7640.5	144029.3	132835.6	0.0	0.0	0.0
1100	27.6	24.7	44	10181.8	144381.1	145447.6	0.0	0.0	0.0
1200	29.0	24.5	44	8520.2	119268.1	120336.2	0.0	0.0	0.0
1300	30.3	24.7	44	10212.0	145587.9	145609.8	0.0	0.0	0.0
1400	31.3	24.7	44	10239.2	146074.5	146325.5	0.0	0.0	0.0
1500	32.0	24.7	44	10185.3	145311.5	145502.1	0.0	0.0	0.0
1600	32.2	24.7	44	10185.4	145389.2	145503.6	0.0	0.0	0.0
1700	32.0	24.5	44	8106.4	113395.0	114170.4	0.0	0.0	0.0
1800	31.4	24.4	45	7255.1	100857.7	101594.7	0.0	0.0	0.0
1900	30.5	27.2	38	7637.8	144249.1	132786.6	0.0	0.0	0.0
2000	29.4	24.4	45	7054.6	96748.1	98653.9	0.0	0.0	0.0
2100	28.3	27.2	38	7514.7	141626.7	130560.2	0.0	0.0	0.0
2200	27.4	27.1	38	6267.4	117816.7	108165.1	0.0	0.0	0.0
2300	26.6	27.2	38	7490.2	139784.0	130117.8	0.0	0.0	0.0

ZONE: Zone 1 DESIGN MONTH: JULY									
Hour	OA TEMP (°C)	ZONE TEMP (°C)	RH (%)	ZONE AIRFLOW (L/s)	ZONE SENSIBLE LOAD (W)	ZONE COND (W)	TERMINAL COOLING COIL (W)	TERMINAL HEATING COIL (W)	ZONE HEATING UNIT (W)
0000	26.4	24.6	44	9281.6	129485.2	131772.9	0.0	0.0	0.0
0100	25.9	24.6	44	9199.1	128887.1	130528.6	0.0	0.0	0.0
0200	25.5	24.6	44	9899.8	139924.1	141146.0	0.0	0.0	0.0
0300	25.1	24.5	44	8164.9	113345.2	115040.4	0.0	0.0	0.0
0400	24.8	24.6	44	9389.1	132322.8	133397.7	0.0	0.0	0.0
0500	24.5	24.7	44	10110.4	143653.6	144357.6	0.0	0.0	0.0
0600	24.4	24.5	44	7948.8	110469.1	111831.5	0.0	0.0	0.0
0700	24.6	24.7	44	10086.2	143549.5	143688.2	0.0	0.0	0.0
0800	25.0	24.6	44	9403.4	132894.4	133812.9	0.0	0.0	0.0
0900	25.8	24.4	45	7146.4	98705.7	99998.7	0.0	0.0	0.0
1000	26.9	27.2	38	7674.4	144649.0	133449.2	0.0	0.0	0.0
1100	28.1	24.7	44	10212.3	144852.6	145913.9	0.0	0.0	0.0
1200	29.5	24.5	44	8546.9	119671.0	120735.5	0.0	0.0	0.0
1300	30.9	24.7	44	10233.7	145921.1	146241.0	0.0	0.0	0.0
1400	31.9	24.7	44	10257.0	146348.4	146598.8	0.0	0.0	0.0
1500	32.5	24.7	44	10205.0	145613.1	145802.3	0.0	0.0	0.0
1600	32.8	24.7	44	10208.3	145741.8	145853.5	0.0	0.0	0.0
1700	32.5	24.5	44	8129.9	113746.8	114519.8	0.0	0.0	0.0
1800	31.9	24.4	45	7279.1	101013.0	101947.4	0.0	0.0	0.0
1900	31.0	27.2	38	7665.3	144751.9	133285.7	0.0	0.0	0.0
2000	29.9	24.4	45	7079.8	97120.2	99023.2	0.0	0.0	0.0
2100	28.9	27.2	38	7543.3	142148.6	131078.2	0.0	0.0	0.0
2200	27.9	27.1	38	6297.0	118348.0	108692.4	0.0	0.0	0.0
2300	27.1	27.2	38	7519.9	140324.0	130653.9	0.0	0.0	0.0

