

Air System Sizing Summary for HVAC

Project Name: 79_qubitsint
Prepared by: D Lab

07/25/2024
08:22PM

Air System Information

Air System Name HVAC
Equipment Class SPLT AHU
Air System Type SZCAV

Number of zones 1
Floor Area 2000.0 ft²
Location Baltimore, Maryland

Sizing Calculation Information

Calculation Months Jan to Dec
Sizing Data Calculated

Zone CFM Sizing Sum of space airflow rates
Space CFM Sizing Individual peak space loads

Central Cooling Coil Sizing Data

Total coil load 4.0 Tons
Total coil load 47.7 MBH
Sensible coil load 37.3 MBH
Coil CFM at Jul 1500 1587 CFM
Max block CFM 1587 CFM
Sum of peak zone CFM 1587 CFM
Sensible heat ratio 0.782
CFM/Ton 399.1
ft²/Ton 503.1
BTU/(hr-ft²) 23.9
Water flow @ 10.0 °F rise N/A

Load occurs at Jul 1500
OA DB / WB 93.0 / 75.0 °F
Entering DB / WB 79.1 / 65.8 °F
Leaving DB / WB 57.2 / 55.8 °F
Coil ADP 54.2 °F
Bypass Factor 0.120
Resulting RH 50 %
Design supply temp. 55.0 °F
Zone T-stat Check 1 of 1 OK
Max zone temperature deviation 0.0 °F

Central Heating Coil Sizing Data

Max coil load 38.0 MBH
Coil CFM at Des Htg 1587 CFM
Max coil CFM 1587 CFM
Water flow @ 20.0 °F drop N/A

Load occurs at Des Htg
BTU/(hr-ft²) 19.0
Ent. DB / Lvg DB 59.1 / 81.4 °F

Supply Fan Sizing Data

Actual max CFM 1587 CFM
Standard CFM 1578 CFM
Actual max CFM/ft² 0.79 CFM/ft²

Fan motor BHP 0.00 BHP
Fan motor kW 0.00 kW
Fan static 0.00 in wg

Outdoor Ventilation Air Data

Design airflow CFM 280 CFM
CFM/ft² 0.14 CFM/ft²

CFM/person 70.00 CFM/person

Zone Sizing Summary for HVAC

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Sizing Calculation Information

Calculation Months Jan to Dec
Sizing Data Calculated

Zone CFM Sizing Sum of space airflow rates
Space CFM Sizing Individual peak space loads

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (CFM)	Minimum Supply Airflow (CFM)	Zone CFM/ft ²	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 20.0 °F	Zone Htg Unit Coil Load (MBH)	Zone Htg Unit Water gpm @ 20.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	1587	1587	0.79	0.0	-	0.0	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft ²)
Zone 1	34.1	Jul 1800	20.2	2000.0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 1							
Automotive Repair Shop	1	34.1	Jul 1800	1587	20.2	2000.0	0.79

Ventilation Sizing Summary for HVAC

1. Summary

Ventilation Sizing Method Sum of Space OA Airflows
Design Ventilation Airflow Rate 280 CFM

2. Space Ventilation Analysis

Zone Name / Space Name	Mult.	Floor Area (ft²)	Maximum Occupants	Maximum Supply Air (CFM)	Required Outdoor Air (CFM/person)	Required Outdoor Air (CFM/ft²)	Required Outdoor Air (CFM)	Required Outdoor Air (% of supply)	Uncorrected Outdoor Air (CFM)
Zone 1									
Automotive Repair Shop	1	2000.0	4.0	1586.7	10.00	0.12	0.0	0.0	280.0
Totals (incl. Space Multipliers)				1586.7					280.0

Air System Design Load Summary for HVAC

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	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1500			HEATING DATA AT DES HTG		
	COOLING OA DB / WB 93.0 °F / 75.0 °F			HEATING OA DB / WB 11.0 °F / 8.6 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	2704 ft²	4274	-	2704 ft²	13423	-
Roof Transmission	2000 ft²	4110	-	2000 ft²	3698	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	176 ft²	773	-	176 ft²	3115	-
Floor Transmission	2000 ft²	0	-	2000 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	2000 W	5614	-	0	0	-
Task Lighting	2000 W	6152	-	0	0	-
Electric Equipment	2000 W	6284	-	0	0	-
People	4	1635	3700	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	15% / 5%	4326	185	0%	0	0
>> Total Zone Loads	-	33169	3885	-	20236	0
Zone Conditioning	-	32229	3885	-	20456	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	1587 CFM	0	-	1587 CFM	0	-
Ventilation Load	280 CFM	5071	6519	280 CFM	17571	0
Supply Fan Load	1587 CFM	0	-	1587 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	37300	10404	-	38027	0
Central Cooling Coil	-	37300	10406	-	0	0
Central Heating Coil	-	0	-	-	38027	-
>> Total Conditioning	-	37300	10406	-	38027	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Zone Design Load Summary for HVAC

