MEP Calculations
Volume 2

Penn State Solar Decathlon Team
MorningStar: Under.One.Sun
Penn State

Faculty Advisor: David Riley

August 7, 2007

Calculations

Table of Contents

Water Use Estimate

Water Use Estimate

Activity	gallons / use	# uses per day	# days of use	gallons used in contest	safety factor	Total Gallons	Water Type
Dishwasher	10	1	4	40	1.10	44.00	HOT
Washing Machine	25	1	2	50	1.10	55.00	HOT
Cooking (water vap.)	0.75	1	3	2.25	1.10	2.48	HOT
Shower Tests	15	2	5	150	1.20	180.00	HOT
HPWH Tank (WH-1)	38	filling only			1.00	38.00	Cold
Solar DHW HTX	1	filling only			1.50	1.50	Cold
20 Gal Heat Storage Tank	20	filling only			1.00	20.00	Cold
DHW Plumbing	2	filling only			1.50	3.00	Cold
Dry Cooler	2	filling only			1.50	3.00	Cold
Radiant Floor	20	filling only			1.50	30.00	Cold
Solar Heat Storage Tank	52	filling only			1.10	57.20	Cold
Solar Loop	4	filling only			1.10	4.40	Cold
Hydronic Plumbing	4	filling only			1.50	6.00	Cold
Heat Pump HTX	2	filling only			1.50	3.00	Cold
South Wall Milk Bottles	128	filling only			1.00	128.00	Cold
Plant Watering	50	1			1.00	500.00	Cold
Rain Garden	1225	filling only			1.00	1225.00	Cold

Total Gallons Needed - NO safety factor		1790
Total Gallons Needed w/ safety factor		2301
Overall Safety Factor		1.29

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Team name:	115 Penn State
Quantity of water required in U.S. gallons:	2300 gallons
Number of filling locations:	2
Number of removal locations:	2
Will vegetation grown on site be eaten? (Y/N):	yes
Pre-water delivery vegetation watering source (s):	none
Post-water delivery vegetation watering source (s):	none

Save Record Cancel

Mechanical Load Calculations

Radiant Design Details

Project #: 1
Date: Feb 02, 2007
Prepared For: Penn State

Penn State University 104 Engineering Unit A University Park, PA 16802
Prepared By: Angela Lewis Phone: 7035057350 Email: ama259@psu.edu

Project Summary

Project #:	1
Project Name:	Morningstar PSU Solar D House
Location:	Washington DC
CloseDate:	
Engineer:	Angela Lewis
Design Data Location:	(User-Specified Location)
Outdoor Temperature:	3 °F
Wind Speed:	22 mph
Total Area:	625 ft²
Construction Quality:	Best
Rooms Requiring Supplemental Heat :	Living Room - Floorplan 1 Kitchen - Floorplan 1 Bathroom - Floorplan 1
Water Source 1 :	2.3 USGPM @ 3.4 ft(H2O) Head (incl S&R and device)
Total Loops:	6
Total Manifolds:	3
Total Zones:	3
Min. Tubing Required:	1,059 ft
RFH Glycol Level:	100% Water
Design Temp. Drop:	10 °F
Radiant Tubing Volume:	9.7 gallons(US)
Volume Water:	9.7 gallons(US)
Volume Glycol:	0 gallons(US)
Total Load:	16,023 Btu/hr
Total Radiant Load:	10,305 Btu/hr

Zone Design Summary

Zone 1

Area Serviced:	395 ft²	**Rooms Serviced:**	Living Room - Floorplan 1
Total Loops:	3		
Total Flowrate:	1.5 USGPM		
Maximum Head Loss:	2.4 ft(H2O)		

Zone 3

Area Serviced:	180 ft²	**Rooms Serviced:**	Kitchen - Floorplan 1
Total Loops:	2		
Total Flowrate:	0.7 USGPM		
Maximum Head Loss:	0.9 ft(H2O)		

Penn State University 104 Engineering Unit A University Park, PA 16802
Prepared By: Angela Lewis Phone: 7035057350 Email: ama259@psu.edu

