Technical Report 1

ASHRAE Standards 62.1 & 90.1 Evaluations

Glen Burnie High School: Buildings D, E & F Glen Burnie, MD



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Executive Summary

Glen Burnie High School is a campus style high school located in Glen Burnie, MD. The campus is comprised of 6 buildings, but for the purposes of this report, only Buildings D, E & F will be evaluated. Each building was checked for compliance with sections 5 and 6 of ASHRAE Standard 62.1; Ventilation for Acceptable Indoor Air Quality, as well as ASHRAE Standard 90.1; Energy Standard for Buildings Except Low-Rise Residential Buildings.

Section 5 of Standard 62.1 focuses on the basics of mechanical systems and equipment found in buildings. It touches on such topics as ventilation requirements, air classification and filtration, dehumidification and condensate removal, and the building envelope, among others. All three buildings were found to be completely compliant with section 5.

The next section evaluated was section 6. This section states the requirements for the minimum amount of outdoor air that must be supplied to buildings based on occupancy, occupancy type, and square footage. After performing the calculations it was found that the majority of the systems within Glen Burnie High School are compliant. There were only four systems that fell slightly short of the baseline, but this was found to be caused by the assumptions made during the calculations. The systems in Building D were combined into a single larger system for the calculations, causing the critical system in the spreadsheets to affect the results of all the systems. This does not actually occur because the systems are independent. Two other systems were under due to changes in taking place in the occupancy type of some of the rooms. The third system, which serves the gymnasium and locker rooms of Building F, has higher required outdoor air rates than are actually needed because of overlapping occupancy times which would not occur during normal building operation. It is assumed that once the changes to the floor plans are completed and the occupancy overlap is taken into consideration, more accurate assumptions will be able to be made and the systems should correct themselves.

Standard 90.1 discusses the required performance and energy efficiencies for buildings. The multiple sections contain information about the climate, a more detailed look at the building envelope, HVAC equipment efficiencies, power, and lighting. The three buildings had their highest rate of non-compliance in this section. The areas that failed were building construction U-Values, and lighting power densities. These failures occurred because the buildings were originally built well before this standard went into effect. Ultimately, this makes the building exempt from many of the sections of the standard, but there were still areas that Glen Burnie High School managed to comply with. Because the buildings are in the process of a mechanical renovation, the new HVAC equipment is completely compliant with the standards. Another point to note is that the recently installed glazing units meet the specifications of the standard as well. Based on these observations, it is safe to assume that as more renovations take place, the buildings will become more compliant to the standard.

ASHRAE Standard 62.1 Section 5 Evaluation

Section 5.1: Natural Ventilation

Glen Burnie High School does not utilize natural ventilation. All ventilation is provided by the cooling/heating system.

Section 5.2: Ventilation Air Distribution

The systems in place are all installed with adjustable outdoor air intakes to modulate the amount of ventilation air supplied to the spaces. The plenums are not used to distribute ventilation air, so the system itself is responsible for distributing the ventilation air evenly to the spaces.

Section 5.3: Exhaust Duct Location

Exhaust ducts are only run through the areas that they are exhausting, and the specs require that all ducts must comply with SMACNA construction standards.

Section 5.4: Ventilation System Controls

All unit ventilators, air handling units, fan coil units, and other ventilating equipment in all three buildings are set to be energized and running when in occupied mode by the Building Automation System (BAS). In unoccupied mode, the systems are set to maintain the unoccupied heating/cooling setpoints only.

Section 5.5: Airstream Surfaces

All air-stream surfaces are made of sheet metal making them exempt to this section.

Section 5.6: Outdoor Air Intakes

All outdoor air intakes are installed with bird screens and rain hoods or louvers to prevent unwanted rain infiltration. Minimum clearances from contaminant sources as stated in table 5-1 are also maintained for all intakes.

Section 5.7: Local Capture of Contaminants

There are no contaminants created by non-combustion equipment in Glen Burnie High School, so this section does not apply.

Section 5.8: Combustion Air

The combustion exhaust created by the boilers in Building F is vented directly outdoors by way of their corresponding flues and up through a shared chimney.

Section 5.9: Particulate Matter Removal

Section 5.9 requires all filters to meet the MERV rating called for in ASHRAE Standard 52.2. The building specs call for the same requirement, so this section is met.

Section 5.10: Dehumidification Systems

The systems are designed to maintain relative humidity at 50% which meets the requirement of 65% or less.

Section 5.11: Drain Pans

All drain pans are sized and sloped to meet manufacturer recommendations which adhere to this standard. Fan coil units located in the locker rooms in Building F had a need for the condensate to rise above the units in order to enter the existing drain pipes, so condensate pumps were added that do not interfere with the condensate removal from the drain pans.

Section 5.12: Finned-Tube Coils and Heat Exchangers

Drain pans are provided for condensate producing coils in the same fashion as for section 5.11. There are no coils used in series in the equipment used for Glen Burnie High School, so access to the coils and the resulting pressure drops are not a factor.

Section 5.13: Humidifiers and Water-Spray Systems

Glen Burnie High School does not utilize humidifiers or water-spray systems. This section does not apply.

Section 5.14: Access for Inspection, Cleaning, and Maintenance

All equipment is placed as to provide unobstructed admittance to access doors and other maintenance areas.

Section 5.15: Building Envelope and Interior Surfaces

Sections 15080 and 15083 of the specs state all requirements for the insulation of ducts, pipes, and other interior surfaces as well as the building envelope in order to prevent any unwanted moisture accumulation. These requirements provide compliance to this section.

Section 5.16: Buildings with Attached Parking Garages

This section does not apply as Glen Burnie High School does not have any attached parking garages.

Section 5.17: Air Classification and Recirculation

The majority of air in the buildings of Glen Burnie High School is class 1 air. The only exceptions are from the gymnasium areas, art classrooms and restrooms, which are class 2 air zones, and the janitor's closets and mechanical rooms, which are class 3 air zones. All of this air is exhausted directly out of the building.

Section 5.18: Requirements for Buildings Containing ETS Areas and ETS-Free Areas

Glen Burnie High School is a non-smoking campus so this section does not apply.

ASHRAE Standard 62.1 Section 6 Evaluation

Section 6: Ventilation Rate Calculation Procedure

Section 6 of Standard 62.1 is used to determine the minimum amount of outdoor air that must be supplied to the building. This is calculated based on occupancy, occupancy type, and square footage. Each system in all three buildings was examined, including the individual unit ventilators for Building D and the air handling units in Buildings E and F. The amount of outdoor air was calculated using the following equations:

$$V_{bz}=R_p*P_z+R_a*A_z$$

Where,

 V_{bz} = Breathing Zone Outdoor Airflow R_p = Outdoor Airflow Rate per Person (CFM/person) P_z = Zone Population R_a = Outdoor Airflow Rate per Unit Area (CFM/SF) A_z = Zone Floor Area (SF)

$$V_{oz}=V_{bz}/E_z$$

Where, V_{oz} = Zone Outdoor Airflow E_z = Zone Air Distribution Effectiveness

$$Z_p = V_{oz}/V_{pz}$$

Where, Z_p = Zone Primary Outdoor Air Fraction V_{pz} = Zone Primary Airflow

$$V_{ou}=D^{*}\Sigma(R_{p}^{*}P_{z})+\Sigma(R_{a}^{*}A_{z})$$

Where, D = Occupant Diversity

 $D=P_s/\sum P_z$

Where, P_s = System Population

Where, V_{ot} = Outdoor Air Intake Flow

All of the spreadsheets showing the calculations for these systems can be found in the appendix at the end of this report.

