Building and Plant Energy Analysis Report

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Central Shared Use Facility
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Table of Contents

Executive Summary

This report looks at the load calculations and energy consumption in the Central Shared Use Facility. It also looks at the LEED Rating System and ASHRAE Standard 90.

The CSUF was designed to have a LEED Silver Rating. After going through the checklist of points, I scored the building 13 points. This is well short of the required 33 points for a silver rating. This is due to unknown aspects of the building, such as storm water management, recycled content and low-emitting materials. Even though the building will not be certified right away, it should easily earn a silver rating.

Looking at ASHRAE Standard 90, I had to make a couple assumptions about the lighting load, and insulation found in the building. After making the assumptions, I found that the building did not meet the requirements set by Standard 90. However, since the building could earn a LEED silver rating, I think it is safe to assume that some of my assumptions were incorrect.

Using Carrier's Hourly Analysis Program, I calculated an annual operating cost of $407,892. This seemed extremely high for such a small building. This was due to a high cooling load which HAP estimated to be 84% of the total cost of the building. Again, there was some information which I did not have, but I should be receiving shortly. That way, I will be able to go through and find my mistake.

LEED Certification:

This building was designed to receive a silver rating under the LEED Rating System. However, the building will not actually be rated because the owner did not want to pay to have it rated. This building is being built on a campus with other new buildings being built in the next couple years, so once the whole campus is done, the owner will be planning on getting the whole campus rated, instead of each building. This has not been done yet, and may be the first time a group of buildings will be rated rather than a single building.

The rating system is split into 6 categories:

Sustainable Sites:

I estimated that the CSU received 5 points under this category, for site selection, public transportation access, parking capacity, and Heat Island Effect's. There were some aspects of this category which I did not know how to evaluate, so there may have been other points that I missed.

Water Efficiency:

I was unsure of how to evaluate this category.

Energy & Atmosphere:

I assumed that the prerequisites were met for this category, and that included meeting the requirements of ASHRAE Standard 90.1-1999. A minimal part of energy used from the central utilities plant is solar power. I assumed this counted for at least 5% for a renewable energy. The Refrigerant used throughout the building and central utility plant is R-134, which is not a HCFC or CFC. With these assumptions, I gave this building another 2 points.

Materials & Resources

I was unsure of how to evaluate this category.

Indoor Environmental Quality

Since a requirement to this section is to comply with ASHRAE Standard 62-1999, I will assume that it does. This contradicts my last tech report, but as stated in the report, some assumptions I made may have been wrong. This building is a government building, so there is no smoking allowed in the building. I gave the building another 5 points in this category for Ventilation Effectiveness, Controllability of Systems, and Thermal Comfort.

Innovation & Design Process

One point was awarded for a LEED Accredited Professional being on the design team.

Total:

I calculated a total of 15 points, but there were many sections I could not evaluate.

Standard 90.1-2004

In this section, we will look at how well the building complies with ASHRAE Standard 90.1-1999. The purpose of this standard is to provide minimum requirements for energy-efficient designs.

Building Envelope:

Climate Zone: Zone 4A (from Table B-1)

Air Leakage:

Building Envelope Sealing: The main wall system for the CSUF is a copper curtain wall assembly. There is a vapor retarder flexible membrane behind the insulation in this assembly. The windows and doors in the curtain walls are all gasketed to prevent leakage. The copper wall base that sits on the foundation is fitted with a waterproofing sealant. The waterproofing continues down along the entire foundation until the footings. The ground slab is also sealed with a vapor retarder. The duct's that penetrate the roof are gasketed as well. This building is sealed accordingly.

Vestibules:

Two Vestibules are located on the first floor, the main entrance, and another entrance into the same space. Each vestibule is designed properly, with doors that swing to the outside. The smaller of the two meets the size requirement of 7 ft between the two doors. There are other doors that separate conditioned spaces and the outside, but these are excluded due to 5.4.3.4.b which says that "Doors in buildings less than four stories above grade." This building is only 3 stories above grade.

Insulation:

The insulation type was found in the specs provided by Kling, the design firm. It was assumed that the insulation was made of Cellular glass.

Roof Insulation

	Insulation Thickness	R-Value	Min R-Value	Comply
Insulation Above Deck	88mm	9.54	15	No

Although the insulation itself is not sufficient enough to comply, there is a green roof on the CSUF, and Standard 90.1 does not mention the effects of a green roof.

Walls Above Grade Insulation:

	Insulation Thickness	R-Value	Min R-Value	Comply
Metal Building	76mm	9.1	13	No

Walls Below Grade Insulation:

	Insulation Thickness	C-Factor	Max C-Factor	Comply
Wall Below Grade	25mm	0.170	1.140	Yes

Slab on Grade

	Insulation	F-Value	Min F-Value	Comply
Unheated Slab	None under slab	0.73	10.73	Yes

Doors

	Assumed U-Factor	Min F-Value	Comply
Custom Steel Doors	0.7	0.7	Yes
Wood Doors	0.5	0.7	Yes

The Copper wall assembly seems to have fallen short of the Standard 90.1 compliance, and the roof section is a bit low as well, however there is a green roof on top of the slab and insulation, and I imagine that would play a major roll in insulating the building. There is a skylight as well, but the skylight area is less than 5% of the total roof area. Not much else was known about the skylight because it may not be in the final plan.

Lighting:

I could not get a lighting schedule for the building, so I could not calculate the lighting density. However, this building was designed with having 2W/ft^2 in mind. With that being said, according to the building area method, this design density would not meet the criteria in the office spaces.

Comments:

Since the building could be LEED Rated for silver, I am assuming some of my assumptions were incorrect, because having a building that complies with ASHRAE Standard 90.1-1999 is a major requirement in the rating process.

First Cost

The buildings mechanical system's first cost was $3,200,000. This was taken directly from the lump sum contract, which totaled $24,241,000. This equates out to approximately $85/square foot. This means the mechanical system was about 13% of the buildings first cost.

Lost Rentable Space

To calculate the lost rentable space from mechanical systems, I added up the Electrical Rooms, Mechanical Rooms, Mechanical Shafts, Elevators, and LAN/DATA rooms. I did not count the elevators in the lobby area, because the lobby area is not considered a rentable space. Also, I did not count the two substations located in the basement, because the building was designed to house two large substations for the surrounding buildings, therefore I did not think they were rentable space either.

Floor	Total Area (m^2)	Lost Space from Mech. Sys. (m^2)	Percentage
Ground Floor	3510	273	7%
First Floor	3000	141.2	5%
Second Floor	2650	161.3	6%
Third Floor	2535	116.7	5%
Totals	11695	692.2	6%

HAP Analysis

I used Carrier's Hourly Analysis Program to help estimate the cooling loads, heating loads, and energy consumption of the Central Shared Use Facility. The design criteria I used can be found in Appendix B, where each air handler and the rooms they supply is shown. The room and air handler information was taken off the 100% complete design drawings provided by Kling.

I did not have all of the information required by the program, so there were some assumptions made by me. I did not have information about the Central Utility Plant, besides that natural gas turbines generate electricity, and natural gas is used in the boilers. I than used the Energy Information Administration websites to get pricing guides for Maryland in the year 2005. I also used www.naturalgas.org to help estimate the emission levels from burning natural gas. Other parameters in the program that I had trouble with included the walls, because some of the building materials that made up the exterior wall was not included in HAP. I also did not have occupancy loads, and made the same assumptions I made in the first tech assignment, which was controlled by Standard 62.

With that being said, the results I got from HAP seem incorrect. The annual operating cost (Table A.2) for the Central Shared Use Facility was calculated to be $407,892. This number is very high, and must be the result of an error on my part. This high operating cost was due to a high cooling load cost. I did not have the pump details which brought in the chilled water from the central utility plant. To get the flow rate for the pump, I added up the water flow rate of each air handler unit. Table A.5 shows the Central Utility Plant Cooling load estimated in HAP contributed to about 84% of the total cost.

The annual emissions were also calculated, using HAP, they can be found on Table A.4

Also, from the looks of Graph A.1, the lighting load seems to have been undersized.

I was expecting to get the TRACE files from Kling to do the energy costs, and load calculations, but was unable to obtain the files in time. With those files, I could find the answers to a lot of the assumptions I had to make for the HAP program, and after I get them, I will be able to make much more accurate predictions for the energy usage and costs.