Zone 4

Area Serviced:	50 ft²	**Rooms Serviced:**	Bathroom - Floorplan 1
Total Loops:	1		
Total Flowrate:	0.1 USGPM		
Maximum Head Loss:	0.1 ft(H2O)		

Manifold And Water Temperature Summary

Water Source 1 (104.7 °F)

Area Serviced:	625 ft²	**Total Flowrate:**	2.3 USGPM
Total Manifolds:	3	**Maximum Head Loss:**	3.4 ft(H2O)
Total Circuits:	6	**Controls:**	Tempering Valve

Manifold	Zone Control	# Circuits	Flow Rate (USGPM)	Head Loss (ft(H2O))	Max. Water Temp. (°F)	# Actuators
Manifold 1	Zone valves	3	1.5	2.4	105	0
Manifold 2	Zone valves	2	0.7	0.9	105	0
Manifold 3	Zone valves	1	0.1	0.1	105	0

Radiant Heating System Design

Living Room - Floorplan 1

Total Area:	395 ft²
Heated Area:	395 ft²
Total Heat Loss:	10,338 Btu/hr
Supplemental Heat:	(2,800) Btu/hr
Total Radiant Load:	6,686 Btu/hr
Design Fluid Temp. Drop	10 °F
Floor Unit Load:	16.9 Btu/hr/ft²

Living Room/Floor

#	Manifold	Length (ft)	Leader Length (ft)	Tube Spacing (in)	Flow Rate (USGPM)	Head Loss (ft(H2O))	Valve Turns	Actuator
1	Manifold 1	218	10.0	8	0.5	2.4	4.0	No
2	Manifold 1	218	10.0	8	0.5	2.4	4.0	No
3	Manifold 1	218	10.0	8	0.5	2.4	4.0	No

Radiant Design Details

Project #: 1
Date: Feb 02, 2007
Prepared For: Penn State

Penn State University 104 Engineering Unit A University Park, PA 16802
Prepared By: Angela Lewis Phone: 7035057350 Email: ama259@psu.edu

Kitchen - Floorplan 1

Total Area:	180 ft²
Heated Area:	180 ft²
Total Heat Loss:	4,733 Btu/hr
Supplemental Heat:	(1,275) Btu/hr
Total Radiant Load:	3,069 Btu/hr
Design Fluid Temp. Drop	10 °F
Floor Unit Load:	17.1 Btu/hr/ft²

Kitchen/Floor

#	Manifold	Length (ft)	Leader Length (ft)	Tube Spacing (in)	Flow Rate (USGPM)	Head Loss (ft(H2O))	Valve Turns	Actuator
1	Manifold 2	155	10.0	8	0.3	0.9	4.0	No
2	Manifold 2	155	10.0	8	0.3	0.9	4.0	No

Bathroom - Floorplan 1

Total Area:	50 ft²
Heated Area:	50 ft²
Total Heat Loss:	952 Btu/hr
Supplemental Heat:	(300) Btu/hr
Total Radiant Load:	550 Btu/hr
Design Fluid Temp. Drop	10 °F
Floor Unit Load:	11 Btu/hr/ft²

Bathroom/Floor

#	Manifold	Length (ft)	Leader Length (ft)	Tube Spacing (in)	Flow Rate (USGPM)	Head Loss (ft(H2O))	Valve Turns	Actuator
1	Manifold 3	95	10.0	8	0.1	0.1	4.0	No

Radiant Panel Summary

Project #: 1
Date: Jul 07, 2007
Prepared For: Penn State

Penn State University 104 Engineering Unit A University Park, PA 16802
Prepared By: Angela Lewis Phone: 7035057350 Email: ama259@psu.edu

Total Area: 625 ft² Total Heat Load: 16,023 Btu/hr Total Flowrate: 2.3 USGPM Maximum Head Loss: 2.4 ft(H2O)