Section 6 Conclusion:

| Outdoor Airflow Rates | | | | | | | | | | |
|-----------------------|-----------|----------------------------|------------|--|--|--|--|--|--|--|
| Building/System | Design OA | Minimum Required OA | Compliance | | | | | | | |
| Building D/UVs | 9700 | 10483 | NO | | | | | | | |
| Building E/AHU-1 | 2000 | 480 | YES | | | | | | | |
| Building E/AHU-2 | 2800 | 1344 | YES | | | | | | | |
| Building E/AHU-3 | 2000 | 510 | YES | | | | | | | |
| Building E/AHU-4 & 5 | 6000 | 2765 | YES | | | | | | | |
| Building E/AHU-6 | 2500 | 28 | YES | | | | | | | |
| Building E/AHU-7 | 350 | 137 | YES | | | | | | | |
| Building E/AHU-8 | 100 | 110 | NO | | | | | | | |
| Building E/AHU-9 | 1300 | 518 | YES | | | | | | | |
| Building F/AHU-1 | 5600 | 5799 | NO | | | | | | | |
| Building F/AHU-2 | 5850 | 5608 | YES | | | | | | | |
| Building F/AHU-3 & 4 | 2140 | 2261 | NO | | | | | | | |
| Building F/AHU-5 | 950 | 391 | YES | | | | | | | |
| | Т | able 1 | | | | | | | | |

There are only four zones/systems that do no not comply with Standard 62.1. Because the variance between the design and required airflows is minimal, it can be reasonably determined that the cause is due to the assumptions that were made during the calculations. All assumptions for occupancy were made based on the type of room, instead of the actual occupancies that occur in the building as these are not known.

The likely reason for the shortage of outdoor air supplied to Building D stems from combining all of the systems into one large system in the spreadsheets. This would cause the critical system to effect the required OA of all of the systems, when in fact, each system is critical only to itself since they are all independent from one another.

AHU-8 in Building E was designed to serve a space that is being converted and has not been fully laid out yet. This led to an assumption for the occupancy of the space, which will change when the actual design conditions are known. Building F/AHU-1 is also non-compliant by a small margin. Like in Building E, there are spaces in Building F that have not yet been fully identified as to their occupancy. Once again, when these assumptions are made more accurate, the difference in OA supply should correct itself.

The gym in Building F is served by AHU-3 and AHU-4 which also supply air to the locker rooms on either side of the gym. The slight difference in outdoor air can be attributed to the occupancy estimates used. For the purpose of the calculation, it is assumed that each space has occupants in it at the same time. However this is not true, as the locker rooms are only occupied right before and right after the gym becomes occupied during normal operating hours for the building.

ASHRAE Standard 90.1 Evaluation

Standard 90.1 provides requirements for the energy-efficient design of buildings, except low-rise residential buildings. In this evaluation, the compliance of Buildings D, E & F will be checked and analyzed to determine why compliance does or does not occur.

Section 5: Building Envelope

Section 5 specifies requirements for the building envelope.

Section 5.1.4: Climate

Glen Burnie High School is located in Glen Burnie, MD, marked on the map below, and falls into climate zone 4a.



Section 5.2: Compliance Paths

Glen Burnie High School's fenestration percentages are as follows:

| Fenestration Percentages | | | | | | | | | | |
|--------------------------------------------------------|----|---|--|--|--|--|--|--|--|--|
| Building Vertical Fenestration % Skylight Fenestration | | | | | | | | | | |
| Building D | 6 | 0 | | | | | | | | |
| Building E | 12 | 0 | | | | | | | | |
| Building F | 12 | 0 | | | | | | | | |

Because these are less than the maximum allowable 40% for vertical and 5% for skylight, all three buildings can be evaluated using the Prescriptive Building Envelope Option.

Section 5.4: Mandatory Provisions

According to section 5.4, air leakage must be controlled, using various means, in the following areas:

- Joints around fenestration and door frames
- Junctions between walls and foundations, building corners, floors, and roofs
- > Openings at utility service penetrations
- Building assemblies used as ducts or plenums
- Joints, seams, and penetrations of vapor retarders
- > All other openings in the building envelope

The mandatory provisions also call for vestibules at building entrances to separate the exterior from the conditioned spaces of the building. Buildings D, E & F all comply with this provision by supplying vestibules with self-closing doors at the intended building entrances. The entrances have also been constructed with the required 7 feet of separation between the door sets so it is not required to have both sets of doors open at the same time.

Section 5.5: Prescriptive Building Envelope Option

| | | • | | | | | | | | | |
|-----------------------------------------------------------------|---------|-------|-----|--|--|--|--|--|--|--|--|
| Building Construction U-Values | | | | | | | | | | | |
| Building Component Actual U-Value Maximum Allowable U-Value Cor | | | | | | | | | | | |
| Roof | 0.21 | 0.048 | NO | | | | | | | | |
| Walls | 0.11 | 0.104 | NO | | | | | | | | |
| Floors | 0.21 | 0.087 | NO | | | | | | | | |
| Slab-On-Grade Floors | 0.21 | 0.86 | YES | | | | | | | | |
| Vertical Glazing | 1.04/.5 | 0.5 | NO | | | | | | | | |

Section 5.5 details the requirements for the building envelope U-Values. Table 3 shows the compliance of the different construction components used in the buildings.

Table 3

The buildings only meet the requirements for the slab-on-grade floors. However, the regular floor slabs should also be acceptable because they separate conditioned spaces. As for the roof and walls, these components are allowed to not meet the requirements because the buildings were originally built before this standard came into effect. The recently installed glazing units that were installed during a partial window replacement do meet the standard, but the remaining original windows do not. Again, this is because they were installed before this standard came into effect.

Section 6: Heating, Ventilating, and Air Conditioning

This section of the standard states requirements for the HVAC system of the building, including efficiency and controls.

Section 6.2: Compliance Paths

Glen Burnie High School must follow Section 6.4: Mandatory Provisions, and Section 6.5: Prescriptive Path. This is because the total size of the buildings exceeds the maximum limit of 25,000 square feet allowed to use the Simplified Approach Option for HVAC Systems.

Section 6.4: Mandatory Provisions

The buildings of Glen Burnie High School are controlled by a BAS which puts the systems into a setback mode during unoccupied times. These unoccupied times occur after school hours and during the weekend. There is also a varied schedule for summer operation. In addition, it is required that all equipment that is not covered by the U.S. NAECA of 1987 must have manufacturer labels stating that the equipment is compliant with Standard 90.1.

Section 6.5: Prescriptive Path

Section 6.5 states that buildings in climate zone 4a are required to have an air-side economizer regardless of system size. Each of the buildings have air-side economizers in place acting to reduce the load on the systems, so this requirement is met.

Standard 90.1 also has limits for the maximum allowable fan motor HP based on CFM. For a constant volume system, the allowable HP is determined by the equation: HP<CFM*.0011. Variable volume systems are based on the equation: HP<CFM*.0015.

Building D uses several unit ventilators, but there are only 5 different airflow levels. Because the UV's are all constant volume, the first equation is used to calculate maximum HP. Table 4 provides the compliance with 90.1's limits for each of the airflows.

| Supply CFM | Compliance | | |
|------------|------------|---------|-----|
| 1500 | 1/4 | 1.65 | YES |
| 1250 | 1/4 | 1.375 | YES |
| 1160 | 1/4 | 1.28 | YES |
| 1000 | 1/4 | 1.1 | YES |
| 750 | 1/4 | 0.83 | YES |
| | | Table 4 | |

Building E is served by another constant volume system consisting of AHU's and a single unit ventilator. The first equation is used again to calculate compliance and the results can be seen in Table 5.

| · · · · · · · · · · · · · · · · · · · | | • | - | | | | | | | | |
|---------------------------------------|--------------|----------------------|------------|--|--|--|--|--|--|--|--|
| Building E Fan Motor Compliance | | | | | | | | | | | |
| Supply CFM | Fan Motor HP | Maximum Allowable HP | Compliance | | | | | | | | |
| 7200 | 10 | 7.92 | YES* | | | | | | | | |
| 2800 | 5 | 3.08 | YES* | | | | | | | | |
| 2500 | 3 | 2.75 | YES* | | | | | | | | |
| 2000 - AHU | 3 | 2.2 | YES* | | | | | | | | |
| 2000 - UV | 1/3 | 2.2 | YES | | | | | | | | |
| 1300 | 1 | 1.43 | YES | | | | | | | | |
| 900 | 3/4 | 0.99 | YES | | | | | | | | |
| | | | | | | | | | | | |

Building F utilizes AHU's, an RTU, and 2 FCU's in the only variable volume system of the three buildings. This means that its compliance is calculated using the second equation. The results of these calculations can be found in Table 6.

| Building F Fan Motor Compliance | | | | | | | | | | | | |
|---------------------------------|--------------------------------------------------------------|-------|-----|--|--|--|--|--|--|--|--|--|
| Supply CFM | Supply CFM Fan Motor HP Maximum Allowable HP | | | | | | | | | | | |
| 17300 | 15 | 25.95 | YES | | | | | | | | | |
| 15300 | 15 | 22.95 | YES | | | | | | | | | |
| 5250 | 5 | 7.88 | YES | | | | | | | | | |
| 3800 | 2 | 5.7 | YES | | | | | | | | | |
| 2360 | 1 | 3.54 | YES | | | | | | | | | |

Table 6

Based on these calculations, all three buildings have compliant fan motors. Building E is able to pass based on the exceptions that for fans less than 6 HP, the next available motor size may be used if it is within 50% of the allowable; and fans greater than 6 HP can use the next available if it is within 30% of the allowable.