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Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1800			HEATING DATA AT DES HTG		
	COOLING OA DB / WB 89.1 °F / 73.9 °F			HEATING OA DB / WB 11.0 °F / 8.6 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	2704 ft²	5018	-	2704 ft²	13423	-
Roof Transmission	2000 ft²	3740	-	2000 ft²	3698	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	176 ft²	661	-	176 ft²	3115	-
Floor Transmission	2000 ft²	0	-	2000 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	2000 W	5837	-	0	0	-
Task Lighting	2000 W	6276	-	0	0	-
Electric Equipment	2000 W	6384	-	0	0	-
People	4	1721	3700	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	15% / 5%	4446	185	0%	0	0
>> Total Zone Loads	-	34083	3885	-	20236	0

Space Design Load Summary for HVAC

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TABLE 1.1.A. Component Loads For Space "Automotive Repair Shop" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1800 COOLING OA DB / WB 89.1 °F / 73.9 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 11.0 °F / 8.6 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	Details	(BTU/hr)	(BTU/hr)	Details	(BTU/hr)	(BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	2704 ft²	5018	-	2704 ft²	13423	-
Roof Transmission	2000 ft²	3740	-	2000 ft²	3698	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	176 ft²	661	-	176 ft²	3115	-
Floor Transmission	2000 ft²	0	-	2000 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	2000 W	5837	-	0	0	-
Task Lighting	2000 W	6276	-	0	0	-
Electric Equipment	2000 W	6384	-	0	0	-
People	4	1721	3700	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	15% / 5%	4446	185	0%	0	0
>> Total Zone Loads	-	34083	3885	-	20236	0

TABLE 1.1.B. Envelope Loads For Space "Automotive Repair Shop" In Zone "Zone 1"						
	Area	U-Value	Shade	COOLING	COOLING	HEATING
	(ft²)	(BTU/(hr-ft²-°F))	Coeff.	TRANS	SOLAR	TRANS
				(BTU/hr)	(BTU/hr)	(BTU/hr)
N EXPOSURE						
WALL	640	0.084	-	798	-	3177
S EXPOSURE						
WALL	640	0.084	-	1149	-	3177
E EXPOSURE						
WALL	640	0.084	-	1591	-	3177
DOOR	160	0.300	-	601	-	2832
W EXPOSURE						
WALL	784	0.084	-	1480	-	3892
DOOR	16	0.300	-	60	-	283
H EXPOSURE						
ROOF	2000	0.031	-	3740	-	3698

System Psychrometrics for HVAC

Project Name: 79_qubitsint
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July DESIGN COOLING DAY, 1500

TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (°F)	Specific Humidity (lb/lb)	Airflow (CFM)	CO2 Level (ppm)	Sensible Heat (BTU/hr)	Latent Heat (BTU/hr)
Ventilation Air	Inlet	93.0	0.01463	280	400	5071	6519
Vent - Return Mixing	Outlet	79.1	0.01056	1587	810	-	-
Central Cooling Coil	Outlet	57.2	0.00917	1587	810	37300	10406
Central Heating Coil	Outlet	57.2	0.00917	1587	810	0	-
Supply Fan	Outlet	57.2	0.00917	1587	810	0	-
Cold Supply Duct	Outlet	57.2	0.00917	1587	810	-	-
Zone Air	-	76.1	0.00969	1587	897	32229	3885
Return Plenum	Outlet	76.1	0.00969	1587	897	0	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1.080; At site altitude = 1.074 BTU/(hr-CFM-F)

Air Density x Heat of Vaporization x Conversion Factor: At sea level = 4746.6; At site altitude = 4720.2 BTU/(hr-CFM)

Site Altitude = 154.0 ft

TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (BTU/hr)	T-stat Mode	Zone Cond (BTU/hr)	Zone Temp (°F)	Zone Airflow (CFM)	CO2 Level (ppm)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
Zone 1	33169	Cooling	32229	76.1	1587	897	0	0

System Psychrometrics for HVAC

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WINTER DESIGN HEATING

TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (°F)	Specific Humidity (lb/lb)	Airflow (CFM)	CO2 Level (ppm)	Sensible Heat (BTU/hr)	Latent Heat (BTU/hr)
Ventilation Air	Inlet	11.0	0.00070	280	400	-17571	0
Vent - Return Mixing	Outlet	59.1	0.00070	1587	439	-	-
Central Cooling Coil	Outlet	59.1	0.00070	1587	439	0	0
Central Heating Coil	Outlet	81.4	0.00070	1587	439	38027	-
Supply Fan	Outlet	81.4	0.00070	1587	439	0	-
Cold Supply Duct	Outlet	81.4	0.00070	1587	439	-	-
Zone Air	-	69.4	0.00070	1587	447	-20456	0
Return Plenum	Outlet	69.4	0.00070	1587	447	0	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1.080; At site altitude = 1.074 BTU/(hr-CFM-F)