Floorplan 1

Room	Heating	Zone #	Heated Area	Unheated Area	Construction	Attachment Method	Tube Type	Tube Spacing	Ldr. Len	Loop Length	# Loops	Room Load per ft²	Surface Temp	Design Temp Drop	Flowrate (Total)	Head Loss	Fluid Temp Req.	Fluid Temp Supplied
Living Room	Floor	1	395	0	Suspended / Joist 16"	Joist Trak Plates	hePEX 1/2"	8	10	218	3	16.9	73.5	10	1.5	2.4	104	105
Kitchen	Floor	3	180	0	Suspended / Joist 16"	Joist Trak Plates	hePEX 1/2"	8	10	155	2	17.1	73.5	10	0.69	0.88	105	105
Bathroom	Floor	4	50	0	Suspended / Joist 16"	Joist Trak Plates	hePEX 1/2"	8	10	95	1	11	70.5	10	0.13	0.09	94	105

Area = ft²; Spacing = in; Length = ft; Unit Heat = Btu/hr/ft²; Temperature = °F; Flow Rate = USGPM; Head Loss = ft(H2O)

* User-Specified Climate Data - Created using Wirsbo Advanced Design Suite - 6.4.1

OCT 2-4 ONLY

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System Checksums

By Souhland Industries

Heat Pump

Incremental Heat Pump

COOLING COIL PEAK

Peaked at Time: Mo/Hr:
Outside Air: OADB/WB/HR: Sum of Peaks

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	296	0	296	2
Skylite Cond	-35	0	-35	0
Roof Cond	50	0	50	0
Glass Solar	8,041	0	8,041	58
Glass Cond	-1,400	0	-1,400	-10
Wall Cond	294	0	294	2
Partition	-301		-301	-2
Exposed Floor	-583		-583	-4
Infiltration	-185		-185	-1
Sub Total ==>	6,176	0	6,176	45
Internal Loads				
Lights	2,566	0	2,566	19
People	1,000		1,000	7
Misc	3,861	0	3,861	28
Sub Total ==>	7,427	0	7,427	54
Ceiling Load	0	0	0	0
Ventilation Load	0	0	0	0
Dehumid. Ov Sizing			0	0
Ov/Undr Sizing	190		190	1
Exhaust Heat		0	0	0
Sup. Fan Heat			0	0
Ret. Fan Heat		0	0	0
Duct Heat Pkup		0	0	0
Reheat at Design			0	0
Grand Total ==>	13,792	0	13,792	100.00

CLG SPACE PEAK

Mo/Hr: Sum of
OADB: Peaks

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	296	2
Skylite Cond	-35	0
Roof Cond	50	0
Glass Solar	8,041	61
Glass Cond	-1,400	-11
Wall Cond	294	2
Partition	-301	-2
Exposed Floor	-583	-4
Infiltration	-205	-2
Sub Total ==>	6,155	46
Internal Loads		
Lights	2,566	19
People	500	4
Misc	3,861	29
Sub Total ==>	6,927	52
Ceiling Load	0	0
Ventilation Load	0	0
Ov/Undr Sizing	190	1
Grand Total ==>	13,272	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 42

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	-147	-147	0.41
Roof Cond	-102	-102	0.29
Glass Solar	0	0	0.00
Glass Cond	-5,694	-5,694	15.98
Wall Cond	-843	-843	2.37
Partition	-782	-782	2.19
Exposed Floor	-1,012	-1,012	2.84
Infiltration	-1,072	-1,072	3.01
Sub Total ==>	-9,653	-9,653	27.09
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	0	0	0.00
Sub Total ==>	0	0	0.00
Ceiling Load	0	0	0.00
Ventilation Load	0	0	0.00
Ov/Undr Sizing	-25,972	-25,972	72.91
Exhaust Heat		0	0.00
OA Preheat Diff.		0	0.00
RA Preheat Diff.		0	0.00
Additional Reheat		0	0.00
Grand Total ==>	-35,625	-35,625	100.00

TEMPERATURES

	Cooling	Heating
SADB	55.0	125.0
Plenum	74.0	74.0
Return	74.0	74.0
Ret/OA	74.0	74.0
Fn MtrTD	0.1	0.0
Fn BldTD	0.2	0.0
Fn Frict	0.5	0.0