ZONE: Zone 1 DESIGN MONTH: AUGUST									
Hour	OA TEMP (°C)	ZONE TEMP (°C)	RH (%)	ZONE AIRFLOW (L/s)	ZONE SENSIBLE LOAD (W)	ZONE COND (W)	TERMINAL COOLING COIL (W)	TERMINAL HEATING COIL (W)	ZONE HEATING UNIT (W)
0000	26.4	24.6	44	9267.4	129270.5	131559.0	0.0	0.0	0.0
0100	25.9	24.6	44	9186.2	128891.1	130332.9	0.0	0.0	0.0
0200	25.5	24.6	44	9803.1	138421.7	139673.9	0.0	0.0	0.0
0300	25.1	24.5	44	8100.2	112368.6	114079.6	0.0	0.0	0.0
0400	24.8	24.6	44	9345.9	131661.3	132744.5	0.0	0.0	0.0
0500	24.5	24.7	44	10084.9	143262.5	143968.7	0.0	0.0	0.0
0600	24.4	24.5	44	7934.6	110260.5	111621.1	0.0	0.0	0.0
0700	24.6	24.7	44	10080.3	143464.0	143898.5	0.0	0.0	0.0
0800	25.0	24.6	44	9404.6	133019.7	133631.9	0.0	0.0	0.0
0900	25.8	24.4	45	7156.7	98866.6	100150.7	0.0	0.0	0.0
1000	26.9	27.2	38	7687.2	144891.1	133682.3	0.0	0.0	0.0
1100	28.1	24.7	44	10225.7	145067.4	146119.8	0.0	0.0	0.0
1200	29.5	24.5	44	8550.3	119726.6	120786.4	0.0	0.0	0.0
1300	30.9	24.7	44	10217.5	145671.5	145993.8	0.0	0.0	0.0
1400	31.9	24.7	44	10213.7	145673.4	145935.5	0.0	0.0	0.0
1500	32.5	24.7	44	10188.7	145362.5	145552.9	0.0	0.0	0.0
1600	32.8	24.7	44	10190.1	145461.3	145575.3	0.0	0.0	0.0
1700	32.5	24.5	44	8108.5	113426.7	114202.8	0.0	0.0	0.0
1800	31.9	24.4	45	7256.8	100881.6	101619.3	0.0	0.0	0.0
1900	31.0	27.2	38	7647.6	144429.8	132965.2	0.0	0.0	0.0
2000	29.9	24.4	45	7059.3	96817.3	98723.0	0.0	0.0	0.0
2100	28.9	27.2	38	7527.9	141868.5	130798.7	0.0	0.0	0.0
2200	27.9	27.1	38	6282.6	118090.9	108435.8	0.0	0.0	0.0
2300	27.1	27.2	38	7506.9	140088.9	130418.9	0.0	0.0	0.0