Section 6.7: Submittals

This section calls for the submission of record drawings and operation manuals within 90 days of construction completion. System balancing and commissioning is also required to be completed. This is satisfied because balancing reports and record drawings are due upon project completion.

Section 6.8: Minimum Equipment Efficiency Tables

According to the equipment submittal, the chiller that is being installed for Building E has a COP of 2.8, this meets the requirement of standard 90.1 exactly since the minimum allowable COP is also 2.8.

The boiler being installed in Building F also meets the efficiency requirements of Standard 90.1. Its product submittal states an efficiency of 81% which exceeds the required minimum efficiency of at least 80%.

Section 7: Service Water Heating

Section 7 states the requirements of service water heating systems in buildings.

Section 7.4: Mandatory Provisions

According to this section, all equipment must comply with the criteria set forth in section 7.8. The system must also be controlled to allow the temperature of the water in storage to be adjusted from 120 degrees F or lower to the desired level. This section also sets limits on the maximum temperature allowed to be delivered from lavatory sinks. As stated earlier, the buildings are all controlled by a BAS which controls the domestic water heaters and expansion tanks.

Section 7.8: Performance Requirements for Water Heating Equipment

Table 7.8 of the standard contains the equations used to calculate the minimum required performance of water heating equipment. Electric water heaters with an input greater than 12kW must use the following equation:

20+35*(V)^.5

Where: V = Water Heater Capacity

If the electric water heater has an input less than 12kW, the following equation is used:

.93-.00132*V

Where: V = Water Heater Capacity

A 225 gallon and 50 gallon water heater will be installed to provide domestic hot water. The 225 gallon water heater has an input of 27 kW so the first equation is used to calculate its minimum required performance while the 50 gallon water heater uses the second equation because its input is only 10 kW. Table 7 provides the required performances for the water heaters.

| Water Heater Performance | | | | | | | | | |
|--------------------------|------------|-----|--|--|--|--|--|--|--|
| Capacity (gal) | Compliance | | | | | | | | |
| 225 | 545 SL | YES | | | | | | | |
| 50 | .86 EF | YES | | | | | | | |
| Table 7 | | | | | | | | | |

The 225 gallon water heater is designed for a 100°F temperature rise and the 50 gallon water heater provides a 60°F temperature rise. This is the only information stated in the schedules, but the equipment submittals state that both water heaters are 90.1 compliant.

Section 8: Power

Section 8 states that feeders are allowed a maximum voltage drop of 2% at design load and branch circuits are allowed a maximum voltage drop of 3% at design load. According to the spec, the maximum allowable voltage drop is 5% total which meets the requirements of this section. Section 8 also requires the same submittal requirements as mentioned earlier in this report, so these are already satisfied.

Section 9: Lighting

Using the Building Area Method Compliance Path, the lighting power densities were calculated for the buildings of Glen Burnie High School. Table 8 shows the calculated compliances.

| Lighting Power Densities | | | | | | | | | | | |
|--------------------------|------------|---------|----|--|--|--|--|--|--|--|--|
| Building | Compliance | | | | | | | | | | |
| Building D | 1.5 | 1.2 | NO | | | | | | | | |
| Building E | 1.5 | 1.2 | NO | | | | | | | | |
| Building F | 1.5 | 1.2 | NO | | | | | | | | |
| | - | Table 8 | | | | | | | | | |

Once again, there is a problem with compliance, but this is due to the buildings being originally constructed before the standard took effect. This results in exemption from the standard for the buildings lighting power densities.

Standard 90.1 Conclusion:

Glen Burnie High School does have problems with compliance to the construction aspects of the 2007 standard, but this is because the building was constructed well before these codes took effect. The new mechanical system that is being installed has a 100% rate of success in meeting the current standards. Also, while the original building construction materials failed, the recently installed windows did not. Based on these findings, it is safe to assume that as more renovations take place to the buildings, the construction materials will have higher compliance rates with the standard.

References:

ASHRAE. 2007, ANSI/ASHRAE, <u>Standard 62.1-2007, Ventilation for Acceptable Indoor Air</u> <u>Quality.</u> American Society of Heating Refrigeration and Air-Conditioning Engineers, Inc., Atlanta, GA.

ASHRAE. 2007, ANSI/ASHRAE, <u>Standard 90.1-2007, Energy Standard for Buildings Except</u> <u>Low-Rise Residential Buildings.</u> American Society of Heating Refrigeration and Air-Conditioning Engineers, Inc., Atlanta, GA.

Bid Documents and Project Specifications for Glen Burnie High School Buildings D, E & F

Appendix:

The following appendix contains the spreadsheets used to calculate the minimum required outdoor airflows for each building's system. In order to calculate this, the square footage, occupancy, and supply airflow of each room had to be entered into the table. In this appendix you will also find the individual Z_p values as well as the max Z_p for each system.