AIRFLOWS

	Cooling	Heating
Vent	0	0
Infil	30	30
Supply	627	627
MinStop/Rh	0	0
Return	657	657
Exhaust	30	30
Rm Exh	0	0
Auxiliary	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	0.0	0.0
cfm/ft²	0.96	0.96
cfm/ton	545.20	
ft²/ton	566.40	
Btu/hr·ft²	21.19	-54.72
No. People	2	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter HR gr/lb	Leave DB °F	Leave WB °F	Leave HR gr/lb
Main Clg	1.2	13.8	13.3	626.6	74.0	59.1	51.3	54.2	51.2	51.2
Aux Clg	0.0	0.0	0.0	0	0	0	0	0	0	0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	1.2	13.8								

AREAS

	Gross Total ft²	Glass ft²	Glass (%)
Floor	651		
Part	530		
ExFlr	651		
Roof	137	9	7
Wall	1,007	349	35

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-35.6	626.6	74.0	125.0
Aux Htg	0.0	0	0	0
Preheat	0.0	0	0	0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-35.6			

Project Name: Solar House
Dataset Name: Y:\PSU Solar Decathlon\SD Nov 21 Southland\Trace Load\SolarD model for DavePeters.trc

TRACE® 700 v6.0 calculated at 01:18 PM on 02/25/2007
Alternative - 1 System Checksums Report Page 1 of 2

Mechanical Cooling Load Calculations

Room Checksums
By Souhland Industries

Bedroom

COOLING COIL PEAK

Peaked at Time: Mo/Hr: 10 / 14
Outside Air: OADB/WB/HR: 68 / 57 / 52

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	0	0	0	0
Skylite Cond	0	0	0	0
Roof Cond	0	0	0	0
Glass Solar	1,684	0	1,684	87
Glass Cond	-263	0	-263	-14
Wall Cond	130	0	130	7
Partition	-95		-95	-5
Exposed Floor	-128		-128	-7
Infiltration	-42		-42	-2
Sub Total ==>	1,286	0	1,286	66
Internal Loads				
Lights	657	0	657	34
People	0		0	0
Misc	0	0	0	0
Sub Total ==>	657	0	657	34
Ceiling Load	0	0	0	0
Ventilation Load	0	0	0	0
Dehumid. Ov Sizing			0	0
Ov/Undr Sizing	0		0	0
Exhaust Heat		0	0	0
Sup. Fan Heat			0	0
Ret. Fan Heat		0	0	0
Duct Heat Pkup		0	0	0
Reheat at Design			0	0
Grand Total ==>	1,943	0	1,943	100.00

CLG SPACE PEAK

Mo/Hr: 10 / 14
OADB: 68

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	0	0
Skylite Cond	0	0
Roof Cond	0	0
Glass Solar	1,684	87
Glass Cond	-263	-14
Wall Cond	130	7
Partition	-95	-5
Exposed Floor	-128	-7
Infiltration	-48	-2
Sub Total ==>	1,280	66
Internal Loads		
Lights	657	34
People	0	0
Misc	0	0
Sub Total ==>	657	34
Ceiling Load	0	0
Ventilation Load	0	0
Ov/Undr Sizing	0	0
Exhaust Heat		
Sup. Fan Heat		
Ret. Fan Heat		
Duct Heat Pkup		
Reheat at Design		
Grand Total ==>	1,937	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 42

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0
Skylite Cond	0	0	0
Roof Cond	0	0	0
Glass Solar	0	0	0
Glass Cond	-984	-984	19
Wall Cond	-263	-263	5
Partition	-211	-211	4
Exposed Floor	-220	-220	4
Infiltration	-245	-245	5
Sub Total ==>	-1,924	-1,924	37
Internal Loads			
Lights	0	0	0
People	0	0	0
Misc	0	0	0
Sub Total ==>	0	0	0
Ceiling Load	0	0	0
Ventilation Load	0	0	0
Ov/Undr Sizing	-3,274	-3,274	63
Exhaust Heat		0	0
OA Preheat Diff.		0	0
RA Preheat Diff.		0	0
Additional Reheat		0	0
System Plenum Heat		0	0
Grand Total ==>	-5,198	-5,198	100.00