Air Density x Heat of Vaporization x Conversion Factor: At sea level = 4746.6; At site altitude = 4720.2 BTU/(hr-CFM)

Site Altitude = 154.0 ft

TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (BTU/hr)	T-stat Mode	Zone Cond (BTU/hr)	Zone Temp (°F)	Zone Airflow (CFM)	CO2 Level (ppm)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
Zone 1	-20236	Heating	-20456	69.4	1587	447	0	0

System Psychrometrics for HVAC

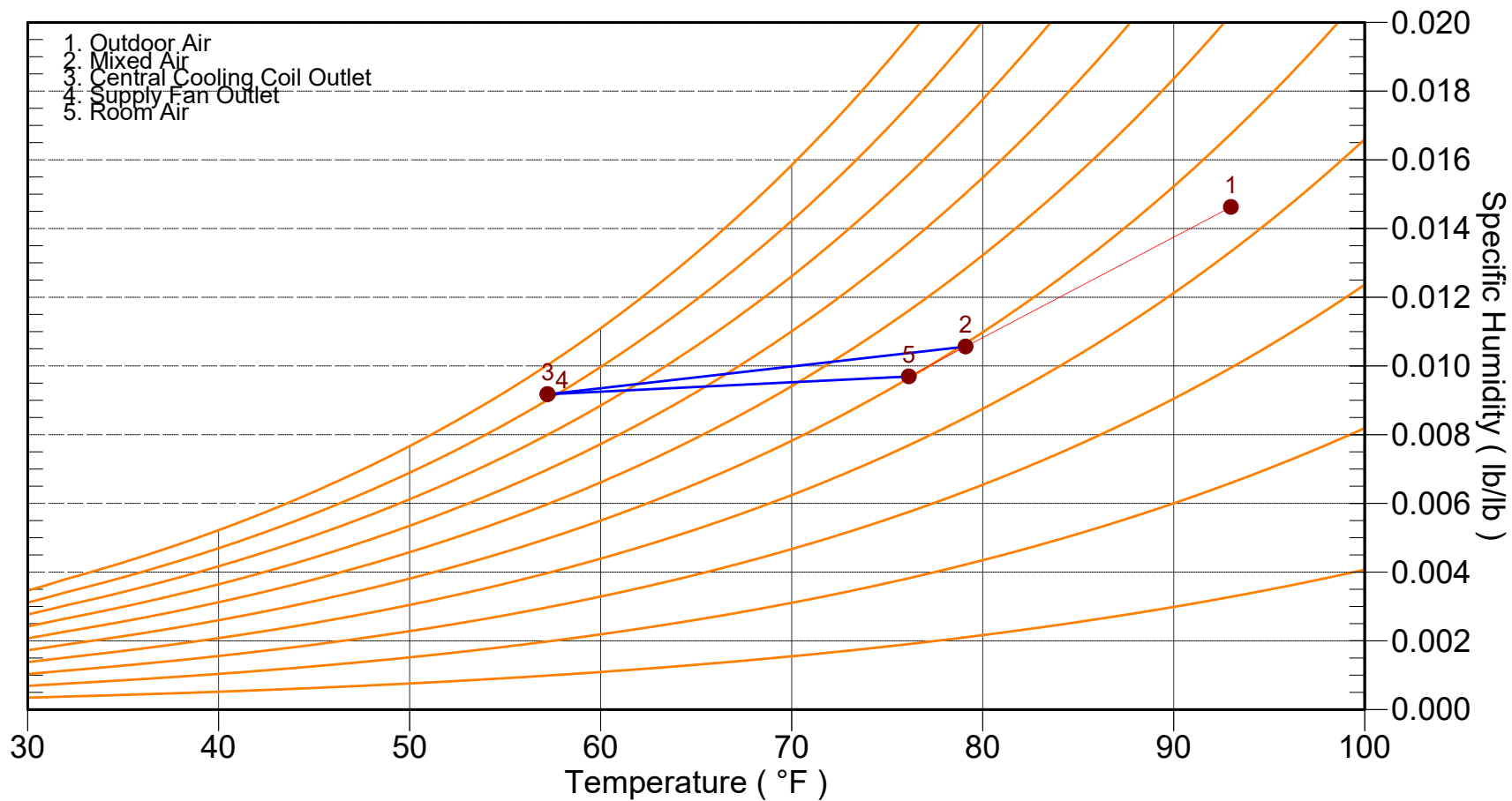
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Location: Baltimore, Maryland

Altitude: 154.0 ft.

Data for: July DESIGN COOLING DAY, 1500



System Psychrometrics for HVAC

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Location: Baltimore, Maryland
Altitude: 154.0 ft.
Data for: WINTER DESIGN HEATING