| Building: | GBHS | Building | D | | | | | | | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|--------------------------------|--------------------------------------------------|--------|-----------------------------------|--------------------|------------------|------------------|------------------|------------------|----------------------------|----------------------------|
| System Tag/Name: | Unit Vo | entilators | | | | | | | | | | |
| Units (select from pull-down list) | IP | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Inputs for System Floor area served by system Population of area served by system (including diversity) Design primary supply fan airflow rate | <u>Name</u> As Ps Vpsd | <u>Units</u> sf P cfm | 100% diversity | - | System 20,748 597 43,070 | | | | | | | |
| OA req'd per unit area for system (Weighted average) | Ras | cfm/sf | | | 0.14 | | | | | | | |
| OA req'd per person for system area (Weighted average) | Rps | cfm/p | | | 10.0 | | | | | | | |
| Inputs for Potentially Critical zones | | | | | | Kila | Orafia | A | O a sul a trans | O an anal Ant | | Ownersh |
| Zone Name | Zone ti | tle turns p | urple italic for critical zone(s) | | | Niin | Crafts | Απ | Sculpture | General Art | Acting Arts | Speech |
| Zone Tag | | | | | | 100 | 104 | 121 | 127 | 130 | 203 | 204 |
| Space type | | Select fr | om pull-down list | | | Wood/metal shop | Art Classroom | Art Classroom | Art Classroom | Art classroom | Classrooms (age 9 plus) | Classrooms (age 9 plus) |
| Floor Area of zone | Az | sf | | | | 115 | 1320 | 3030 | 1575 | 1500 | 744 | 800 |
| Design population of zone | Pz | P | (default value listed; may be ov | errid | den) | 0 | 40 | 40 | 43 | 35 | 30 | 30 |
| Design total supply to zone (primary plus local recirculated) | Vdzd | cfm | | | | 750 | 3000 | 4500 | 2000 | 3000 | 2000 | 2000 |
| Induction Terminal Unit, Dual Fan Dual Duct or Transfer Fan? | Er | Select fr | om puil-down list or leave blank | CITIN/ | A | 0/. | 75% | 75% | 75% | 75% | 75% | 75% |
| Inputs for Operating Condition Analyzed | | | | | | /0 | 1370 | 1 3 70 | 1370 | 1370 | 1 3 70 | 1 3 70 |
| Percent of total design airflow rate at conditioned analyzed | Ds | % | | | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| Air distribution type at conditioned analyzed | | Select fr | om pull-down list | | | CS | CS | CS | CS | CS | CS | CS |
| Zone air distribution effectiveness at conditioned analyzed | Ez | | | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Primary air fraction of supply air at conditioned analyzed | Ер | | | | | | | | | | | |
| Ventilation System Efficiency | Ev | | | | 0.85 | | | | | | | |
| Outdoor air intake required for system | Vot | cfm | | | 10483 | | | | | | | |
| Outdoor air per unit floor area | Vot/As | cfm/sf | | | 0.51 | | | | | | | |
| Outdoor air per person served by system (including diversity) | Vot/Ps | cfm/p | | | 17.6 | | | | | | | |
| Outdoor air as a % of design primary supply air | Ypd | cfm | | | 24% | | | | | | | |
| Detailed Calculations | | | | | | | | | | | | |
| Initial Calculations for the System as a whole | | | | | | | | | | | | |
| Primary supply air flow to system at conditioned analyzed | Vps | cfm | = VpdDs | = | 43070 | | | | | | | |
| UncorrectedOA requirement for system | Vou | cfm | = Rps Ps + Ras As | = | 8912 | | | | | | | |
| Uncorrected OA regid as a fraction of primary SA | XS | | = Vou / Vps | = | 0.21 | | | | | | | |
| | Raz | cfm/sf | | | | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 | 0.12 | 0.12 |
| OA rate per person | Roz | cfm/p | | | | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 |
| Total supply air to zone (at condition being analyzed) | Vdz | cfm | | | | 750 | 3000 | 4500 | 2000 | 3000 | 2000 | 2000 |
| Unused OA req'd to breathing zone | Vbz | cfm | = Rpz Pz + Raz Az | = | | 20.7 | 637.6 | 945.4 | 713.5 | 620.0 | 389.3 | 396.0 |
| Unused OA requirement for zone | Voz | cfm | = Vbz/Ez | = | | 21 | 638 | 945 | 714 | 620 | 389 | 396 |
| Fraction of zone supply not directly recirc. from zone | Fa | | = Ep + (1-Ep)Er | = | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Fraction of zone supply from fully mixed primary air | Fb | | = Ep | = | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Fraction of zone OA not directly recirc. from zone | Fc | | = 1-(1-Ez)(1-Ep)(1-Er) | = | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Unused OA fraction required in supply air to zone | Zd | | = Voz / Vdz | = | | 0.03 | 0.21 | 0.21 | 0.36 | 0.21 | 0.19 | 0.20 |
| Unused OA fraction required in primary air to zone | Zp | | = Voz / Vpz | = | | 0.03 | 0.21 | 0.21 | 0.36 | 0.21 | 0.19 | 0.20 |
| Zono Ventilation Efficiency (App & Method) | Ev7 | | = (E ₂ + EbYs - EcZ) / E ₂ | _ | | 1 19 | 0.00 | 1.00 | 0.85 | 1.00 | 1.01 | 1.01 |
| System Ventilation Efficiency (App A Method) | Ev | | = (ra + 10/s + 10/z) ra = min (Fyz) | _ | 0.85 | 1.10 | 0.99 | 1.00 | 0.85 | 1.00 | 1.01 | 1.01 |
| Ventilation System Efficiency (Table 6.3 Method) | Ev | | = Value from Table 6.3 | _ | 0.79 | | | | | | | |
| Minimum outdoor air intake airflow | | | 0.0 | | | | | | | | | |
| Outdoor Air Intake Flow required to System | Vot | cfm | = Vou / Ev | = | 10483 | | | | | | | |
| OA intake req'd as a fraction of primary SA | Y | | = Vot / Vps | = | 0.24 | | | | | | | |
| Outdoor Air Intake Flow required to System (Table 6.3 Method |) Vot | cfm | = Vou / Ev | = | 11235 | | | | | | | |
| OA intake req'd as a fraction of primary SA (Table 6.3 Method) | Y | | = Vot / Vps | = | 0.26 | | | | | | | |
| OA Temp at which Min OA provides all cooling | | D. 5 | | | | | | | | | | |
| OAT below which OA Intake flow is @ minimum | | Deg F | $= {(Ip-dIst)-(1-Y)^{*}(Ir+dTr)}$ | = | 2 | | | | | | | |

| Building: System Tag/Name: | GBHS Unit V | Building entilators | D | | | | | | | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|---------------------------------------------------|----------------------------------------------------|-------------|-----------------------------------------|---------------------|----------------------|---------------------|----------------------|---------------------|---------------------|---------------------|
| Units (select from pull-down list) | IP | | | | | - | | | | | | |
| | | | | _ | | - | | | | | | |
| Inputs for System Floor area served by system Population of area served by system (including diversity) Design primary supply fan airflow rate OA req'd per unit area for system (Weighted average) OA req'd per person for system area (Weighted average) | <u>Name</u> As Ps Vpsd Ras Rps | <u>Units</u> sf P cfm cfm/sf cfm/p | 100% diversity | 5 | 20,748 597 43,070 0.14 10.0 | | | | | | | |
| Inputs for Potentially Critical zones | | | | | | Sneech | Acting Arts | Potentially C | Com & CDV | Finishing | Fredich | Frailah |
| Zone Name | Zone t | itle turns p | ourple italic for critical zone(s) | | | Speech | Acting Arts | Acting Arts | Arts | Finishing | English | English |
| Zone Tag | | | , , , , , , , , , , , , , , , , , , , , | | | 205 | 206 | 219 | 223 | 224 | 300 | 301 |
| Space type | | Soloct f | rom pull-down list | | | Classrooms | Classrooms | Classrooms | Classrooms | Classrooms | Classrooms | Classrooms |
| Floor Area of zone | Az | sf | ioni pull-down list | | | (age 9 plus) 675 | (age 9 plus) 2745 | (age 9 plus) 936 | (age 9 plus) 1320 | (age 9 plus) 170 | (age 9 plus) 384 | (age 9 plus) 720 |
| Design population of zone | Pz | Р | (default value listed; may be ov | errido | den) | 25 | 60 | 35 | 40 | 5 | 20 | 35 |
| Design total supply to zone (primary plus local recirculated) | Vdzd | cfm | | | | 2320 | 3750 | 2000 | 3000 | 750 | 1250 | 1500 |
| Induction Terminal Unit, Dual Fan Dual Duct or Transfer Fan? | Fr | Select f | rom pull-down list or leave blank | If N// | A | 75% | 75% | 75% | 75% | 75% | 75% | 75% |
| Inputs for Operating Condition Analyzed | L. | | | | | 1070 | 1070 | 1070 | 1070 | 1070 | 1070 | 1070 |
| Percent of total design airflow rate at conditioned analyzed | Ds | % | | | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| Air distribution type at conditioned analyzed | F - | Select f | rom pull-down list | | | CS | CS | CS | CS | CS | CS | CS |
| Primary air fraction of supply air at conditioned analyzed | EZ | | | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Results | цþ | | | | | | | | | I | | |
| Ventilation System Efficiency Outdoor air intake required for system Outdoor air per unit floor area Outdoor air per person served by system (including diversity) Outdoor air as a % of design primary supply air | Ev Vot Vot/As Vot/Ps Ypd | cfm cfm/sf cfm/p cfm | | | 0.85 10483 0.51 17.6 24% | | | | | | | |
| Detailed Calculations | | | | | | | | | | | | |
| Initial Calculations for the System as a whole Primary supply air flow to system at conditioned analyzed UncorrectedOA requirement for system Uncorrected OA req'd as a fraction of primary SA Initial Calculations for individual zones | Vps Vou Xs | cfm cfm | = VpdDs = Rps Ps + Ras As = Vou / Vps | = = = | 43070 8912 0.21 | | | | | | | |
| OA rate per unit area for zone | Raz | cfm/sf | | | | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 |
| OA rate per person | Rpz | cfm/p | | | | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 |
| Total supply air to zone (at condition being analyzed) | Vdz | cfm | | | | 2320 | 3750 | 2000 | 3000 | 750 | 1250 | 1500 |
| Unused OA requirement for zone | Voz | cfm | = Vbz/Ez | = | | 331 | 929.4 | 462.3 | 558 | 70.4 | 240.1 | 436.4 |
| Fraction of zone supply not directly recirc. from zone | Fa | | = Ep + (1-Ep)Er | = | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Fraction of zone supply from fully mixed primary air | Fb | | = Ep | = | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Fraction of zone OA not directly recirc. from zone | FC Zd | | = 1-(1-Ez)(1-Ep)(1-Er) | = | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Unused OA fraction required in supply air to zone | Zo | | $= \sqrt{02}/\sqrt{02}$ = $\sqrt{02}/\sqrt{02}$ | = | | 0.14 | 0.25 | 0.23 | 0.19 | 0.09 | 0.20 | 0.29 |
| System Ventilation Efficiency | | | | | | | | | | | | |
| Zone Ventilation Efficiency (App A Method) | Evz | | = (Fa + FbXs - FcZ) / Fa | = | | 1.06 | 0.96 | 0.98 | 1.02 | 1.11 | 1.01 | 0.92 |
| System Ventilation Efficiency (App A Method) | Ev | | = min (Evz) | = | 0.85 | | | | | | | |
| Minimum outdoor air intake airflow | LV | | | - | 0.79 | | | | | | | |
| Outdoor Air Intake Flow required to System | Vot | cfm | = Vou / Ev | = | 10483 | | | | | | | |
| OA intake req'd as a fraction of primary SA | Y | | = Vot / Vps | = | 0.24 | | | | | | | |
| Outdoor Air Intake Flow required to System (Table 6.3 Method |) Vot | ctm | = Vou / Ev | = | 11235 | | | | | | | |
| OA Intake requires a fraction of primary SA (Table 6.3 Method OA Temp at which Min OA provides all cooling | , , | | - vot/vps | - | 0.26 | | | | | | | |
| OAT below which OA Intake flow is @ minimum | | Deg F | = {(Tp-dTsf)-(1-Y)*(Tr+dTr | = | 2 | | | | | | | |