ZONE: Zone 1 DESIGN MONTH: SEPTEMBER									
Hour	OA TEMP (°C)	ZONE TEMP (°C)	RH (%)	ZONE AIRFLOW (L/s)	ZONE SENSIBLE LOAD (W)	ZONE COND (W)	TERMINAL COOLING COIL (W)	TERMINAL HEATING COIL (W)	ZONE HEATING UNIT (W)
0000	25.3	24.6	44	9188.3	128067.7	130364.8	0.0	0.0	0.0
0100	24.8	24.6	44	9108.3	127509.6	129159.5	0.0	0.0	0.0
0200	24.4	24.6	44	9886.2	136624.5	137898.8	0.0	0.0	0.0
0300	24.0	24.5	44	7983.9	110621.8	112352.3	0.0	0.0	0.0
0400	23.7	24.6	44	9288.3	130482.7	131572.0	0.0	0.0	0.0
0500	23.4	24.6	44	10025.5	142355.7	143062.2	0.0	0.0	0.0
0600	23.3	24.5	44	7880.7	109463.8	110822.9	0.0	0.0	0.0
0700	23.5	24.6	44	10029.8	142694.6	143127.5	0.0	0.0	0.0
0800	23.9	24.6	44	9366.5	132448.2	133054.8	0.0	0.0	0.0
0900	24.7	24.4	45	7129.8	98480.9	99756.0	0.0	0.0	0.0
1000	25.8	27.2	38	7653.5	144285.2	133070.4	0.0	0.0	0.0
1100	27.0	24.7	44	10201.7	144707.5	145751.7	0.0	0.0	0.0
1200	28.4	24.5	44	8512.2	119160.5	120217.6	0.0	0.0	0.0
1300	29.8	24.7	44	10146.7	144579.4	144911.2	0.0	0.0	0.0
1400	30.8	24.7	44	10106.5	144013.6	144297.6	0.0	0.0	0.0
1500	31.4	24.7	44	10115.4	144234.6	144433.4	0.0	0.0	0.0
1600	31.7	24.7	44	10110.1	144227.8	144353.0	0.0	0.0	0.0
1700	31.4	24.6	44	8021.1	112115.4	112604.1	0.0	0.0	0.0
1800	30.8	24.4	45	7166.6	99344.6	100295.0	0.0	0.0	0.0
1900	29.9	27.2	38	7559.3	142820.0	131366.9	0.0	0.0	0.0
2000	28.8	24.4	45	6970.8	95509.8	97427.0	0.0	0.0	0.0
2100	27.8	27.2	38	7442.1	140308.1	129248.5	0.0	0.0	0.0
2200	26.8	27.1	38	6197.2	116558.1	106912.5	0.0	0.0	0.0
2300	26.0	27.2	38	7424.0	138582.2	128921.1	0.0	0.0	0.0

ZONE: Zone 2 DESIGN MONTH: JUNE									
Hour	OA TEMP (°C)	ZONE TEMP (°C)	RH (%)	ZONE AIRFLOW (L/s)	ZONE SENSIBLE LOAD (W)	ZONE COND (W)	TERMINAL COOLING COIL (W)	TERMINAL HEATING COIL (W)	ZONE HEATING UNIT (W)
0000	25.9	24.6	44	7503.5	105580.6	106443.7	0.0	0.0	0.0
0100	25.4	24.6	44	7457.7	105141.1	105752.6	0.0	0.0	0.0
0200	25.0	24.6	44	7990.3	113354.0	113810.6	0.0	0.0	0.0
0300	24.6	24.5	44	6526.9	91194.2	91841.1	0.0	0.0	0.0
0400	24.2	24.6	44	7458.8	105351.2	105789.6	0.0	0.0	0.0
0500	24.0	24.6	44	8009.1	113816.1	114096.5	0.0	0.0	0.0
0600	23.9	24.5	44	6293.4	87859.3	88383.9	0.0	0.0	0.0
0700	24.1	24.6	44	8009.7	113932.9	114106.1	0.0	0.0	0.0
0800	24.5	24.6	44	7509.8	106305.8	106537.4	0.0	0.0	0.0
0900	25.2	24.4	45	5743.6	79818.8	80298.6	0.0	0.0	0.0
1000	26.3	27.3	38	6412.1	116001.6	111592.9	0.0	0.0	0.0
1100	27.6	24.7	44	8260.1	117533.2	117920.1	0.0	0.0	0.0
1200	29.0	24.5	44	7011.5	98685.2	99056.7	0.0	0.0	0.0
1300	30.3	24.7	44	8371.6	119535.1	119623.6	0.0	0.0	0.0
1400	31.3	24.7	44	8389.3	119832.3	119894.8	0.0	0.0	0.0
1500	32.0	24.7	44	8270.4	118024.2	118077.0	0.0	0.0	0.0
1600	32.2	24.7	44	8263.1	117941.4	117965.7	0.0	0.0	0.0
1700	32.0	24.5	44	6619.2	92939.5	93210.9	0.0	0.0	0.0
1800	31.4	24.4	45	5933.9	82754.9	83088.8	0.0	0.0	0.0
1900	30.5	27.3	38	6410.9	116079.6	111572.5	0.0	0.0	0.0
2000	29.4	24.4	45	5764.5	79897.1	80604.2	0.0	0.0	0.0
2100	28.3	27.2	38	6326.3	114395.1	110038.2	0.0	0.0	0.0
2200	27.4	27.2	38	5341.3	96124.9	92307.3	0.0	0.0	0.0
2300	26.6	27.2	38	6299.0	113362.3	109544.4	0.0	0.0	0.0