Energy Consumption

Since the building has not been built yet, there have been no meter readings to gather the buildings energy use yet. Therefore, I estimated the energy use by using data collected from the "Electricity Consumption and Expenditure Intensities" report from 1999. Based on other buildings, the data collected in this report provided an estimate for the amount of kWh per square foot in a building, depending on the principle activity of the building. The CSUF has multiple activities, so I broke the building up into the activities of Education, Food Services, Office, Storage, and Other.

Table 1			
Spaces	**Area (square meters)**	**kWh/m^2**	**kWh**
Education	695.2	93.6	65071
Food Services	885.6	367.9	325812
Office	1021.7	201.2	205566
Other	5574.6	262.5	1463332
		TOTAL	**2,059,781**

After putting the building into HAP, the program estimated a number significantly less than this estimation. Table A.1 is from the HAP estimates shows that 839,000 kWh. This is drastically less, because I did not have equipment detail for areas that would have a high electrical load like the kitchen, auditoriums, gymnasium, and data center. With the addition of the equipment loads from these spaces, the HAP estimate would be a lot higher. All of the power consumed by the Central Shared Use Facility is generated in the Central Utility Plant with Natural Gas Turbines.

Appendix A

Table A.1 Annual Energy Consumption

Component	Central Shared Use Facility
HVAC Components	
Electric (kWh)	589,147
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (Therm)	6,274
Remote Steam (na)	0
Remote CW (Therm)	326,168
Non-HVAC Components	
Electric (kWh)	250,334
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (Therm)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	839,481
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (Therm)	6,274
Remote Steam (na)	0
Remote CW (Therm)	326,168

Table A.2 Annual Costs

Component	Central Shared Use Facility ($)
Air System Fans	40,136
Cooling	342,841
Heating	6,588
Pumps	740
Cooling Tower Fans	0
HVAC Sub-Total	**390,305**
Lights	17,523
Electric Equipment	0
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	**17,523**
Grand Total	**407,829**

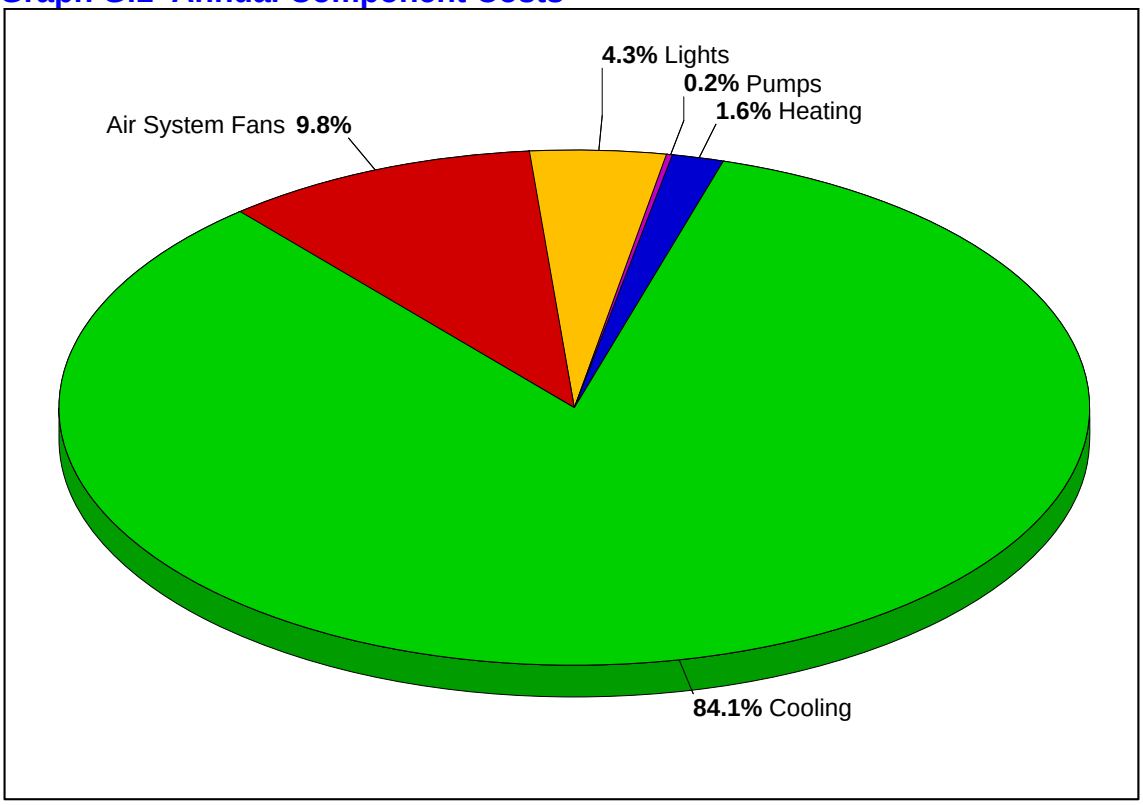
Table A.3 Component Cost as a Percentage of Total Cost

Component	Central Shared Use Facility (%)
Air System Fans	9.8
Cooling	84.1
Heating	1.6
Pumps	0.2
Cooling Tower Fans	0.0
HVAC Sub-Total	**95.7**
Lights	4.3
Electric Equipment	0.0
Misc. Electric	0.0
Misc. Fuel Use	0.0
Non-HVAC Sub-Total	**4.3**
Grand Total	**100.0**

Table A.4 Annual Emissions

Component	Central Shared Use Facility
CO2 (kg)	1,761,986
SO2 (kg)	0
NOx (kg)	3

Graph G.1 Annual Component Costs



Appendix B

HAP Design Parameters

Air System Sizing Summary for AHU B-1

Project Name: CSUF
Prepared by: psuae

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Air System Information

Air System Name	**AHU B-1**		Number of zones	**16**	
Equipment Class	**CW AHU**		Floor Area	**3284.0**	m²
Air System Type	**VAV**		Location	**Washington, Dist. of Columbia**	

Sizing Calculation Information

Zone and Space Sizing Method:

Zone L/s	**Peak zone sensible load**	Calculation Months	**Jan to Dec**
Space L/s	**Individual peak space loads**	Sizing Data	**User-Modified**

Central Cooling Coil Sizing Data

Total coil load	**67.9**	kW	Load occurs at	**Aug 1700**	
Sensible coil load	**53.8**	kW	OA DB / WB	**34.1 / 24.2**	°C
Coil L/s at Aug 1700	**2017**	L/s	Entering DB / WB	**25.4 / 15.3**	°C
Max block L/s	**10909**	L/s	Leaving DB / WB	**3.3 / 2.6**	°C
Sum of peak zone L/s	**3144**	L/s	Coil ADP	**0.8**	°C
Sensible heat ratio	**0.792**		Bypass Factor	**0.100**	
m²/kW	**48.4**		Resulting RH	**30**	%
W/m²	**20.7**		Design supply temp.	**7.2**	°C
Water flow @ 11.1 °K rise	**1.46**	L/s	Zone T-stat Check	**15 of 16**	OK
			Max zone temperature deviation	**1.2**	°K

Supply Fan Sizing Data

Actual max L/s	**10909**	L/s	Fan motor BHP	**39.88**	BHP
Standard L/s	**10883**	L/s	Fan motor kW	**29.74**	kW
Actual max L/(s-m²)	**3.32**	L/(s-m²)	Fan static	**1472**	Pa

Outdoor Ventilation Air Data

Design airflow L/s	**1660**	L/s	l/s/person	**19.08**	l/s/person
L/(s-m²)	**0.51**	L/(s-m²)			

Zone Sizing Summary for AHU B-1

Project Name: CSUF
Prepared by: psuae

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Air System Information

Air System Name ..... **AHU B-1**
Equipment Class ..... **CW AHU**
Air System Type ..... **VAV**

Number of zones **16**
Floor Area ..... **3284.0** m²
Location ..... **Washington, Dist. of Columbia**

Sizing Calculation Information

Zone and Space Sizing Method:

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

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **User-Modified**

Zone Sizing Data

Zone Name	Maximum Cooling Sensible (kW)	Design Air Flow (L/s)	Minimum Air Flow (L/s)	Time of Peak Load	Maximum Heating Load (kW)	Zone Floor Area (m²)	Zone L/(s-m²)
VVS-3	0.5	234	118	Jan 1800	0.0	88.7	2.64
VVS-3	0.2	179	118	Jul 1700	0.1	75.2	2.38
VVS-2	0.4	135	83	Jul 1800	0.3	119.3	1.13
VVS-5	1.2	400	212	Jul 1800	1.0	155.6	2.57
VVS-2	2.5	140	83	Jan 1800	0.0	56.8	2.46
VVS-2	0.5	126	83	Jan 1800	0.0	62.5	2.02
VVS-3	1.6	175	118	Jan 1800	0.0	39.3	4.45
VVS-7	7.9	624	330	Aug 1800	8.6	549.3	1.14
VVS-1	0.1	97	47	Jan 1800	0.0	70.5	1.38
VVS-5	1.1	308	212	Jan 1800	0.0	149.6	2.06
VVS-7	7.9	624	330	Aug 1800	8.6	549.3	1.14
VVS-1	0.9	100	47	Jan 1800	0.0	19.3	5.18
Fire Pump	0.0	1	0	Jan 1800	0.0	18.3	0.03
Trash	0.0	1	0	Jan 1800	0.0	18.3	0.03
Zone 15	0.2	1	0	Jan 1800	0.0	146.0	0.00
Zone 16	2.8	1	1	Jul 1700	2.3	1166.0	0.00

Zone Terminal Sizing Data

Zone Name	Reheat Coil Load (kW)	Reheat Coil Water L/s @ 25.0 °K	Zone Htg Coil Load (kW)	Zone Htg Water L/s @ 25.0 °K	Mixing Box Fan Airflow (L/s)
VVS-3	3.8	0.04	0.0	0.00	0
VVS-3	3.8	0.04	0.0	0.00	0
VVS-2	2.7	0.03	0.0	0.00	0
VVS-5	6.9	0.07	0.0	0.00	0
VVS-2	2.7	0.03	0.0	0.00	0
VVS-2	2.7	0.03	0.0	0.00	0
VVS-3	3.8	0.04	0.0	0.00	0
VVS-7	10.7	0.10	0.0	0.00	0
VVS-1	1.7	0.02	0.0	0.00	0
VVS-5	6.9	0.07	0.0	0.00	0
VVS-7	10.7	0.10	0.0	0.00	0
VVS-1	1.7	0.02	0.0	0.00	0
Fire Pump	0.0	0.00	5.6	0.05	0
Trash	0.0	0.00	5.6	0.05	0
Zone 15	0.0	0.00	5.6	0.05	0
Zone 16	0.0	0.00	11.2	0.11	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 (m²)	Space L/(s-m²)

Zone Sizing Summary for AHU B-1

Project Name: CSUF
Prepared by: psuae

10/31/2005
02:09AM

Zone Name / Space Name	Mult.	Cooling Sensible (kW)	Time of Load	Air Flow (L/s)	Heating Load (kW)	Floor Area (m²)	Space L/(s-m²)
VVS-3							
G/H Office 0040	1	0.1	Jan 1800	3	0.0	13.7	0.22
G/H Office 0039	1	0.0	Jan 1800	2	0.0	10.6	0.22
G/H Office 0023	1	0.0	Jan 1800	2	0.0	10.6	0.22
G/H Office 0024	1	0.0	Jan 1800	2	0.0	10.6	0.22
G/H Office 0025	1	0.0	Jan 1800	2	0.0	10.6	0.22
G/H Office 0026	1	0.0	Jan 1800	2	0.0	10.6	0.22
G/H Office 0027	1	0.0	Jan 1800	2	0.0	10.6	0.22
Badging	1	0.2	Jan 1800	10	0.0	11.4	0.87
VVS-3							
Corridor 0052	1	0.2	Jul 1700	9	0.1	75.2	0.12
VVS-2							
Corridor 0052	1	0.2	Jul 1700	9	0.1	75.2	0.12
Vestibule 052A	1	0.1	Jul 1600	5	0.1	12.3	0.38
G/H Office 0033	1	0.0	Jan 1800	2	0.0	10.6	0.22
G/H Office 0034	1	0.0	Jan 1800	2	0.0	10.6	0.22
G/H Office 0035	1	0.0	Jan 1800	2	0.0	10.6	0.22
VVS-5							
Workspace A	1	1.2	Jul 1800	60	1.0	155.6	0.39
VVS-2							
Command Center	1	2.5	Jan 1800	126	0.0	56.8	2.22
VVS-2							
G/H Office 0048	1	0.0	Jan 1800	2	0.0	8.2	0.22
E/F Office	1	0.3	Jan 1800	14	0.0	16.3	0.87
Workspace B	1	0.2	Jan 1800	8	0.0	38.0	0.22
VVS-3							
Briefing	1	1.5	Jan 1800	72	0.0	32.7	2.22
Closet	1	0.1	Jan 1800	5	0.0	6.6	0.73
VVS-7							
Service Tunnel	1	7.9	Aug 1800	392	8.6	549.3	0.71
VVS-1							
Kitchen Surplus	1	0.1	Jan 1800	3	0.0	47.3	0.07
Corridor 0050	1	0.0	Jan 1800	2	0.0	23.2	0.07
VVS-5							
Conference 0056	1	0.6	Jan 1800	28	0.0	18.2	1.56
Office 0055	1	0.0	Jan 1800	2	0.0	11.1	0.22
Office 0058	1	0.0	Jan 1800	2	0.0	11.1	0.22
Open Office 0054	1	0.3	Jan 1800	15	0.0	70.8	0.22
Open Office 0057	1	0.2	Jan 1800	8	0.0	38.4	0.22
VVS-7							
Service Tunnel	1	7.9	Aug 1800	392	8.6	549.3	0.71
VVS-1							
Conference 0030	1	0.9	Jan 1800	43	0.0	19.3	2.22
Fire Pump							
Fire Pump	1	0.0	Jan 1800	1	0.0	18.3	0.07
Trash							
Trash	1	0.0	Jan 1800	1	0.0	18.3	0.07
Zone 15							
Pump and Plumb.	1	0.2	Jan 1800	10	0.0	146.0	0.07
Zone 16							
Shell Space Ground	1	2.8	Jul 1700	139	2.3	1166.0	0.12

Air System Design Load Summary for AHU B-1

Project Name: CSUF
Prepared by: psuae

10/31/2005
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	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1700 COOLING OA DB / WB 34.1 °C / 24.2 °C			HEATING DATA AT DES HTG HEATING OA DB / WB -9.4 °C / -11.0 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	0 m²	0	-	0 m²	-	-
Wall Transmission	2059 m²	15549	-	2059 m²	20909	-
Roof Transmission	0 m²	0	-	0 m²	0	-
Window Transmission	0 m²	0	-	0 m²	0	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	0 m²	0	-	0 m²	0	-
Floor Transmission	3243 m²	0	-	3243 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	10111 W	6242	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	0 W	0	-	0	0	-
People	87	5136	5227	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	**-**	**26927**	**5227**	**-**	**20909**	**0**
Zone Conditioning	-	28856	5227	-	2218	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	70%	0	-	0	0	-
Plenum Lighting Load	30%	3033	-	0	0	-
Return Fan Load	2017 L/s	0	-	0 L/s	0	-
Ventilation Load	307 L/s	3776	8866	0 L/s	0	0
Supply Fan Load	2017 L/s	9543	-	0 L/s	0	-
Space Fan Coil Fans	-	0	-	-	-20	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**45209**	**14093**	**-**	**2198**	**0**
Central Cooling Coil	-	53780	14092	-	0	0
Terminal Reheat Coils	-	-8571	-	-	0	-
Zone Heating Unit Coils	-	0	-	-	2198	-
>> Total Conditioning	**-**	**45209**	**14092**	**-**	**2198**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Air System Sizing Summary for AHU 1-1

Project Name: CSUF
Prepared by: psuae

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Air System Information

Air System Name	**AHU 1-1**		Number of zones	**16**	
Equipment Class	**CW AHU**		Floor Area	**8279.5**	m²
Air System Type	**VAV**		Location	**Washington, Dist. of Columbia**	

Sizing Calculation Information

Zone and Space Sizing Method:

Zone L/s	**Peak zone sensible load**	Calculation Months	**Jan to Dec**
Space L/s	**Individual peak space loads**	Sizing Data	**User-Modified**

Central Cooling Coil Sizing Data

Total coil load	**510.2**	kW	Load occurs at	**Jul 1500**	
Sensible coil load	**231.6**	kW	OA DB / WB	**35.0 / 24.4**	°C
Coil L/s at Jul 1500	**5429**	L/s	Entering DB / WB	**40.3 / 30.3**	°C
Max block L/s	**5429**	L/s	Leaving DB / WB	**4.9 / 5.7**	°C
Sum of peak zone L/s	**7456**	L/s	Coil ADP	**0.9**	°C
Sensible heat ratio	**0.454**		Bypass Factor	**0.100**	
m²/kW	**16.2**		Resulting RH	**51**	%
W/m²	**61.6**		Design supply temp.	**7.2**	°C
Water flow @ 11.1 °K rise	**11.00**	L/s	Zone T-stat Check	**2 of 16**	OK
			Max zone temperature deviation	**28.9**	°K