| Building | | GBHS | Building | D | | | | | | | | | |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|--------------------------------------------|-------|----------------------------------------------|--------|---------------------------------------------------|--------------|--------------|--------------|--------------|--------------|----------------|
| System 1 | ag/Name: | Unit Ve | ntilators | | | | | | | | | | |
| Operatin | g Condition Description: | ID | | | | | | | | | | | |
| Units (se | lect nom puil-down list) | IF | | | | | | | | | | | |
| Inputs fo | r System Floor area served by system Population of area served by system (including diversity) Design primary supply fan airflow rate OA req'd per unit area for system (Weighted average) OA req'd per person for system area (Weighted average) r Potentially Critical zones | <u>Name</u> As Ps Vpsd Ras Rps | Units sf P cfm cfm/sf cfm/p | | 100% diversity | | System 20,748 597 43,070 0.14 10.0 | | | | | | |
| | Zone Name | - | | | and the second second | | | Spanish | Foreign Lang | Foreign Lang | Foreign Lang | Foreign Lang | English |
| | Zone Tag | Zone til | ie turns p | urple | e Italic for critical zone(s) | | | 302 | 303 | Lab 305 | 1 & 2 306 | Plan 309 | Faculty 318 |
| | Space type | | | | | | | Classrooms | Classrooms | Classrooms | Classrooms | Classrooms | Classrooms |
| | Eloor Area of zone | Δ-7 | Select f | om | oull-down list | | · | (age 9 plus) |
| | Design population of zone | Pz | P | (def | ault value listed: mav be o | verrid | den) | 25 | 25 | 40 | 55 | 4 | 10 |
| | Design total supply to zone (primary plus local recirculated) | Vdzd | cfm | (00. | aut value neted, may be e | | uo, | 1500 | 1500 | 3000 | 3000 | 1000 | 1250 |
| | Induction Terminal Unit, Dual Fan Dual Duct or Transfer Fan? | | Select f | om p | oull-down list or leave blan | k if N | 'A | | | | | | |
| | Local recirc. air % representative of ave system return air | Er | | | | | | 75% | 75% | 75% | 75% | 75% | 75% |
| Inputs fo | r Operating Condition Analyzed | | | | | _ | | | | | | | |
| | Percent of total design airflow rate at conditioned analyzed | Ds | % | | | | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| | Air distribution type at conditioned analyzed | E-7 | Select fi | om | oull-down list | | | CS | CS | CS | CS | CS | <u>CS</u> |
| | Primary air fraction of supply air at conditioned analyzed | EZ | | | | | ļ | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Results | r mary an nacion of supply an at conditioned analyzed | цþ | | | | | | | | | | | |
| | Ventilation System Efficiency Outdoor air intake required for system Outdoor air per unit floor area Outdoor air per person served by system (including diversity) Outdoor air as a % of design primary supply air | EV Vot Vot/As Vot/Ps Ypd | cfm cfm/sf cfm/p cfm | | | | 0.85 10483 0.51 17.6 24% | | | | | | |
| Detailed | Calculations | | | | | | | | | | | | |
| Initial Ca | culations for the System as a whole | | | | | | | | | | | | |
| | Primary supply air flow to system at conditioned analyzed | Vps | cfm cfm | = | VpdDs Rps Ps + Ras As | = | 43070 | | | | | | |
| | Uncorrected OA regid as a fraction of primary SA | Xs | Cim | _ | Vou / Vps | = | 0.21 | | | | | | |
| Initial Ca | culations for individual zones | | | | | | | | | | | | |
| | OA rate per unit area for zone | Raz | cfm/sf | | | | | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 |
| | OA rate per person | Rpz | cfm/p | | | | | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 |
| | Total supply air to zone (at condition being analyzed) | Vdz | cfm | | | | | 1500 | 1500 | 3000 | 3000 | 1000 | 1250 |
| | Unused OA req'd to breathing zone | Vbz | cfm | = | Rpz Pz + Raz Az | = | | 330.6 | 336.4 | 541.1 | 714.2 | 65.0 | 168.4 |
| | Unused OA requirement for zone | Voz | cfm | = | Vbz/Ez | = | | 331 | 336 | 541 | 714 | 65 | 168 |
| | Fraction of zone supply not directly recirc. from zone | Fa | | = | Ep + (1-Ep)Er | = | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | Fraction of zone supply from fully mixed primary air | FD | | = | Ep 1 (1 E_{7})(1 E_{7})(1 E_{7}) | = | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | Linused OA fraction required in supply air to zone | 7d | | _ | V_{02} / V_{02} | = | | 0.22 | 0.22 | 0.18 | 0.24 | 0.06 | 0.13 |
| | Unused OA fraction required in primary air to zone | Zn | | _ | Voz / Voz | _ | | 0.22 | 0.22 | 0.18 | 0.24 | 0.06 | 0.13 |
| System \ | entilation Efficiency | | | | | | | | | | | | |
| | Zone Ventilation Efficiency (App A Method) | Evz | | = | (Fa + FbXs - FcZ) / Fa | = | | 0.99 | 0.98 | 1.03 | 0.97 | 1.14 | 1.07 |
| | System Ventilation Efficiency (App A Method) | Ev | | = | min (Evz) | = | 0.85 | | | | | | |
| | Ventilation System Efficiency (Table 6.3 Method) | Ev | | = | Value from Table 6.3 | = | 0.79 | | | | | | |
| Minimum | outdoor air intake airflow | | | | | | | | | | | | |
| | Outdoor Air Intake Flow required to System | Vot | ctm | = | Vou / Ev | = | 10483 | | | | | | |
| | Outdoor Air Intake Flow required to System (Table 6.2 Mothod) | Vot | cfm | = | Vou / Ev | = | 11225 | | | | | | |
| | OA intake regid as a fraction of primary SA (Table 6.3 Method) | Y | CITI | 1 | Vot / Vos | 1 | 0.26 | | | | | | |
| OA Temr | at which Min OA provides all cooling | | | | | | 0.20 | | | | | | |
| | OAT below which OA Intake flow is @ minimum | | Deg F | = | {(Tp-dTsf)-(1-Y)*(Tr+dTr | = | 2 | | | | | | |