ZONE: Zone 2 DESIGN MONTH: JULY									
Hour	OA TEMP (°C)	ZONE TEMP (°C)	RH (%)	ZONE AIRFLOW (L/s)	ZONE SENSIBLE LOAD (W)	ZONE COND (W)	TERMINAL COOLING COIL (W)	TERMINAL HEATING COIL (W)	ZONE HEATING UNIT (W)
0000	26.4	24.6	44	7511.4	105699.3	106561.7	0.0	0.0	0.0
0100	25.9	24.6	44	7465.9	105266.2	105876.9	0.0	0.0	0.0
0200	25.5	24.6	44	7982.3	113231.4	113890.0	0.0	0.0	0.0
0300	25.1	24.5	44	6523.2	91138.4	91786.4	0.0	0.0	0.0
0400	24.8	24.6	44	7457.2	105326.2	105745.3	0.0	0.0	0.0
0500	24.5	24.6	44	8010.7	113840.8	114121.2	0.0	0.0	0.0
0600	24.4	24.5	44	6298.0	87928.8	88453.0	0.0	0.0	0.0
0700	24.6	24.6	44	8016.5	114036.7	114209.2	0.0	0.0	0.0
0800	25.0	24.6	44	7518.2	106434.3	106665.0	0.0	0.0	0.0
0900	25.8	24.4	45	5750.5	79920.9	80400.1	0.0	0.0	0.0
1000	26.9	27.3	38	6421.4	116171.7	111782.0	0.0	0.0	0.0
1100	28.1	24.7	44	8268.4	117661.4	118047.4	0.0	0.0	0.0
1200	29.5	24.5	44	7018.0	98783.5	99154.5	0.0	0.0	0.0
1300	30.9	24.7	44	8374.5	119579.8	119688.4	0.0	0.0	0.0
1400	31.9	24.7	44	8387.2	119800.0	119863.5	0.0	0.0	0.0
1500	32.5	24.7	44	8268.0	117987.5	118041.2	0.0	0.0	0.0
1600	32.8	24.7	44	8266.7	117996.2	118020.3	0.0	0.0	0.0
1700	32.5	24.5	44	6623.4	93002.0	93273.2	0.0	0.0	0.0
1800	31.9	24.4	45	5938.7	82825.5	83159.1	0.0	0.0	0.0
1900	31.0	27.3	38	6418.1	116210.2	111702.5	0.0	0.0	0.0
2000	29.9	24.4	45	5770.4	79985.0	80891.7	0.0	0.0	0.0
2100	28.9	27.2	38	6334.4	114542.8	110185.1	0.0	0.0	0.0
2200	27.9	27.2	38	5349.9	96280.6	92482.1	0.0	0.0	0.0
2300	27.1	27.2	38	6308.0	113525.4	109706.7	0.0	0.0	0.0