TEMPERATURES

	Cooling	Heating
SADB	55.0	125.0
Plenum	74.0	74.0
Return	74.0	74.0
Ret/OA	74.0	74.0
Fn MtrTD	0.1	0.0
Fn BldTD	0.2	0.0
Fn Frict	0.5	0.0

AIRFLOWS

	Cooling	Heating
Vent	0	0
Infil	7	7
Supply	91	91
MinStop/Rh	0	0
Return	98	98
Exhaust	7	7
Rm Exh	0	0
Auxil	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	0.0	0.0
cfm/ft²	0.67	0.67
cfm/ton	564.83	
ft²/ton	849.36	
Btu/hr·ft²	14.13	-37.81
No. People	0	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter HR gr/lb	Leave DB °F	Leave WB °F	Leave HR gr/lb
Main Clg	0.2	1.9	1.9	91	74.0	59.1	51.3	54.2	51.2	51.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.2	1.9								

AREAS

	Gross Total ft²	Glass ft²	Glass (%)
Floor	138		
Part	143		
ExFlr	138		
Roof	0	0	0
Wall	266	60	23

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-5.2	91	74.0	125.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-5.2			

Room Checksums
By Souhland Industries

Breezeway

COOLING COIL PEAK

Peaked at Time: Mo/Hr: 10 / 16
Outside Air: OADB/WB/HR: 68 / 57 / 50

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	0	0	0	0
Skylite Cond	0	0	0	0
Roof Cond	0	0	0	0
Glass Solar	1,673	0	1,673	150
Glass Cond	-576	0	-576	-52
Wall Cond	22	0	22	2
Partition	-54		-54	-5
Exposed Floor	-106		-106	-10
Infiltration	-35		-35	-3
Sub Total ==>	924	0	924	83
Internal Loads				
Lights	0	0	0	0
People	0		0	0
Misc	0	0	0	0
Sub Total ==>	0	0	0	0
Ceiling Load	0	0	0	0
Ventilation Load	0	0	0	0
Dehumid. Ov Sizing			0	0
Ov/Undr Sizing	190		190	17
Exhaust Heat		0	0	0
Sup. Fan Heat			0	0
Ret. Fan Heat		0	0	0
Duct Heat Pkup		0	0	0
Reheat at Design			0	0
Grand Total ==>	1,114	0	1,114	100.00

CLG SPACE PEAK

Mo/Hr: 10 / 16
OADB: 68

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	0	0
Skylite Cond	0	0
Roof Cond	0	0
Glass Solar	1,673	150
Glass Cond	-576	-52
Wall Cond	22	2
Partition	-54	-5
Exposed Floor	-106	-10
Infiltration	-32	-3
Sub Total ==>	927	83
Internal Loads		
Lights	0	0
People	0	0
Misc	0	0
Sub Total ==>	0	0
Ceiling Load	0	0
Ventilation Load	0	0
Ov/Undr Sizing	190	17
Grand Total ==>	1,117	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 42

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0
Skylite Cond	0	0	0
Roof Cond	0	0	0
Glass Solar	0	0	0
Glass Cond	-2,418	-2,418	81
Wall Cond	-67	-67	2
Partition	-168	-168	6
Exposed Floor	-182	-182	6
Infiltration	-163	-163	5
Sub Total ==>	-2,998	-2,998	100
Internal Loads			
Lights	0	0	0
People	0	0	0
Misc	0	0	0
Sub Total ==>	0	0	0
Ceiling Load	0	0	0
Ventilation Load	0	0	0
Ov/Undr Sizing	0	0	0
Exhaust Heat		0	0
OA Preheat Diff.		0	0
RA Preheat Diff.		0	0
Additional Reheat		0	0
System Plenum Heat		0	0
Grand Total ==>	-2,998	-2,998	100.00