| Building: | GBHS | Building | F | | | | | | |
|----------------------------------------------------------------|-----------|------------------|-------|-------------------------------|-----------|-------|---------------|--------------------|--------------|
| System Tag/Name: | AHU-1 | - and a second | - | | | | 1 | | |
| Operating Condition Description: | | | | | | | ł | | |
| Units (select from pull-down list) | IP | | | | | | t | | |
| | | | | | | | | | |
| Inputs for System | Name | Units | | | S | stem | T | | |
| Floor area served by system | As | sf | | | | 1599 | t | | |
| Population of area served by system (including diversity) | Ps | Р | | 100% diversity | | 22 | t | | |
| Design primary supply fan airflow rate | Vpsd | cfm | | | | 1,900 | t | | |
| OA reg'd per unit area for system (Weighted average) | Ras | cfm/sf | | | | 0.19 | 1 | | |
| OA reg'd per person for system area (Weighted average) | Rps | cfm/p | | | | 5.6 | 1 | | |
| Inputs for Potentially Critical zones | | | | | | | Poter | ntially Critical Z | ones |
| Zone Name | Zone tit | tle turns p | urple | e italic for critical zone(s) | | | Shower Rm | Locker Rm | Office |
| Zone Tag | | | | | | | 16 | 21 | 26 |
| Space type | | | | | | | Swimming | Spectator | Office space |
| | | Select fr | om p | pull-down list | | | (pool & deck) | areas | |
| Floor Area of zone | Az | sf | | | | | 492 | 967 | 140 |
| Design population of zone | Pz | Р | (def | ault value listed; may be ov | erridde | en) | 5 | 15 | 2 |
| Design total supply to zone (primary plus local recirculated) | Vdzd | ctm Select fr | | احجاج جروما ومنقا مريرها الرو | . :4 NI/A | | 700 | 1000 | 200 |
| Induction Terminal Unit, Dual Fan Dual Duct or Transfer Fan? | Er. | Select fr | om p | pull-down list of leave blank | ar N/A | | 750/ | 750/ | 750/ |
| Inputs for Operating Condition Analyzed | <u>C1</u> | | | | | | 15% | 15% | (5%) |
| Percent of total design airflow rate at conditioned analyzed | Ds | % | | | | 100% | 100% | 100% | 100% |
| Air distribution type at conditioned analyzed | 20 | Select fr | om r | oull-down list | | 10070 | CS | CS | CS |
| Zone air distribution effectiveness at conditioned analyzed | Fz | 001000111 | þ | pan aominina | | | 1.00 | 1.00 | 1.00 |
| Primary air fraction of supply air at conditioned analyzed | Ep | | | | | | | | |
| Results | | | | | | | 1 1 | | |
| Ventilation System Efficiency | Ev | | | | | 0.89 | | | |
| Outdoor air intake required for system | Vot | cfm | | | | 480 | | | |
| Outdoor air per unit floor area | Vot/As | cfm/sf | | | | 0.30 | | | |
| Outdoor air per person served by system (including diversity) | Vot/Ps | cfm/p | | | | 21.8 | | | |
| Outdoor air as a % of design primary supply air | Ypd | cfm | | | | 25% | | | |
| | | | | | | | | | |
| Detailed Calculations | | | | | | | | | |
| Initial Calculations for the System as a whole | \/ | - 6 | | | | 4000 | | | |
| Primary supply air flow to system at conditioned analyzed | Vps | ctm | = | VpdDs | = | 1900 | | | |
| UncorrectedOA requirement for system | Vou | cim | = | Kps Ps + Kas As | = | 425 | | | |
| Initial Calculations for individual zonos | AS | | = | vou / vps | = | 0.22 | | | |
| | Raz | cfm/sf | | | | | 0.48 | 0.06 | 0.06 |
| OA rate per unit area for 2016 | Rnz | cfm/n | | | | | 0.40 | 7 50 | 5.00 |
| Total supply air to zone (at condition being analyzed) | Vdz | cfm | | | | | 700 | 1000 | 200 |
| Linused OA reg'd to breathing zone | Vhz | cfm | = | Roz Pz + Raz Az | = | | 236.2 | 170.5 | 18.4 |
| Unused OA requirement for zone | Voz | cfm | = | Vbz/Ez | = | | 236 | 171 | 18 |
| Fraction of zone supply not directly recirc. from zone | Fa | | = | Ep + (1-Ep)Er | = | | 1.00 | 1.00 | 1.00 |
| Fraction of zone supply from fully mixed primary air | Fb | | = | Ep | = | | 1.00 | 1.00 | 1.00 |
| Fraction of zone OA not directly recirc. from zone | Fc | | = | 1-(1-Ez)(1-Ep)(1-Er) | = | | 1.00 | 1.00 | 1.00 |
| Unused OA fraction required in supply air to zone | Zd | | = | Voz / Vdz | = | | 0.34 | 0.17 | 0.09 |
| Unused OA fraction required in primary air to zone | Zp | | = | Voz / Vpz | = | | 0.34 | 0.17 | 0.09 |
| System Ventilation Efficiency | | | | | | | | | |
| Zone Ventilation Efficiency (App A Method) | Evz | | = | (Fa + FbXs - FcZ) / Fa | = | | 0.89 | 1.05 | 1.13 |
| System Ventilation Efficiency (App A Method) | Ev | | = | min (Evz) | = | 0.89 | | | |
| Ventilation System Efficiency (Table 6.3 Method) | Ev | | = | Value from Table 6.3 | = | 0.81 | | | |
| Minimum outdoor air intake airflow | | | | | | | | | |
| Outdoor Air Intake Flow required to System | Vot | cfm | = | Vou / Ev | = | 480 | | | |
| OA intake req'd as a fraction of primary SA | Y | | = | Vot / Vps | = | 0.25 | | | |
| Outdoor Air Intake Flow required to System (Table 6.3 Method) | Vot | cfm | = | Vou / Ev | = | 523 | | | |
| OA Intake req'd as a traction of primary SA (Table 6.3 Method) | Y | | = | vot / vps | = | 0.28 | | | |
| OAT temp at which Min OA provides all cooling | | Deg E | | (/Tn dTof) (1 V)*/T++ dT+ | | F | | | |
| OAT below which OA Intake flow is @ minimum | | Degr | = | {(IP-01SI)-(I-Y)"(IF+01F | = | 5 | | | |