ZONE: Zone 2 DESIGN MONTH: AUGUST									
Hour	OA TEMP (°C)	ZONE TEMP (°C)	RH (%)	ZONE AIRFLOW (L/s)	ZONE SENSIBLE LOAD (W)	ZONE COND (W)	TERMINAL COOLING COIL (W)	TERMINAL HEATING COIL (W)	ZONE HEATING UNIT (W)
0000	26.4	24.6	44	7500.1	105529.1	106391.9	0.0	0.0	0.0
0100	25.9	24.6	44	7455.5	105108.6	105719.5	0.0	0.0	0.0
0200	25.5	24.6	44	7945.2	112662.6	113125.9	0.0	0.0	0.0
0300	25.1	24.5	44	6488.6	90621.8	91273.6	0.0	0.0	0.0
0400	24.8	24.6	44	7431.5	104937.4	105358.8	0.0	0.0	0.0
0500	24.5	24.6	44	7994.1	113586.7	113688.0	0.0	0.0	0.0
0600	24.4	24.5	44	6287.7	87776.6	88300.6	0.0	0.0	0.0
0700	24.6	24.6	44	8012.2	113972.0	114143.3	0.0	0.0	0.0
0800	25.0	24.6	44	7518.0	106433.1	106662.0	0.0	0.0	0.0
0900	25.8	24.4	45	5759.2	80051.5	80527.6	0.0	0.0	0.0
1000	26.9	27.3	38	6433.7	116388.2	111985.1	0.0	0.0	0.0
1100	28.1	24.7	44	8283.4	117893.4	118275.8	0.0	0.0	0.0
1200	29.5	24.5	44	7026.4	98910.7	99279.3	0.0	0.0	0.0
1300	30.9	24.7	44	8361.6	119380.6	119470.6	0.0	0.0	0.0
1400	31.9	24.7	44	8325.0	118839.0	118912.1	0.0	0.0	0.0
1500	32.5	24.6	44	8248.7	117691.5	117746.6	0.0	0.0	0.0
1600	32.8	24.6	44	8249.4	117731.4	117756.8	0.0	0.0	0.0
1700	32.5	24.5	44	6605.7	92738.1	93010.6	0.0	0.0	0.0
1800	31.9	24.4	45	5921.3	82569.0	82903.7	0.0	0.0	0.0
1900	31.0	27.3	38	6404.7	115666.2	111459.0	0.0	0.0	0.0
2000	29.9	24.4	45	5754.9	79755.9	80463.5	0.0	0.0	0.0
2100	28.9	27.2	38	6322.6	114329.3	109971.9	0.0	0.0	0.0
2200	27.9	27.2	38	5338.9	96082.4	92264.1	0.0	0.0	0.0
2300	27.1	27.2	38	6297.9	113341.7	109523.1	0.0	0.0	0.0