TEMPERATURES

	Cooling	Heating
SADB	55.0	125.0
Plenum	74.0	74.0
Return	74.0	74.0
Ret/OA	74.0	74.0
Fn MtrTD	0.1	0.0
Fn BldTD	0.2	0.0
Fn Frict	0.5	0.0

AIRFLOWS

	Cooling	Heating
Vent	0	0
Infil	5	5
Supply	53	53
MinStop/Rh	0	0
Return	57	57
Exhaust	5	5
Rm Exh	0	0
Auxil	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	0.0	0.0
cfm/ft²	0.46	0.46
cfm/ton	566.57	
ft²/ton	1,224.62	
Btu/hr·ft²	9.80	-26.30
No. People	0	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter gr/lb	Leave DB °F	Leave WB °F	Leave gr/lb
Main Clg	0.1	1.1	1.1	53	74.0	59.1	51.3	54.2	51.2	51.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.1	1.1								

AREAS

	Gross Total ft²	Glass ft²	Glass (%)
Floor	114		
Part	114		
ExFlr	114		
Roof	0	0	0
Wall	200	148	74

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-3.0	53	74.0	125.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-3.0			

Room Checksums
By Souhland Industries

Dining/Living

COOLING COIL PEAK

Peaked at Time: Mo/Hr: 10 / 15
Outside Air: OADB/WB/HR: 68 / 57 / 52

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	0	0	0	0
Skylite Cond	0	0	0	0
Roof Cond	0	0	0	0
Glass Solar	4,508	0	4,508	71
Glass Cond	-489	0	-489	-8
Wall Cond	143	0	143	2
Partition	-153		-153	-2
Exposed Floor	-246		-246	-4
Infiltration	-74		-74	-1
Sub Total ==>	3,690	0	3,690	58
Internal Loads				
Lights	1,254	0	1,254	20
People	1,000		1,000	16
Misc	448	0	448	7
Sub Total ==>	2,702	0	2,702	42
Ceiling Load	0	0	0	0
Ventilation Load	0	0	0	0
Dehumid. Ov Sizing			0	0
Ov/Undr Sizing	0		0	0
Exhaust Heat		0	0	0
Sup. Fan Heat			0	0
Ret. Fan Heat		0	0	0
Duct Heat Pkup		0	0	0
Reheat at Design			0	0
Grand Total ==>	6,392	0	6,392	100.00

CLG SPACE PEAK

Mo/Hr: 10 / 15
OADB: 68

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	0	0
Skylite Cond	0	0
Roof Cond	0	0
Glass Solar	4,508	77
Glass Cond	-489	-8
Wall Cond	143	2
Partition	-153	-3
Exposed Floor	-246	-4
Infiltration	-85	-1
Sub Total ==>	3,678	63
Internal Loads		
Lights	1,254	21
People	500	9
Misc	448	8
Sub Total ==>	2,202	37
Ceiling Load	0	0
Ventilation Load	0	0
Ov/Undr Sizing	0	0
Exhaust Heat		
OA Preheat Diff.		
RA Preheat Diff.		
Additional Reheat		
System Plenum Heat		
Grand Total ==>	5,881	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 42

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0
Skylite Cond	0	0	0
Roof Cond	0	0	0
Glass Solar	0	0	0
Glass Cond	-2,030	-2,030	13
Wall Cond	-277	-277	2
Partition	-403	-403	3
Exposed Floor	-420	-420	3
Infiltration	-468	-468	3
Sub Total ==>	-3,598	-3,598	23
Internal Loads			
Lights	0	0	0
People	0	0	0
Misc	0	0	0
Sub Total ==>	0	0	0
Ceiling Load	0	0	0
Ventilation Load	0	0	0
Ov/Undr Sizing	-12,186	-12,186	77
Exhaust Heat		0	0
OA Preheat Diff.		0	0
RA Preheat Diff.		0	0
Additional Reheat		0	0
System Plenum Heat		0	0
Grand Total ==>	-15,785	-15,785	100.00

TEMPERATURES

	Cooling	Heating
SADB	55.0	125.0
Plenum	74.0	74.0
Return	74.0	74.0
Ret/OA	74.0	74.0
Fn MtrTD	0.1	0.0
Fn BldTD	0.2	0.0
Fn Frict	0.5	0.0