Supply Fan Sizing Data

Actual max L/s	**5429**	L/s	Fan motor BHP	**20.51**	BHP
Standard L/s	**5416**	L/s	Fan motor kW	**15.29**	kW
Actual max L/(s-m²)	**0.66**	L/(s-m²)	Fan static	**1521**	Pa

Outdoor Ventilation Air Data

Design airflow L/s	**3291**	L/s	l/s/person	**0.35**	l/s/person
L/(s-m²)	**0.40**	L/(s-m²)			

Zone Sizing Summary for AHU 1-1

Project Name: CSUF
Prepared by: psuae

10/31/2005
02:10AM

Air System Information

Air System Name ..... **AHU 1-1**
Equipment Class ..... **CW AHU**
Air System Type ..... **VAV**

Number of zones **16**
Floor Area ..... **8279.5** m²
Location ..... **Washington, Dist. of Columbia**

Sizing Calculation Information

Zone and Space Sizing Method:

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

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **User-Modified**

Zone Sizing Data

Zone Name	Maximum Cooling Sensible (kW)	Design Air Flow (L/s)	Minimum Air Flow (L/s)	Time of Peak Load	Maximum Heating Load (kW)	Zone Floor Area (m²)	Zone L/(s-m²)
VVS-6	85.9	472	248	Jun 1500	19.6	595.0	0.79
VVS-8	85.9	804	566	Jun 1500	19.6	595.0	1.35
VVS-8	85.9	1136	566	Jun 1500	19.6	595.0	1.91
VVS-7	85.9	568	330	Jun 1500	19.6	595.0	0.95
DDB-4	50.8	672	160	Jun 1700	6.7	639.4	1.05
DDB-4	50.8	710	160	Jun 1700	6.7	639.4	1.11
DDB-4	50.8	710	160	Jun 1700	6.7	639.4	1.11
DDB-4	50.8	710	160	Jun 1700	6.7	639.4	1.11
VVS-4	50.8	284	154	Jun 1700	6.7	639.4	0.44
VVS-4	50.8	284	154	Jun 1700	6.7	639.4	0.44
VVS-4	50.8	284	154	Jun 1700	6.7	639.4	0.44
VVS-4	50.8	284	154	Jun 1700	6.7	639.4	0.44
VVS-4	50.8	284	154	Jun 1700	6.7	639.4	0.44
VVS-2	0.1	142	83	Aug 1800	0.0	14.0	10.14
VVS-1	1.9	71	47	Aug 1800	0.5	110.3	0.64
VVS-1	0.1	41	41	Jan 1800	0.0	20.6	1.99

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)
VVS-6	8.0	0.17	21.0	0.45	0
VVS-8	19.0	0.41	0.0	0.00	0
VVS-8	19.0	0.41	0.0	0.00	0
VVS-7	10.7	0.23	0.0	0.00	0
DDB-4	16.7	0.36	0.0	0.00	0
DDB-4	16.7	0.36	0.0	0.00	0
DDB-4	16.7	0.36	0.0	0.00	0
DDB-4	16.7	0.36	0.0	0.00	0
VVS-4	5.0	0.11	0.0	0.00	0
VVS-4	5.0	0.11	0.0	0.00	0
VVS-4	5.0	0.11	0.0	0.00	0
VVS-4	5.0	0.11	0.0	0.00	0
VVS-4	5.0	0.11	0.0	0.00	0
VVS-2	2.7	0.06	0.0	0.00	0
VVS-1	1.7	0.04	0.0	0.00	0
VVS-1	1.7	0.04	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 (m²)	Space L/(s-m²)

Zone Name / Space Name	Mult.	Cooling Sensible (kW)	Time of Load	Air Flow (L/s)	Heating Load (kW)	Floor Area (m²)	Space L/(s-m²)
VVS-6							
Lobby Second North	1	85.9	Jun 1500	4275	19.6	595.0	7.19
VVS-8							
Lobby Second North	1	85.9	Jun 1500	4275	19.6	595.0	7.19
VVS-8							
Lobby Second North	1	85.9	Jun 1500	4275	19.6	595.0	7.19
VVS-7							
Lobby Second North	1	85.9	Jun 1500	4275	19.6	595.0	7.19
DDB-4							
Dinning	1	50.8	Jun 1700	2530	6.7	639.4	3.96
DDB-4							
Dinning	1	50.8	Jun 1700	2530	6.7	639.4	3.96
DDB-4							
Dinning	1	50.8	Jun 1700	2530	6.7	639.4	3.96
DDB-4							
Dinning	1	50.8	Jun 1700	2530	6.7	639.4	3.96
VVS-4							
Dinning	1	50.8	Jun 1700	2530	6.7	639.4	3.96
VVS-4							
Dinning	1	50.8	Jun 1700	2530	6.7	639.4	3.96
VVS-4							
Dinning	1	50.8	Jun 1700	2530	6.7	639.4	3.96
VVS-4							
Dinning	1	50.8	Jun 1700	2530	6.7	639.4	3.96
VVS-4							
Dinning	1	50.8	Jun 1700	2530	6.7	639.4	3.96
VVS-2							
Kitchen Storage	1	0.1	Aug 1800	3	0.0	14.0	0.23
VVS-1							
Cook Prep	1	1.9	Aug 1800	97	0.5	110.3	0.88
VVS-1							
Kitchen Office	1	0.0	Jan 1800	2	0.0	8.4	0.22
Dry Surplus	1	0.0	Jan 1800	1	0.0	12.2	0.07

Air System Design Load Summary for AHU 1-1

Project Name: CSUF
Prepared by: psuae

10/31/2005
02:10AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1500 COOLING OA DB / WB 35.0 °C / 24.4 °C			HEATING DATA AT DES HTG HEATING OA DB / WB -9.4 °C / -11.0 °C		
ZONE LOADS	**Details**	**Sensible (W)**	**Latent (W)**	**Details**	**Sensible (W)**	**Latent (W)**
Window & Skylight Solar Loads	1334 m²	166789	-	1334 m²	-	-
Wall Transmission	688 m²	1317	-	688 m²	2691	-
Roof Transmission	0 m²	0	-	0 m²	0	-
Window Transmission	1334 m²	42132	-	1334 m²	136098	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	7 m²	113	-	7 m²	364	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	17884 W	10931	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	0 W	0	-	0	0	-
People	9329	542677	486510	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	**-**	**763958**	**486510**	**-**	**139154**	**0**
Zone Conditioning	-	357976	486510	-	90645	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	70%	0	-	0	0	-
Plenum Lighting Load	30%	5365	-	0	0	-
Return Fan Load	5429 L/s	0	-	3291 L/s	0	-
Ventilation Load	3291 L/s	-53152	-207859	2008 L/s	59777	0
Supply Fan Load	5429 L/s	15292	-	3291 L/s	-9432	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**325481**	**278650**	**-**	**140990**	**0**
Central Cooling Coil	-	231585	278656	-	0	0
Terminal Reheat Coils	-	-1833	-	-	125168	-
Zone Heating Unit Coils	-	0	-	-	15798	-
>> Total Conditioning	**-**	**229752**	**278656**	**-**	**140966**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Air System Sizing Summary for AHU 1-2

Project Name: CSUF
Prepared by: psuae

10/31/2005
02:11AM

Air System Information

Air System Name	**AHU 1-2**		Number of zones	**17**	
Equipment Class	**CW AHU**		Floor Area	**5180.7**	m²
Air System Type	**VAV**		Location	**Washington, Dist. of Columbia**	

Sizing Calculation Information

Zone and Space Sizing Method:

Zone L/s	**Peak zone sensible load**	Calculation Months	**Jan to Dec**
Space L/s	**Individual peak space loads**	Sizing Data	**User-Modified**

Central Cooling Coil Sizing Data

Total coil load	**583.5**	kW	Load occurs at	**Jul 1500**	
Sensible coil load	**247.2**	kW	OA DB / WB	**35.0 / 24.4**	°C
Coil L/s at Jul 1500	**6002**	L/s	Entering DB / WB	**39.5 / 31.1**	°C
Max block L/s	**7730**	L/s	Leaving DB / WB	**5.3 / 6.3**	°C
Sum of peak zone L/s	**7175**	L/s	Coil ADP	**1.5**	°C
Sensible heat ratio	**0.424**		Bypass Factor	**0.100**	
m²/kW	**8.9**		Resulting RH	**61**	%
W/m²	**112.6**		Design supply temp.	**7.3**	°C
Water flow @ 11.1 °K rise	**12.58**	L/s	Zone T-stat Check	**11 of 17**	OK
			Max zone temperature deviation	**28.9**	°K