ZONE: Zone 2 DESIGN MONTH: SEPTEMBER									
Hour	OA TEMP (°C)	ZONE TEMP (°C)	RH (%)	ZONE AIRFLOW (L/s)	ZONE SENSIBLE LOAD (W)	ZONE COND (W)	TERMINAL COOLING COIL (W)	TERMINAL HEATING COIL (W)	ZONE HEATING UNIT (W)
0000	25.3	24.6	44	7454.1	104833.7	105698.8	0.0	0.0	0.0
0100	24.8	24.6	44	7410.8	104433.6	105046.6	0.0	0.0	0.0
0200	24.4	24.6	44	7891.9	111849.7	112316.5	0.0	0.0	0.0
0300	24.0	24.5	44	6432.5	89786.1	90441.5	0.0	0.0	0.0
0400	23.7	24.6	44	7390.5	104318.5	104741.1	0.0	0.0	0.0
0500	23.4	24.6	44	7963.1	113116.8	113397.8	0.0	0.0	0.0
0600	23.3	24.5	44	6262.2	87401.6	87624.4	0.0	0.0	0.0
0700	23.5	24.6	44	7991.1	113653.7	113823.5	0.0	0.0	0.0
0800	23.9	24.6	44	7500.8	108175.4	108402.3	0.0	0.0	0.0
0900	24.7	24.4	45	5758.1	80039.2	80510.9	0.0	0.0	0.0
1000	25.8	27.3	38	6432.7	116383.6	111986.4	0.0	0.0	0.0
1100	27.0	24.7	44	8286.9	117951.8	118329.5	0.0	0.0	0.0
1200	28.4	24.5	44	7014.6	98736.2	99103.2	0.0	0.0	0.0
1300	29.8	24.7	44	8301.5	118455.4	118552.0	0.0	0.0	0.0
1400	30.8	24.6	44	8192.0	116790.4	116881.7	0.0	0.0	0.0
1500	31.4	24.6	44	8193.0	116837.5	116896.6	0.0	0.0	0.0
1600	31.7	24.6	44	8193.5	116874.7	116904.5	0.0	0.0	0.0
1700	31.4	24.5	44	6548.5	91894.1	92160.8	0.0	0.0	0.0
1800	30.8	24.4	45	5864.3	81729.3	82068.0	0.0	0.0	0.0
1900	29.9	27.2	38	6354.1	115045.8	110541.4	0.0	0.0	0.0
2000	28.8	24.4	45	5701.0	78983.7	79674.7	0.0	0.0	0.0
2100	27.8	27.2	38	6274.8	113460.3	109105.1	0.0	0.0	0.0
2200	26.8	27.1	38	5291.8	95238.5	91422.2	0.0	0.0	0.0
2300	26.0	27.2	38	6252.7	112521.4	108704.6	0.0	0.0	0.0

**July DESIGN COOLING DAY, 1400**

**TABLE 1: SYSTEM DATA**

Component	Location	Dry-Bulb Temp (°C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	31.9	0.01778	0	400	0	0
Vent - Return Mixing	Outlet	24.7	0.00851	18844	1127	-	-
Preheat Coil	Outlet	24.7	0.00851	18844	1127	0	-
Central Cooling Coil	Outlet	12.8	0.00845	18844	1127	266462	3168
Supply Fan	Outlet	12.8	0.00845	18844	1127	0	-
Cold Supply Duct	Outlet	12.8	0.00845	18844	1127	-	-
Zone Air	-	24.7	0.00851	18844	1127	266462	3209
Return Plenum	Outlet	24.7	0.00851	18844	1127	0	-
Return Fan	Outlet	24.7	0.00851	18844	1127	0	-

*Air Density x Heat Capacity x Conversion Factor: At sea level = 1.207; At site altitude = 1.202 W/(L/s-K)*

*Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947.6; At site altitude = 2935.8 W/(L/s)*

*Site Altitude = 33.8 m*

**TABLE 2: ZONE DATA**

Zone Name	Zone Sensible Load (W)	T-stat Mode	Zone Cond (W)	Zone Temp (°C)	Zone Airflow (L/s)	CO2 Level (ppm)	Terminal Heating Coil (W)	Zone Heating Unit (W)
Zone 1	146348	Cooling	146599	24.7	10257	1123	0	0
Zone 2	119800	Cooling	119884	24.7	8387	1131	0	0

**WINTER DESIGN HEATING**

**TABLE 1: SYSTEM DATA**

Component	Location	Dry-Bulb Temp (°C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	5.6	0.00282	0	400	0	0
Vent - Return Mixing	Outlet	20.0	0.00851	199	800	-	-
Preheat Coil	Outlet	20.0	0.00851	199	800	0	-
Central Cooling Coil	Outlet	12.8	0.00851	199	800	1739	0
Supply Fan	Outlet	12.8	0.00851	199	800	0	-
Cold Supply Duct	Outlet	12.8	0.00851	199	800	-	-
Zone Air	-	20.0	0.00851	199	800	-18182	0
Return Plenum	Outlet	20.0	0.00851	199	800	0	-
Return Fan	Outlet	20.0	0.00851	199	800	0	-