AIRFLOWS

	Cooling	Heating
Vent	0	0
Infil	13	13
Supply	278	278
MinStop/Rh	0	0
Return	291	291
Exhaust	13	13
Rm Exh	0	0
Auxil	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	0.0	0.0
cfm/ft²	1.06	1.06
cfm/ton	521.24	
ft²/ton	492.80	
Btu/hr·ft²	24.35	-60.13
No. People	2	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter HR gr/lb	Leave DB °F	Leave WB °F	Leave HR gr/lb
Main Clg	0.5	6.4	5.9	278	74.0	59.1	51.3	54.2	50.8	49.8
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.5	6.4								

AREAS

	Gross Total ft²	Glass ft²	Glass (%)
Floor	263		
Part	273		
ExFlr	263		
Roof	0	0	0
Wall	341	124	36

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-15.8	278	74.0	125.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-15.8			

Room Checksums
By Souhland Industries

Kitchen

COOLING COIL PEAK

Peaked at Time: Mo/Hr: 10 / 15
Outside Air: OADB/WB/HR: 68 / 57 / 52

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	296	0	296	7
Skylite Cond	-35	0	-35	-1
Roof Cond	43	0	43	1
Glass Solar	44	0	44	1
Glass Cond	-31	0	-31	-1
Wall Cond	-15	0	-15	0
Partition	0		0	0
Exposed Floor	-62		-62	-2
Infiltration	-21		-21	-1
Sub Total ==>	219	0	219	5
Internal Loads				
Lights	440	0	440	11
People	0		0	0
Misc	3,413	0	3,413	84
Sub Total ==>	3,853	0	3,853	95
Ceiling Load	0	0	0	0
Ventilation Load	0	0	0	0
Dehumid. Ov Sizing			0	0
Ov/Undr Sizing	0		0	0
Exhaust Heat		0	0	0
Sup. Fan Heat			0	0
Ret. Fan Heat		0	0	0
Duct Heat Pkup		0	0	0
Reheat at Design			0	0
Grand Total ==>	4,071	0	4,071	100.00

CLG SPACE PEAK

Mo/Hr: 10 / 15
OADB: 68

	Space Sensible Btu/h	Percent Of Total (%)
	296	7
	-35	-1
	43	1
	44	1
	-31	-1
	-15	0
	0	0
	-62	-2
	-24	-1
	216	5
	440	11
	0	0
	3,413	84
	3,853	95
	0	0
	0	0
	0	0
	4,068	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 42

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0
Skylite Cond	-147	-147	1
Roof Cond	-66	-66	1
Glass Solar	0	0	0
Glass Cond	-131	-131	1
Wall Cond	-108	-108	1
Partition	0	0	0
Exposed Floor	-118	-118	1
Infiltration	-131	-131	1
Sub Total ==>	-701	-701	6
Internal Loads			
Lights	0	0	0
People	0	0	0
Misc	0	0	0
Sub Total ==>	0	0	0
Ceiling Load	0	0	0
Ventilation Load	0	0	0
Ov/Undr Sizing	-10,219	-10,219	94
Exhaust Heat		0	0
OA Preheat Diff.		0	0
RA Preheat Diff.		0	0
Additional Reheat		0	0
System Plenum Heat		0	0
Grand Total ==>	-10,920	-10,920	100.00

TEMPERATURES

	Cooling	Heating
SADB	55.0	125.0
Plenum	74.0	74.0
Return	74.0	74.0
Ret/OA	74.0	74.0
Fn MtrTD	0.1	0.0
Fn BldTD	0.2	0.0
Fn Frict	0.5	0.0

AIRFLOWS

	Cooling	Heating
Vent	0	0
Infil	4	4
Supply	192	192
MinStop/Rh	0	0
Return	196	196
Exhaust	4	4
Rm Exh	0	0
Auxil	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	0.0	0.0
cfm/ft²	2.09	2.09
cfm/ton	566.13	
ft²/ton	271.17	
Btu/hr·ft²	44.25	-118.69
No. People	0	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter HR gr/lb	Leave DB °F	Leave WB °F	Leave HR gr/lb
Main Clg	0.3	4.1	4.1	192	74.0	59.1	51.3	54.2	51.2	51.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.3	4.1								