Supply Fan Sizing Data

Actual max L/s	**7730**	L/s	Fan motor BHP	**24.82**	BHP
Standard L/s	**7712**	L/s	Fan motor kW	**18.51**	kW
Actual max L/(s-m²)	**1.49**	L/(s-m²)	Fan static	**1293**	Pa

Outdoor Ventilation Air Data

Design airflow L/s	**3145**	L/s	l/s/person	**0.57**	l/s/person
L/(s-m²)	**0.61**	L/(s-m²)			

Zone Sizing Summary for AHU 1-2

Project Name: CSUF
Prepared by: psuae

10/31/2005
02:11AM

Air System Information

Air System Name ..... **AHU 1-2**
Equipment Class ..... **CW AHU**
Air System Type ..... **VAV**

Number of zones **17**
Floor Area ..... **5180.7** m²
Location ..... **Washington, Dist. of Columbia**

Sizing Calculation Information

Zone and Space Sizing Method:

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

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **User-Modified**

Zone Sizing Data

Zone Name	Maximum Cooling Sensible (kW)	Design Air Flow (L/s)	Minimum Air Flow (L/s)	Time of Peak Load	Maximum Heating Load (kW)	Zone Floor Area (m²)	Zone L/(s-m²)
VVS-6	115.2	472	248	Jun 1500	32.2	718.8	0.66
VVS-8	115.2	1136	566	Jun 1500	32.2	718.8	1.58
VVS-8	115.2	944	566	Jun 1500	32.2	718.8	1.31
VVS-5	115.2	376	212	Jun 1500	32.2	718.8	0.52
VVS-8	115.2	752	566	Jun 1500	32.2	718.8	1.05
VVS-5	1.6	319	212	Jan 1800	0.0	119.1	2.68
VVS-4	0.9	236	154	Jan 1800	0.0	76.3	3.09
VVS-6	4.4	381	248	Sep 1500	1.5	58.4	6.52
VVS-3	0.8	208	118	Jan 1800	0.0	69.6	2.99
VVS-2	4.6	134	83	Jan 1800	0.0	244.6	0.55
VVS-5	4.6	426	212	Jan 1800	0.0	244.6	1.74
VVS-4	4.6	284	154	Jan 1800	0.0	244.6	1.16
VVS-5	4.6	426	212	Jan 1800	0.0	244.6	1.74
VVS-6	4.5	456	248	Sep 1500	1.6	86.5	5.27
VVS-4	4.6	306	154	Sep 1500	1.7	104.7	2.92
VVS-3	2.6	177	118	Oct 1400	1.0	50.6	3.50
VVS-2	2.0	142	83	Oct 1400	0.7	43.1	3.29

Zone Terminal Sizing Data

Zone Name	Reheat Coil Load (kW)	Reheat Coil Water L/s @ 2.0 °K	Zone Htg Coil Load (kW)	Zone Htg Water L/s @ 2.0 °K	Mixing Box Fan Airflow (L/s)
VVS-6	8.0	0.96	69.0	8.26	0
VVS-8	19.0	2.27	0.0	0.00	0
VVS-8	19.0	2.27	0.0	0.00	0
VVS-5	6.9	0.83	0.0	0.00	0
VVS-8	19.0	2.27	0.0	0.00	0
VVS-5	6.9	0.83	0.0	0.00	0
VVS-4	5.0	0.60	0.0	0.00	0
VVS-6	8.0	0.96	0.0	0.00	0
VVS-3	3.8	0.45	0.0	0.00	0
VVS-2	2.7	0.32	0.0	0.00	0
VVS-5	6.9	0.83	0.0	0.00	0
VVS-4	5.0	0.60	0.0	0.00	0
VVS-5	6.9	0.83	0.0	0.00	0
VVS-6	8.0	0.96	0.0	0.00	0
VVS-4	5.0	0.60	0.0	0.00	0
VVS-3	3.8	0.45	0.0	0.00	0
VVS-2	2.7	0.32	0.0	0.00	0

Space Loads and Airflows

		Cooling	Time	Air	Heating	Floor	

Zone Sizing Summary for AHU 1-2

Project Name: CSUF
Prepared by: psuae

10/31/2005
02:11AM

Zone Name / Space Name	Mult.	Sensible (kW)	of Load	Flow (L/s)	Load (kW)	Area (m²)	Space L/(s-m²)
VVS-6							
Lobby First South	1	115.2	Jun 1500	5764	32.2	718.8	8.02
VVS-8							
Lobby First South	1	115.2	Jun 1500	5764	32.2	718.8	8.02
VVS-8							
Lobby First South	1	115.2	Jun 1500	5764	32.2	718.8	8.02
VVS-5							
Lobby First South	1	115.2	Jun 1500	5764	32.2	718.8	8.02
VVS-8							
Lobby First South	1	115.2	Jun 1500	5764	32.2	718.8	8.02
VVS-5							
Treatment	2	0.1	Jan 1800	4	0.0	10.9	0.37
Doctors Office	1	0.1	Jan 1800	4	0.0	16.1	0.22
Reception	1	1.2	Jan 1800	61	0.0	56.0	1.10
Nurse	1	0.1	Jan 1800	3	0.0	13.5	0.22
Resting	1	0.1	Jan 1800	5	0.0	11.7	0.41
VVS-4							
Resting	1	0.1	Jan 1800	5	0.0	11.7	0.41
Credit Union	1	0.1	Jan 1800	7	0.0	30.8	0.22
EAP Reception	1	0.4	Jan 1800	19	0.0	17.5	1.10
E/F Office	1	0.3	Jan 1800	14	0.0	16.3	0.88
VVS-6							
Credit Union Office	2	1.5	Sep 1500	76	0.6	12.0	6.35
E/F Office	1	0.3	Jan 1800	14	0.0	16.3	0.88
NTEU	1	1.0	Sep 1500	52	0.4	18.1	2.87
VVS-3							
Retail	1	0.8	Jan 1800	42	0.0	69.6	0.61
VVS-2							
Gym	1	4.6	Jan 1800	229	0.0	244.6	0.94
VVS-5							
Gym	1	4.6	Jan 1800	229	0.0	244.6	0.94
VVS-4							
Gym	1	4.6	Jan 1800	229	0.0	244.6	0.94
VVS-5							
Gym	1	4.6	Jan 1800	229	0.0	244.6	0.94
VVS-6							
Aerobics Studio	1	4.5	Sep 1500	224	1.6	86.5	2.59
VVS-4							
Aerobics Studio	1	4.5	Sep 1500	224	1.6	86.5	2.59
Fitness Supplies	1	0.1	Aug 1800	5	0.1	18.2	0.27
VVS-3							
Mens Locker Room	1	2.6	Oct 1400	131	1.0	50.6	2.59
VVS-2							
Womens Locker Room	1	2.0	Oct 1400	98	0.7	43.1	2.27

Air System Design Load Summary for AHU 1-2

Project Name: CSUF
Prepared by: psuae

10/31/2005
02:11AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1500 COOLING OA DB / WB 35.0 °C / 24.4 °C			HEATING DATA AT DES HTG HEATING OA DB / WB -9.4 °C / -11.0 °C		
ZONE LOADS	**Details**	**Sensible (W)**	**Latent (W)**	**Details**	**Sensible (W)**	**Latent (W)**
Window & Skylight Solar Loads	1607 m²	175533	-	1607 m²	-	-
Wall Transmission	611 m²	1424	-	611 m²	2389	-
Roof Transmission	0 m²	0	-	0 m²	0	-
Window Transmission	1607 m²	50741	-	1607 m²	163911	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	23 m²	371	-	23 m²	1197	-
Floor Transmission	33 m²	0	-	33 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	11878 W	7260	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	0 W	0	-	0	0	-
People	5520	371235	462261	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	**-**	**606565**	**462261**	**-**	**167497**	**0**
Zone Conditioning	-	247469	462261	-	96800	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	70%	0	-	0	0	-
Plenum Lighting Load	30%	3563	-	0	0	-
Return Fan Load	6002 L/s	0	-	4154 L/s	0	-
Ventilation Load	2442 L/s	-22163	-125944	1690 L/s	49987	0
Supply Fan Load	6002 L/s	14602	-	4154 L/s	-10480	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**243471**	**336318**	**-**	**136307**	**0**
Central Cooling Coil	-	247152	336331	-	0	0
Terminal Reheat Coils	-	-3681	-	-	108928	-
Zone Heating Unit Coils	-	0	-	-	27316	-
>> Total Conditioning	**-**	**243471**	**336331**	**-**	**136244**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Air System Sizing Summary for AHU 2-1