*Air Density x Heat Capacity x Conversion Factor: At sea level = 1.207; At site altitude = 1.202 W/(L/s-K)*

*Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947.6; At site altitude = 2935.8 W/(L/s)*

*Site Altitude = 33.8 m*

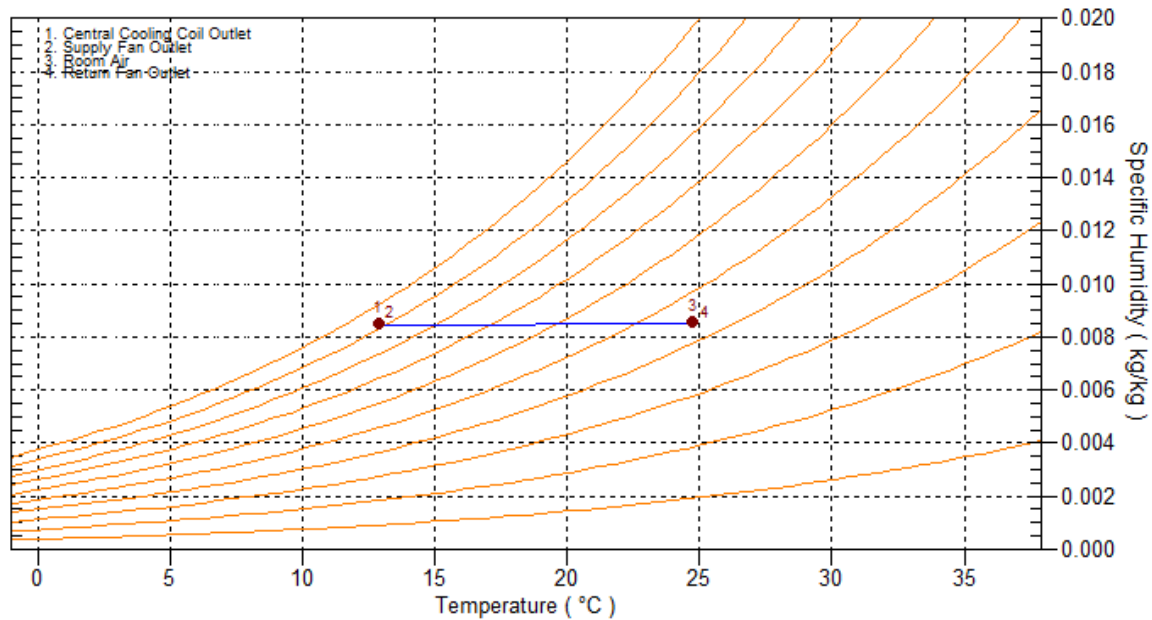
**TABLE 2: ZONE DATA**

Zone Name	Zone Sensible Load (W)	T-stat Mode	Zone Cond (W)	Zone Temp (°C)	Zone Airflow (L/s)	CO2 Level (ppm)	Terminal Heating Coil (W)	Zone Heating Unit (W)
Zone 1	-14009	Heating	-13021	20.3	110	800	14009	0
Zone 2	-5912	Heating	-5161	19.7	90	800	5912	0