AREAS

	Gross Total	Glass ft²	Glass (%)
Floor	92		
Part	0		
ExFlr	92		
Roof	92	9	10
Wall	92	8	9

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-10.9	192	74.0	125.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-10.9			

Electrical Calculations

Feeder load	VA	DF	NEC Code	Demand Load
Lighting / General Receptacles (3VA/s.f.) (3VA/s.f. x 800s.f. = 2400VA)	2400	100%	220.82(B)	2400
Small Appliance circuit loads	3000	100%	220.82(B)	3000
Washer	1500	100%	220.82(B)	1500
Car Charger	1500	100%	220.82(B)	1500
Refrigerator	1800	100%	220.82(B)	1800
Dishwasher	875	100%	220.82(B)	875
Microhood	1500	100%	220.82(B)	1500
Dryer	5600	100%	220.82(B)	5600
Cooktop	7400	100%	220.82(B)	7400
AFC-1	667	100%	220.82(B)	667
P-1	1656	100%	220.82(B)	1656
ERV-1	150	100%	220.82(B)	150
EF-1	150	100%	220.82(B)	150
P-2 THRU P-6	30	100%	220.82(B)	30
			Total	28228
			1st 10000 VA at 100%	10000
			Rest at 40%	7291.2
HPWH-1	1610	100%	220.82(C)(3)	1610
WH-1	6000	100%	220.82(C)(3)	6000
HP-1	4186	100%	220.82(C)(3)	4186
RH-1	4992	100%	220.82(C)(3)	4992
			Total (VA)	**34079.2**
			Total Demand Amps	**141.9966667**

CONDUIT SIZING FOR TYPICAL FEEDERS
2#12, #12(G), 1/2"C.
2#10, #10(G), 3/4"C.
2#8, #10(G), 3/4"C.
2#2/0, #4(G), 2"C.
3#1/0, #4(G), 2"C.

BRANCH CIRCUIT LENGTHS

Load Description: **Typical Branch Circuit # 12s**

Max Length (L):	63
Wire Size :	12
Load amps (I):	16
Voltage:	120
Connection Type:	4
# Parallel Sets:	1
Conduit Type:	N
Power Factor	0.90

Circuit Amp Ft.:	1,008
Table Value:	30.00
Multiplier:	1.18
Power Factor Index:	4

VD = 3.568 Volts, or 2.97 Percent

Load Description: **Typical Branch Circuit #10s**

Max Length (L):	67
Wire Size :	10
Load amps (I):	24
Voltage:	120
Connection Type:	4
# Parallel Sets:	1
Conduit Type:	N
Power Factor	0.90

Circuit Amp Ft.:	1,608
Table Value:	19.00
Multiplier:	1.18
Power Factor Index:	4

VD = 3.605 Volts, or 3.00 Percent

Load Description: **Typical Branch Circuit #8s**

Length (L):	150
Wire Size :	8
Load amps (I):	32
Voltage:	240
Connection Type:	4
# Parallel Sets:	1
Conduit Type:	N
Power Factor	0.90

Circuit Amp Ft.:	4,800
Table Value:	12.00
Multiplier:	1.18
Power Factor Index:	4

VD = 6.797 Volts, or 2.83 Percent

Voltage Drop Notes:

Power Factor	Index
0.70	2
0.80	3
0.90	4
0.95	5
1.00	6

Intermediate Data Results Do not enter data here

Final Result Data, Do not enter data here.

Cells for input of data

LOAD CONNECTION			
1	Balanced 3 Phase line-to-line (Delta Connected)	no multiplier	1.00
2	Balanced line-to-neutral load (Wye Connected)	multiply by	0.58
3	Balanced line-to-neutral load (Single Phase 3W)	multiply by	0.58
4	Any 2 wire load	multiply by	1.18