| Building | | GBHS | Building | E | | | | | | | | | |
|------------|----------------------------------------------------------------|------------|--------------|------------------------------------|---------|--------|--------------|--------------|------------|--------------------|------------|-----------|-----------|
| System ' | ag/Name: | AHU-2 | | | | | | | | | | | |
| Operatin | g Condition Description: | | | | | | | | | | | | |
| Units (se | lect from pull-down list) | IP | | | | | | | | | | | |
| Innuts fo | r System | Name | Units | | S | system | | | | | | | |
| inputo re | Floor area served by system | As | sf | | _ | 2610 | | | | | | | |
| | Population of area served by system (including diversity) | Ps | P | 100% diversity | | 137 | | | | | | | |
| | Design primary supply fan airflow rate | Vpsd | cfm | | | 2.800 | | | | | | | |
| | OA reg'd per unit area for system (Weighted average) | Ras | cfm/sf | | | 0.06 | | | | | | | |
| | OA reg'd per person for system area (Weighted average) | Rps | cfm/p | | | 7.4 | | | | | | | |
| Inputs fo | r Potentially Critical zones | | | | | | | | Poter | ntially Critical Z | ones | | |
| | Zone Name | Zone ti | itle turns p | ourple italic for critical zone(s) | | | Coach 2 | Coach1 | Team 3 | Team 1 | Team 2 | Team 4 | Corridor |
| | Zone Tag | | | | | | 18B | 18A | 42 | 27 | 28 | 40 | 30 |
| | Space type | | | | | | Office space | Office space | Spectator | Spectator | Spectator | Spectator | Corridors |
| | opuce type | | Select f | rom pull-down list | | | | | areas | areas | areas | areas | |
| | Floor Area of zone | Az | sf | | | | 190 | 190 | 282 | 765 | 332 | 451 | 400 |
| | Design population of zone | Pz | Р | (default value listed; may be ov | errido | len) | 2 | 2 | 22 | 55 | 26 | 30 | 0 |
| | Design total supply to zone (primary plus local recirculated) | Vdzd | cfm | | | | 125 | 125 | 480 | 840 | 525 | 465 | 240 |
| | Induction Terminal Unit, Dual Fan Dual Duct or Transfer Fan? | _ | Select f | rom pull-down list or leave blank | cif N/A | 4 | | | | | | | |
| | Local recirc. air % representative of ave system return air | Er | | | | | 75% | 75% | 75% | 75% | 75% | 75% | 75% |
| Inputs fo | r Operating Condition Analyzed | | | | | 10001 | 10000 | 4000/ | 1000 | 1000/ | 1000/ | 1000/ | 1000/ |
| | Percent of total design airflow rate at conditioned analyzed | Ds | % | | | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| | Air distribution type at conditioned analyzed | F - | Select | rom pull-down list | | | CS | CS | US 1.00 | US 1.00 | US 1.00 | CS | CS |
| | Zone air distribution effectiveness at conditioned analyzed | EZ | | | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Besults | Fillinary all fraction of supply all at conditioned analyzed | ЕР | | | | | | | | | | | |
| Results | Vontilation System Efficiency | Ev | | | | 0.97 | | | | | | | |
| | Outdoor air intake required for system | EV Vot | cfm | | | 1344 | | | | | | | |
| | Outdoor air make required for system | Vot/Ac | cfm/cf | | | 0.51 | | | | | | | |
| | Outdoor air per person served by system (including diversity) | Vot/Ps | cfm/n | | | 0.51 | | | | | | | |
| | Outdoor air as a % of design primary supply air | Votrs | cfm | | | 48% | | | | | | | |
| | Outdoor an as a 70 of design primary suppry an | rpu | CIIII | | | 40 /0 | | | | | | | |
| Detailed | Calculations | | | | | | | | | | | | |
| Initial Ca | Iculations for the System as a whole | | | | | | | | | | | | |
| | Primary supply air flow to system at conditioned analyzed | Vps | cfm | = VpdDs | = | 2800 | | | | | | | |
| | UncorrectedOA requirement for system | Vou | cfm | = Rps Ps + Ras As | = | 1174 | | | | | | | |
| | Uncorrected OA req'd as a fraction of primary SA | Xs | | = Vou / Vps | = | 0.42 | | | | | | | |
| Initial Ca | Iculations for individual zones | | | | | | | | | | | | |
| | OA rate per unit area for zone | Raz | cfm/sf | | | | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 |
| | OA rate per person | Rpz | cfm/p | | | | 5.00 | 5.00 | 7.50 | 7.50 | 7.50 | 7.50 | 0.00 |
| | Total supply air to zone (at condition being analyzed) | Vdz | cfm | | | | 125 | 125 | 480 | 840 | 525 | 465 | 240 |
| | Unused OA req'd to breathing zone | Vbz | cfm | = Rpz Pz + Raz Az | = | | 21.4 | 21.4 | 181.9 | 458.4 | 214.9 | 252.1 | 24.0 |
| | Unused OA requirement for zone | Voz | cfm | = Vbz/Ez | = | | 21 | 21 | 182 | 458 | 215 | 252 | 24 |
| | Fraction of zone supply not directly recirc. from zone | Fa | | = Ep + (1-Ep)Er | = | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | Fraction of zone supply from fully mixed primary air | Fb | | = Ep | = | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | Fraction of zone OA not directly recirc. from zone | Fc | | = 1-(1-Ez)(1-Ep)(1-Er) | = | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | Unused OA fraction required in supply air to zone | Zd | | = Voz / Vdz | = | | 0.17 | 0.17 | 0.38 | 0.55 | 0.41 | 0.54 | 0.10 |
| | Unused OA fraction required in primary air to zone | Zp | | = Voz / Vpz | = | | 0.17 | 0.17 | 0.38 | 0.55 | 0.41 | 0.54 | 0.10 |
| System ' | /entilation Efficiency | | | | | | | | | | | | |
| | Zone Ventilation Efficiency (App A Method) | Evz | | = (Fa + FbXs - FcZ) / Fa | = | | 1.25 | 1.25 | 1.04 | 0.87 | 1.01 | 0.88 | 1.32 |
| | System Ventilation Efficiency (App A Method) | Ev | | = min (Evz) | = | 0.87 | | | | | | | |
| | Ventilation System Efficiency (Table 6.3 Method) | Ev | | = Value from Table 6.3 | = | 0.60 | | | | | | | |
| Minimun | outdoor air intake airflow | | | | | | | | | | | | |
| | Outdoor Air Intake Flow required to System | Vot | cfm | = Vou / Ev | = | 1344 | | | | | | | |
| | OA intake req'd as a fraction of primary SA | Y | | = Vot / Vps | = | 0.48 | | | | | | | |
| | Outdoor Air Intake Flow required to System (Table 6.3 Method) | Vot | ctm | = Vou / Ev | = | 1943 | | | | | | | |
| 0 A T. | OA intake req d as a fraction of primary SA (Table 6.3 Method) | Y | | = vot / vps | = | 0.69 | | | | | | | |
| OA Tem | o at which will OA provides all cooling | | Dee | | | 07 | | | | | | | |
| | OAT below which OA Intake flow is @ minimum | | Deg F | $= {(Ip-dIst)-(1-Y)^*(Ir+dTr)}$ | = | 37 | | | | | | | |