Project Name: CSUF
Prepared by: psuae

10/31/2005
02:12AM

Air System Information

Air System Name	**AHU 2-1**		Number of zones	**14**	
Equipment Class	**CW AHU**		Floor Area	**3919.1**	m²
Air System Type	**VAV**		Location	**Washington, Dist. of Columbia**	

Sizing Calculation Information

Zone and Space Sizing Method:

Zone L/s	**Peak zone sensible load**	Calculation Months	**Jan to Dec**
Space L/s	**Individual peak space loads**	Sizing Data	**User-Modified**

Central Cooling Coil Sizing Data

Total coil load	**520.9**	kW	Load occurs at	**Jul 1500**	
Sensible coil load	**233.3**	kW	OA DB / WB	**35.0 / 24.4**	°C
Coil L/s at Jul 1500	**5789**	L/s	Entering DB / WB	**38.7 / 29.7**	°C
Max block L/s	**6930**	L/s	Leaving DB / WB	**5.2 / 5.9**	°C
Sum of peak zone L/s	**6850**	L/s	Coil ADP	**1.5**	°C
Sensible heat ratio	**0.448**		Bypass Factor	**0.100**	
m²/kW	**7.5**		Resulting RH	**58**	%
W/m²	**132.9**		Design supply temp.	**7.2**	°C
Water flow @ 11.1 °K rise	**11.23**	L/s	Zone T-stat Check	**6 of 14**	OK
			Max zone temperature deviation	**28.9**	°K

Supply Fan Sizing Data

Actual max L/s	**6930**	L/s	Fan motor BHP	**22.25**	BHP
Standard L/s	**6913**	L/s	Fan motor kW	**16.59**	kW
Actual max L/(s-m²)	**1.77**	L/(s-m²)	Fan static	**1293**	Pa

Outdoor Ventilation Air Data

Design airflow L/s	**3015**	L/s	l/s/person	**0.56**	l/s/person
L/(s-m²)	**0.77**	L/(s-m²)			

Zone Sizing Summary for AHU 2-1

Project Name: CSUF
Prepared by: psuae

10/31/2005
02:12AM

Air System Information

Air System Name ..... **AHU 2-1**
Equipment Class ..... **CW AHU**
Air System Type ..... **VAV**

Number of zones **14**
Floor Area ..... **3919.1** m²
Location ..... **Washington, Dist. of Columbia**

Sizing Calculation Information

Zone and Space Sizing Method:

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

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **User-Modified**

Zone Sizing Data

Zone Name	Maximum Cooling Sensible (kW)	Design Air Flow (L/s)	Minimum Air Flow (L/s)	Time of Peak Load	Maximum Heating Load (kW)	Zone Floor Area (m²)	Zone L/(s-m²)
DDB-1	14.1	380	64	Jul 1800	0.4	161.3	2.36
DDB-2	14.1	456	83	Jul 1800	0.4	161.3	2.83
DDB-2	14.1	456	83	Jul 1800	0.4	161.3	2.83
DDB-1	1.7	255	64	Jan 1800	0.0	54.4	4.69
VVS-1	0.0	88	47	Jan 1800	0.0	23.2	3.79
VVS-1	0.0	76	47	Jan 1800	0.0	23.2	3.28
VVS-8	85.9	960	566	Jun 1500	19.6	595.0	1.61
VVS-8	85.9	960	566	Jun 1500	19.6	595.0	1.61
DDB-2	3.0	464	74	Jan 1800	0.0	73.8	6.29
VVS-8	85.9	960	566	Jun 1500	19.6	595.0	1.61
VVS-4	85.9	245	154	Jun 1500	19.6	595.0	0.41
DDB-2	5.5	468	74	Jan 1800	0.0	136.6	3.43
DDB-4	10.3	912	160	Sep 1600	1.8	149.0	6.12
VVS-2	85.9	170	83	Jun 1500	19.6	595.0	0.29

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)
DDB-1	6.9	0.15	7.0	0.15	0
DDB-2	8.1	0.17	0.0	0.00	0
DDB-2	8.1	0.17	0.0	0.00	0
DDB-1	6.9	0.15	0.0	0.00	0
VVS-1	1.7	0.04	0.0	0.00	0
VVS-1	1.7	0.04	0.0	0.00	0
VVS-8	19.0	0.41	0.0	0.00	0
VVS-8	19.0	0.41	0.0	0.00	0
DDB-2	8.1	0.17	0.0	0.00	0
VVS-8	19.0	0.41	0.0	0.00	0
VVS-4	5.0	0.11	0.0	0.00	0
DDB-2	8.1	0.17	0.0	0.00	0
DDB-4	16.7	0.36	0.0	0.00	0
VVS-2	2.7	0.06	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 (m²)	Space L/(s-m²)
DDB-1							
Auditorium North	1	14.1	Jul 1800	699	0.4	161.3	4.33
DDB-2							
Auditorium North	1	14.1	Jul 1800	699	0.4	161.3	4.33

Zone Sizing Summary for AHU 2-1

Project Name: CSUF
Prepared by: psuae

10/31/2005
02:12AM

Zone Name / Space Name	Mult.	Cooling Sensible (kW)	Time of Load	Air Flow (L/s)	Heating Load (kW)	Floor Area (m²)	Space L/(s-m²)
DDB-2							
Auditorium North	1	14.1	Jul 1800	699	0.4	161.3	4.33
DDB-1							
Video Conference North	1	1.7	Jan 1800	85	0.0	54.4	1.56
VVS-1							
Corridor 200	1	0.0	Jan 1800	2	0.0	23.2	0.07
VVS-1							
Corridor 200	1	0.0	Jan 1800	2	0.0	23.2	0.07
VVS-8							
Lobby Second North	1	85.9	Jun 1500	4275	19.6	595.0	7.19
VVS-8							
Lobby Second North	1	85.9	Jun 1500	4275	19.6	595.0	7.19
DDB-2							
Training 2	1	3.0	Jan 1800	149	0.0	73.8	2.01
VVS-8							
Lobby Second North	1	85.9	Jun 1500	4275	19.6	595.0	7.19
VVS-4							
Lobby Second North	1	85.9	Jun 1500	4275	19.6	595.0	7.19
DDB-2							
Training 3	1	5.5	Jan 1800	275	0.0	136.6	2.01
DDB-4							
Training 1	1	10.3	Sep 1600	510	1.8	149.0	3.42
VVS-2							
Lobby Second North	1	85.9	Jun 1500	4275	19.6	595.0	7.19

Air System Design Load Summary for AHU 2-1

Project Name: CSUF
Prepared by: psuae

10/31/2005
02:12AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1500 COOLING OA DB / WB 35.0 °C / 24.4 °C			HEATING DATA AT DES HTG HEATING OA DB / WB -9.4 °C / -11.0 °C		
ZONE LOADS	**Details**	**Sensible (W)**	**Latent (W)**	**Details**	**Sensible (W)**	**Latent (W)**
Window & Skylight Solar Loads	975 m²	105700	-	975 m²	-	-
Wall Transmission	378 m²	645	-	378 m²	1479	-
Roof Transmission	0 m²	0	-	0 m²	0	-
Window Transmission	975 m²	30778	-	975 m²	99423	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	0 m²	0	-	0 m²	0	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	8465 W	5174	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	0 W	0	-	0	0	-
People	5425	344069	392403	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	**-**	**486366**	**392403**	**-**	**100902**	**0**
Zone Conditioning	-	234979	392403	-	49486	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	70%	0	-	0	0	-
Plenum Lighting Load	30%	2539	-	0	0	-
Return Fan Load	5789 L/s	0	-	2631 L/s	0	-
Ventilation Load	2518 L/s	-19639	-104843	1327 L/s	38873	0
Supply Fan Load	5789 L/s	14027	-	2631 L/s	-7431	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**231906**	**287560**	**-**	**80928**	**0**
Central Cooling Coil	-	233330	287568	-	0	0
Terminal Reheat Coils	-	-1424	-	-	80876	-
Zone Heating Unit Coils	-	0	-	-	0	-
>> Total Conditioning	**-**	**231906**	**287568**	**-**	**80876**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Air System Sizing Summary for AHU 2-2