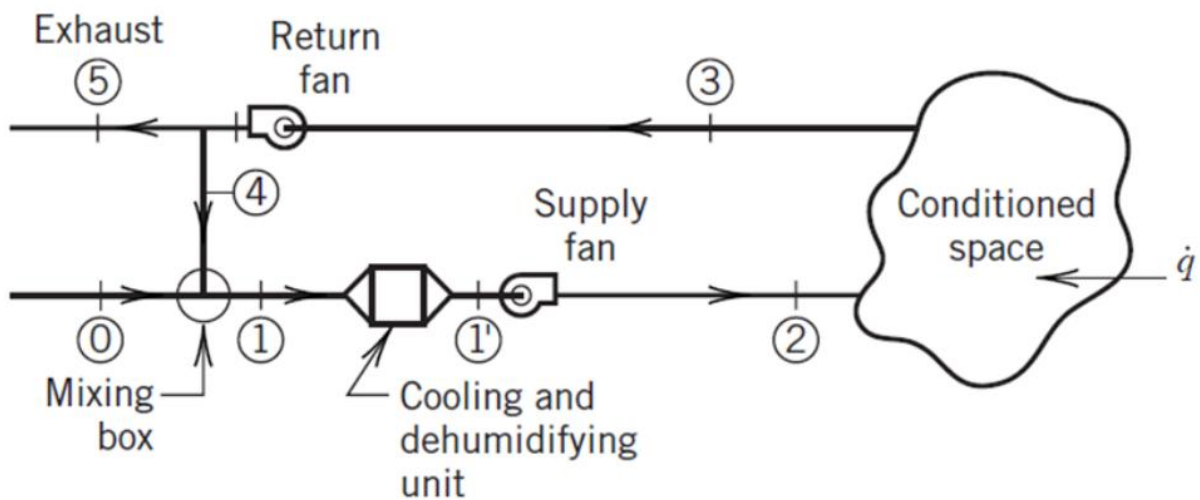
Location: Beirut, Lebanon

Altitude: 33.8 m.

Data for: July DESIGN COOLING DAY, 1400



#### IV. Part C: the mass flow rates at the different sections



From the results obtained in "Part B", we take the worst case (the highest cooling load)

$$\begin{cases} \dot{q} = 2007.88 \text{ W} \\ \dot{q}_s = 1280.83 \text{ W} \\ \dot{q}_l = 727.05 \text{ W} \\ SHF = \frac{\dot{q}_s}{\dot{q}} = 0.6379 \end{cases}$$

$$State0: \begin{cases} T_0 = 30.7 \text{ }^\circ\text{C} \\ \phi_0 = 50\% \\ \dot{Q}_0 = 30.1 \text{ l/s} \end{cases}$$

$$State3: \begin{cases} T_3 = 22 \text{ }^\circ\text{C} \\ T_{3wb} = 14 \text{ }^\circ\text{C} \end{cases}$$

The state 3 and 4 are the same.

SHF, this will define the supply line on which state 2 is on the protractor. We draw a line for SHF=0.6379 and then another parallel line to the SHF passing by state 3.

In order to determine state 2, we have  $\dot{q} = \dot{m}_{air} (i_3 - i_2)$

Where  $\dot{m}_{air} = \dot{m}_0 + \dot{m}_4 = \dot{m}_{1'} = \dot{m}_1 = \dot{m}_2$

Let us fix state 1, after mixing of state 4 and 0 where conditions at state 4 are the same conditions at state 3.

We will assume that the return air is 3 times the outdoor air. Thus,  $\dot{m}_4 = 3 * \dot{m}_0$

$$\Rightarrow \dot{m}_{air} = \dot{m}_2 = \dot{m}_0 + 3 * \dot{m}_0 = 4 * \dot{m}_0$$

Form the "PSYCHROMETRIC CHART":

$$v_0 = 0.88 \text{ m}^3/\text{kg}$$

$$\Rightarrow \dot{m}_0 = \frac{\dot{Q}_0}{v_0} = \frac{30.1 * 10^{-3}}{0.88} = 0.0342 \text{ Kg/s}$$

$$\Rightarrow \dot{m}_2 = 4 * 0.0342 = 0.1368 \text{ Kg/s}$$

From the chart and after indicate the states we can determine the enthalpy at state 3.

$$\Rightarrow i_3 = 39.1 \text{ KJ/Kg}$$

$$i_2 = i_3 - \frac{\dot{q}}{\dot{m}_2} = 39.1 - \frac{2007.88 * 10^{-3}}{0.1368} = 24.423 \text{ KJ/Kg}$$

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.