Project Name: CSUF
Prepared by: psuae

10/31/2005
02:13AM

Air System Information

Air System Name	**AHU 2-2**		Number of zones	**12**	
Equipment Class	**CW AHU**		Floor Area	**4502.1**	m²
Air System Type	**VAV**		Location	**Washington, Dist. of Columbia**	

Sizing Calculation Information

Zone and Space Sizing Method:

Zone L/s	**Peak zone sensible load**	Calculation Months	**Jan to Dec**
Space L/s	**Individual peak space loads**	Sizing Data	**User-Modified**

Central Cooling Coil Sizing Data

Total coil load	**522.4**	kW	Load occurs at	**Jul 1500**	
Sensible coil load	**283.0**	kW	OA DB / WB	**35.0 / 24.4**	°C
Coil L/s at Jul 1500	**7400**	L/s	Entering DB / WB	**36.6 / 25.7**	°C
Max block L/s	**7400**	L/s	Leaving DB / WB	**4.8 / 4.9**	°C
Sum of peak zone L/s	**7846**	L/s	Coil ADP	**1.3**	°C
Sensible heat ratio	**0.542**		Bypass Factor	**0.100**	
m²/kW	**8.6**		Resulting RH	**42**	%
W/m²	**116.0**		Design supply temp.	**7.1**	°C
Water flow @ 11.1 °K rise	**11.26**	L/s	Zone T-stat Check	**2 of 12**	OK
			Max zone temperature deviation	**28.9**	°K

Supply Fan Sizing Data

Actual max L/s	**7400**	L/s	Fan motor BHP	**27.09**	BHP
Standard L/s	**7382**	L/s	Fan motor kW	**20.20**	kW
Actual max L/(s-m²)	**1.64**	L/(s-m²)	Fan static	**1474**	Pa

Outdoor Ventilation Air Data

Design airflow L/s	**5080**	L/s	l/s/person	**1.06**	l/s/person
L/(s-m²)	**1.13**	L/(s-m²)			

Zone Sizing Summary for AHU 2-2

Project Name: CSUF
Prepared by: psuae

10/31/2005
02:13AM

Air System Information

Air System Name ..... **AHU 2-2**
Equipment Class ..... **CW AHU**
Air System Type ..... **VAV**

Number of zones **12**
Floor Area ..... **4502.1** m²
Location ..... **Washington, Dist. of Columbia**

Sizing Calculation Information

Zone and Space Sizing Method:

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

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **User-Modified**

Zone Sizing Data

Zone Name	Maximum Cooling Sensible (kW)	Design Air Flow (L/s)	Minimum Air Flow (L/s)	Time of Peak Load	Maximum Heating Load (kW)	Zone Floor Area (m²)	Zone L/(s-m²)
VVS-2	95.0	255	83	Jun 0800	36.0	418.3	0.61
DDB-4	32.1	836	160	Aug 1700	1.4	345.1	2.42
DDB-4	32.1	760	160	Aug 1700	1.4	345.1	2.20
DDB-4	32.1	912	160	Aug 1700	1.4	345.1	2.64
VVS-8	95.0	1000	566	Jun 0800	36.0	418.3	2.39
VVS-8	95.0	1000	566	Jun 0800	36.0	418.3	2.39
VVS-3	10.7	155	118	Oct 1400	4.4	367.9	0.42
VVS-7	95.0	500	330	Jun 0800	36.0	418.3	1.20
VVS-5	10.6	336	212	Oct 1400	4.4	335.8	1.00
VVS-8	95.0	1000	566	Jun 0800	36.0	418.3	2.39
VVS-6	10.6	468	248	Oct 1400	4.4	335.8	1.39
VVS-7	10.6	624	330	Oct 1400	4.4	335.8	1.86

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)
VVS-2	2.7	0.06	0.0	0.00	0
DDB-4	16.7	0.36	0.0	0.00	0
DDB-4	16.7	0.36	0.0	0.00	0
DDB-4	16.7	0.36	0.0	0.00	0
VVS-8	19.0	0.41	0.0	0.00	0
VVS-8	19.0	0.41	0.0	0.00	0
VVS-3	3.8	0.08	0.0	0.00	0
VVS-7	10.7	0.23	0.0	0.00	0
VVS-5	6.9	0.15	0.0	0.00	0
VVS-8	19.0	0.41	0.0	0.00	0
VVS-6	8.0	0.17	0.0	0.00	0
VVS-7	10.7	0.23	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 (m²)	Space L/(s-m²)
VVS-2							
Lobby Second South	1	95.0	Jun 0800	4700	36.0	418.3	11.24
DDB-4							
Auditorium South	1	32.1	Aug 1700	1586	1.4	345.1	4.60
DDB-4							
Auditorium South	1	32.1	Aug 1700	1586	1.4	345.1	4.60
DDB-4							
Auditorium South	1	32.1	Aug 1700	1586	1.4	345.1	4.60

Zone Sizing Summary for AHU 2-2

Project Name: CSUF
Prepared by: psuae

10/31/2005
02:13AM

Zone Name / Space Name	Mult.	Cooling Sensible (kW)	Time of Load	Air Flow (L/s)	Heating Load (kW)	Floor Area (m²)	Space L/(s-m²)
VVS-8							
Lobby Second South	1	95.0	Jun 0800	4700	36.0	418.3	11.24
VVS-8							
Lobby Second South	1	95.0	Jun 0800	4700	36.0	418.3	11.24
VVS-3							
Office Second South	3	0.0	Jan 1800	2	0.0	10.7	0.21
Library	1	10.6	Oct 1400	524	4.4	335.8	1.56
VVS-7							
Lobby Second South	1	95.0	Jun 0800	4700	36.0	418.3	11.24
VVS-5							
Library	1	10.6	Oct 1400	524	4.4	335.8	1.56
VVS-8							
Lobby Second South	1	95.0	Jun 0800	4700	36.0	418.3	11.24
VVS-6							
Library	1	10.6	Oct 1400	524	4.4	335.8	1.56
VVS-7							
Library	1	10.6	Oct 1400	524	4.4	335.8	1.56

Air System Design Load Summary for AHU 2-2

Project Name: CSUF
Prepared by: psuae

10/31/2005
02:13AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1500 COOLING OA DB / WB 35.0 °C / 24.4 °C			HEATING DATA AT DES HTG HEATING OA DB / WB -9.4 °C / -11.0 °C		
ZONE LOADS	**Details**	**Sensible (W)**	**Latent (W)**	**Details**	**Sensible (W)**	**Latent (W)**
Window & Skylight Solar Loads	1897 m²	206086	-	1897 m²	-	-
Wall Transmission	2097 m²	5139	-	2097 m²	8206	-
Roof Transmission	0 m²	0	-	0 m²	0	-
Window Transmission	1897 m²	59919	-	1897 m²	193556	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	0 m²	0	-	0 m²	0	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	9725 W	5944	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	0 W	0	-	0	0	-
People	4803	294336	306098	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	**-**	**571423**	**306098**	**-**	**201763**	**0**
Zone Conditioning	-	295683	306098	-	59032	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	70%	0	-	0	0	-
Plenum Lighting Load	30%	2917	-	0	0	-
Return Fan Load	7400 L/s	0	-	3499 L/s	0	-
Ventilation Load	5080 L/s	-30934	-66723	3499 L/s	71327	0
Supply Fan Load	7400 L/s	20200	-	3499 L/s	-10469	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**287867**	**239376**	**-**	**119891**	**0**
Central Cooling Coil	-	282970	239381	-	0	0
Terminal Reheat Coils	-	0	-	-	119891	-
>> Total Conditioning	**-**	**282970**	**239381**	**-**	**119891**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Air System Sizing Summary for AHU-S 1

Project Name: CSUF
Prepared by: psuae

10/31/2005
02:14AM

Air System Information

Air System Name	**AHU-S 1**	Number of zones	**1**
Equipment Class	**PKG ROOF**	Floor Area	**141.7** m²
Air System Type	**VAV**	Location	**Washington, Dist. of Columbia**

Sizing Calculation Information

Zone and Space Sizing Method:

Zone L/s	**Peak zone sensible load**	Calculation Months	**Jan to Dec**
Space L/s	**Individual peak space loads**	Sizing Data	**User-Modified**

Central Cooling Coil Sizing Data

Total coil load	**33.1**	kW	Load occurs at	**Jun 0800**	
Sensible coil load	**33.1**	kW	OA DB / WB	**25.6 / 21.1**	°C
Coil L/s at Jun 0800	**2312**	L/s	Entering DB / WB	**25.3 / 8.4**	°C
Max block L/s	**2625**	L/s	Leaving DB / WB	**13.5 / 2.3**	°C
Sum of peak zone L/s	**2625**	L/s	Coil ADP	**12.1**	°C
Sensible heat ratio	**1.000**		Bypass Factor	**0.100**	
m²/kW	**4.3**		Resulting RH	**0**	%
W/m²	**233.3**		Design supply temp.	**12.7**	°C
Water flow @ 5.6 °K rise	**N/A**		Zone T-stat Check	**1 of 1**	OK
			Max zone temperature deviation	**0.0**	°K

Supply Fan Sizing Data

Actual max L/s	**2625**	L/s	Fan motor BHP	**3.80**	BHP
Standard L/s	**2619**	L/s	Fan motor kW	**2.83**	kW
Actual max L/(s-m²)	**18.53**	L/(s-m²)	Fan static	**583**	Pa

Outdoor Ventilation Air Data

Design airflow L/s	**0**	L/s	l/s/person	**0.00**	l/s/person
L/(s-m²)	**0.00**	L/(s-m²)			

Zone Sizing Summary for AHU-S 1

Project Name: CSUF
Prepared by: psuae

10/31/2005
02:14AM

Air System Information

Air System Name ..... **AHU-S 1**
Equipment Class ..... **PKG ROOF**
Air System Type ..... **VAV**

Number of zones **1**
Floor Area ..... **141.7** m²
Location ..... **Washington, Dist. of Columbia**

Sizing Calculation Information

Zone and Space Sizing Method:

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

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **User-Modified**

Zone Sizing Data

Zone Name	Maximum Cooling Sensible (kW)	Design Air Flow (L/s)	Minimum Air Flow (L/s)	Time of Peak Load	Maximum Heating Load (kW)	Zone Floor Area (m²)	Zone L/(s-m²)
Zone 1	27.6	2625	26	Jun 0800	17.8	141.7	18.53

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	0.0	-	6.5	0.14	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 (m²)	Space L/(s-m²)
Zone 1							
Ground Stairwell North	1	0.6	Jul 1800	43	0.9	51.4	0.85
First Stairwell North	1	9.5	Jun 1600	705	5.9	32.7	21.57
Second Starwell North	1	9.5	Jun 1600	706	5.9	36.1	19.55
Third Stairwell North	1	8.6	Jun 0800	642	5.1	21.5	29.84

Air System Design Load Summary for AHU-S 1

Project Name: CSUF
Prepared by: psuae

10/31/2005
02:14AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jun 0800 COOLING OA DB / WB 25.6 °C / 21.1 °C			HEATING DATA AT DES HTG HEATING OA DB / WB -9.4 °C / -11.0 °C		
ZONE LOADS	**Details**	**Sensible (W)**	**Latent (W)**	**Details**	**Sensible (W)**	**Latent (W)**
Window & Skylight Solar Loads	170 m²	25871	-	170 m²	-	-
Wall Transmission	96 m²	316	-	96 m²	922	-
Roof Transmission	0 m²	0	-	0 m²	0	-
Window Transmission	170 m²	1206	-	170 m²	16924	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	0 m²	0	-	0 m²	0	-
Floor Transmission	51 m²	0	-	51 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	306 W	226	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	0 W	0	-	0	0	-
People	0	0	0	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	**-**	**27618**	**0**	**-**	**17847**	**0**
Zone Conditioning	-	30529	0	-	7076	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	2312 L/s	0	-	26 L/s	0	-
Ventilation Load	0 L/s	0	0	0 L/s	0	0
Supply Fan Load	2312 L/s	2525	-	26 L/s	-612	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**33054**	**0**	**-**	**6464**	**0**
Central Cooling Coil	-	33054	0	-	-36	0
Zone Heating Unit Coils	-	0	-	-	6500	-
>> Total Conditioning	**-**	**33054**	**0**	**-**	**6464**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Air System Sizing Summary for AHU-S 2

Project Name: CSUF
Prepared by: psuae

10/31/2005
02:15AM

Air System Information

Air System Name	**AHU-S 2**	Number of zones	**1**
Equipment Class	**PKG ROOF**	Floor Area	**142.3** m²
Air System Type	**VAV**	Location	**Washington, Dist. of Columbia**

Sizing Calculation Information

Zone and Space Sizing Method:

Zone L/s	**Peak zone sensible load**	Calculation Months	**Jan to Dec**
Space L/s	**Individual peak space loads**	Sizing Data	**User-Modified**

Central Cooling Coil Sizing Data

Total coil load	**36.4**	kW	Load occurs at	**Jun 0800**	
Sensible coil load	**36.4**	kW	OA DB / WB	**25.6 / 21.1**	°C
Coil L/s at Jun 0800	**2432**	L/s	Entering DB / WB	**25.4 / 8.4**	°C
Max block L/s	**2625**	L/s	Leaving DB / WB	**13.0 / 2.1**	°C
Sum of peak zone L/s	**2625**	L/s	Coil ADP	**11.6**	°C
Sensible heat ratio	**1.000**		Bypass Factor	**0.100**	
m²/kW	**3.9**		Resulting RH	**0**	%
W/m²	**255.9**		Design supply temp.	**12.7**	°C
Water flow @ 5.6 °K rise	**N/A**		Zone T-stat Check	**1 of 1**	OK
			Max zone temperature deviation	**0.0**	°K

Supply Fan Sizing Data

Actual max L/s	**2625**	L/s	Fan motor BHP	**3.80**	BHP
Standard L/s	**2619**	L/s	Fan motor kW	**2.83**	kW
Actual max L/(s-m²)	**18.45**	L/(s-m²)	Fan static	**583**	Pa

Outdoor Ventilation Air Data

Design airflow L/s	**0**	L/s	l/s/person	**0.00**	l/s/person
L/(s-m²)	**0.00**	L/(s-m²)			

Zone Sizing Summary for AHU-S 2

Project Name: CSUF
Prepared by: psuae

10/31/2005
02:15AM

Air System Information

Air System Name ..... **AHU-S 2**
Equipment Class ..... **PKG ROOF**
Air System Type ..... **VAV**

Number of zones **1**
Floor Area ..... **142.3** m²
Location ..... **Washington, Dist. of Columbia**

Sizing Calculation Information

Zone and Space Sizing Method:

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

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **User-Modified**

Zone Sizing Data

Zone Name	Maximum Cooling Sensible (kW)	Design Air Flow (L/s)	Minimum Air Flow (L/s)	Time of Peak Load	Maximum Heating Load (kW)	Zone Floor Area (m²)	Zone L/(s-m²)
Zone 1	31.0	2625	26	Jun 0800	17.8	142.3	18.45

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	0.0	-	6.5	0.14	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 (m²)	Space L/(s-m²)
Zone 1							
Ground Stairwell South	1	0.6	Jul 1600	44	0.9	52.0	0.85
First Stairwell South	1	10.6	Jun 0800	789	5.9	32.7	24.12
Second Starwell South	1	10.6	Jun 0800	789	5.9	36.1	21.86
Third Stairwell South	1	9.3	Jun 0800	693	5.1	21.5	32.23

Air System Design Load Summary for AHU-S 2

Project Name: CSUF
Prepared by: psuae

10/31/2005
02:15AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jun 0800 COOLING OA DB / WB 25.6 °C / 21.1 °C			HEATING DATA AT DES HTG HEATING OA DB / WB -9.4 °C / -11.0 °C		
ZONE LOADS	**Details**	**Sensible (W)**	**Latent (W)**	**Details**	**Sensible (W)**	**Latent (W)**
Window & Skylight Solar Loads	170 m²	29242	-	170 m²	-	-
Wall Transmission	96 m²	332	-	96 m²	922	-
Roof Transmission	0 m²	0	-	0 m²	0	-
Window Transmission	170 m²	1206	-	170 m²	16924	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	0 m²	0	-	0 m²	0	-
Floor Transmission	51 m²	0	-	51 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	307 W	240	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	0 W	0	-	0	0	-
People	0	0	0	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	**-**	**31020**	**0**	**-**	**17847**	**0**
Zone Conditioning	-	33771	0	-	7076	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	2432 L/s	0	-	26 L/s	0	-
Ventilation Load	0 L/s	0	0	0 L/s	0	0
Supply Fan Load	2432 L/s	2646	-	26 L/s	-612	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**36417**	**0**	**-**	**6463**	**0**
Central Cooling Coil	-	36417	0	-	-37	0
Zone Heating Unit Coils	-	0	-	-	6500	-
>> Total Conditioning	**-**	**36417**	**0**	**-**	**6463**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		