| Building: | GBHS | Buildina I | E | | | | | | |
|----------------------------------------------------------------|-------------|------------------|-------|-------------------------------|---------|-------|---------------|-------------------|--------------|
| System Tag/Name: | AHU-3 | | | | | | | | |
| Operating Condition Description: | | | | | | | | | |
| Units (select from pull-down list) | IP | | | | | | | | |
| | | | | | | | | | |
| Inputs for System | Name | Units | | | Sy | stem | | | |
| Floor area served by system | As | sf | | | | 1550 | | | |
| Population of area served by system (including diversity) | Ps | Р | | 100% diversity | | 22 | | | |
| Design primary supply fan airflow rate | Vpsd | cfm | | | | 1.930 | | | |
| OA reg/d per unit area for system (Weighted average) | Ras | cfm/sf | | | | 0.19 | | | |
| OA regid per person for system area (Weighted average) | Rns | cfm/n | | | | 5.6 | | | |
| Inputs for Potentially Critical zones | цро | onnip | | | | 0.0 | Poter | tially Critical 7 | ones |
| Zone Name | Zone ti | le turns n | urnle | e italic for critical zone(s) | | | Shower Pm | Locker Rm | Office |
| Zone Tag | 20110 1 | ie turns p | apic | | | | 29 | 27 | 25 |
| | | | | | | | Swimming | Spoctator | Offico spaco |
| Space type | | Select fr | om r | oull-down list | | | (nool & dook) | orectator | Once space |
| Elect Area of zono | ۸-7 | of | om | Jui-down list | | | (pool & deck) | areas | 140 |
| Design population of zone | 74Z 10-7 | 5I D | (dat | ault value listed: movike av | orridda | n) | 4/4 | 930 | 140 |
| Design population of Zone | r2 \/d=d | r" ofm | (uet | aun value listeu; may be ov | emade | 11) | 5 | 15 | 2 |
| Design total supply to zone (primary plus local recirculated) | vaza | cim Solant fr | | will down list on leave king | | | 565 | 1000 | 365 |
| Induction Terminal Unit, Dual Pan Dual Duct of Transfer Pan? | - - | Select fr | omp | Jun-down list of leave blank | CILIN/A | | 750/ | 750/ | 750/ |
| Local recirc. air % representative of ave system return air | Εſ | | | | | | /5% | 75% | /5% |
| Inputs for Operating Condition Analyzed | - | a (| | | | 1000/ | 4000/ | 1000/ | 1000/ |
| Percent of total design airflow rate at conditioned analyzed | Ds | % | | | | 100% | 100% | 100% | 100% |
| Air distribution type at conditioned analyzed | _ | Select fr | om p | oull-down list | | | CS | CS | CS |
| Zone air distribution effectiveness at conditioned analyzed | Ez | | | | | | 1.00 | 1.00 | 1.00 |
| Primary air fraction of supply air at conditioned analyzed | Ep | | | | | | | | |
| Results | _ | | | | | | | | |
| Ventilation System Efficiency | Ev | | | | | 0.81 | | | |
| Outdoor air intake required for system | Vot | cfm | | | | 510 | | | |
| Outdoor air per unit floor area | Vot/As | cfm/sf | | | | 0.33 | | | |
| Outdoor air per person served by system (including diversity) | Vot/Ps | cfm/p | | | | 23.2 | | | |
| Outdoor air as a % of design primary supply air | Ypd | cfm | | | | 26% | | | |
| | | | | | | | | | |
| Detailed Calculations | | | | | | | | | |
| Initial Calculations for the System as a whole | | | | | | | | | |
| Primary supply air flow to system at conditioned analyzed | Vps | cfm | = | VpdDs | = | 1930 | | | |
| UncorrectedOA requirement for system | Vou | cfm | = | Rps Ps + Ras As | = | 415 | | | |
| Uncorrected OA req'd as a fraction of primary SA | Xs | | = | Vou / Vps | = | 0.21 | | | |
| Initial Calculations for individual zones | | | | | | | | | |
| OA rate per unit area for zone | Raz | cfm/sf | | | | | 0.48 | 0.06 | 0.06 |
| OA rate per person | Rpz | cfm/p | | | | | 0.00 | 7.50 | 5.00 |
| Total supply air to zone (at condition being analyzed) | Vdz | cfm | | | | | 565 | 1000 | 365 |
| Unused OA req'd to breathing zone | Vbz | cfm | = | Rpz Pz + Raz Az | = | | 227.5 | 168.7 | 18.4 |
| Unused OA requirement for zone | Voz | cfm | = | Vbz/Ez | = | | 228 | 169 | 18 |
| Fraction of zone supply not directly recirc. from zone | Fa | | = | Ep + (1-Ep)Er | = | | 1.00 | 1.00 | 1.00 |
| Fraction of zone supply from fully mixed primary air | Fb | | = | Ep | = | | 1.00 | 1.00 | 1.00 |
| Fraction of zone OA not directly recirc. from zone | Fc | | = | 1-(1-Ez)(1-Ep)(1-Er) | = | | 1.00 | 1.00 | 1.00 |
| Unused OA fraction required in supply air to zone | Zd | | = | Voz / Vdz | = | | 0.40 | 0.17 | 0.05 |
| Unused OA fraction required in primary air to zone | Zp | | = | Voz / Vpz | = | | 0.40 | 0.17 | 0.05 |
| System Ventilation Efficiency | | | | | | | | | |
| Zone Ventilation Efficiency (App A Method) | Evz | | = | (Fa + FbXs - FcZ) / Fa | = | | 0.81 | 1.05 | 1.16 |
| System Ventilation Efficiency (App A Method) | Ev | | = | min (Evz) | = | 0.81 | | | |
| Ventilation System Efficiency (Table 6.3 Method) | Ev | | = | Value from Table 6.3 | = | 0.75 | | | |
| Minimum outdoor air intake airflow | | | | | | | | | |
| Outdoor Air Intake Flow required to System | Vot | cfm | = | Vou / Ev | = | 510 | | | |
| OA intake reg'd as a fraction of primary SA | Y | | = | Vot / Vps | = | 0.26 | | | |
| Outdoor Air Intake Flow required to System (Table 6.3 Method | Vot | cfm | - | Vou / Ev | _ | 555 | | | |
| OA intake regid as a fraction of primary SA (Table 6.3 Method) | Y | 3 | | Vot / Vos | - | 0.29 | | | |
| OA Temp at which Min OA provides all cooling | | | | | | 0.20 | | | |
| OAT below which OA Intake flow is @ minimum | | Deg E | = | {(Tp-dTsf)-(1-Y)*(Tr+dTr | = | 8 | | | |

| Building: | GBHS | Building | E | | | | | |
|----------------------------------------------------------------|--------|--------------|-------|-------------------------------|----------|-------|--------------------|---------------|
| System Tag/Name: | AHU-4 | & 5 | | | | | | |
| Operating Condition Description: | | | | | | | [| |
| Units (select from pull-down list) | IP | | | | | | | |
| | | | | | | | _ | |
| Inputs for System | Name | <u>Units</u> | | | Sys | stem | | |
| Floor area served by system | As | sf | | | | 9217 | | |
| Population of area served by system (including diversity) | Ps | P | | 100% diversity | | 500 | | |
| Design primary supply fan airflow rate | Vpsd | cfm | | | 1 | 4,400 | | |
| OA req'd per unit area for system (Weighted average) | Ras | ctm/st | | | | 0.30 | | |
| OA req'd per person for system area (Weighted average) | Rps | cfm/p | | | | 0.0 | | |
| Inputs for Potentially Critical zones | 7 | | | | | | Potentially C | ritical Zones |
| | Zone u | ie turns p | urpie | e italic for critical zone(s) | | | Gym | |
| Zone Tag | | | | | | | 112 Cum stadium | 04 |
| Space type | | | | | | | Gym, stadium | Office space |
| Space type | | Solact fi | rom r | ull-down list | | | (play area) | |
| Floor Area of zone | Δ7 | sf | ion p | Jui-down list | | | 0 217 | |
| Design population of zone | Pz | P | (def: | ault value listed: may be ov | erridder | 1) | 500 | |
| Design total supply to zone (primary plus local recirculated) | Vdzd | cfm | , | | | ., | 14,400 | |
| Induction Terminal Unit. Dual Fan Dual Duct or Transfer Fan? | | Select fi | rom r | oull-down list or leave blan | cif N/A | | , .50 | |
| Local recirc. air % representative of ave system return air | Er | | | | | | 75% | 75% |
| Inputs for Operating Condition Analyzed | | | | | | | | |
| Percent of total design airflow rate at conditioned analyzed | Ds | % | | | | 100% | 100% | 100% |
| Air distribution type at conditioned analyzed | | Select fr | rom p | oull-down list | | | CS | CS |
| Zone air distribution effectiveness at conditioned analyzed | Ez | | | | | | 1.00 | 1.00 |
| Primary air fraction of supply air at conditioned analyzed | Ep | | | | | | | |
| Results | | | | | | | | |
| Ventilation System Efficiency | Ev | | | | | 1.00 | | |
| Outdoor air intake required for system | Vot | cfm | | | | 2765 | | |
| Outdoor air per unit floor area | Vot/As | cfm/sf | | | | 0.30 | | |
| Outdoor air per person served by system (including diversity) | Vot/Ps | cfm/p | | | | 5.5 | | |
| Outdoor air as a % of design primary supply air | Ypd | cfm | | | | 19% | | |
| Detailed Calculations | | | | | _ | | | |
| Detailed Calculations | | | | | | | | |
| Primary supply air flow to system at conditioned analyzed | Vns | cfm | _ | VodDs | _ 1 | 14400 | | |
| LincorrectedOA requirement for system | Vou | cfm | _ | Rns Ps + Ras As | _ | 2765 | | |
| Uncorrected OA regid as a fraction of primary SA | Xs | Cim | _ | Vou / Vos | _ | 0.19 | | |
| Initial Calculations for individual zones | 7.0 | | - | | - | 0.10 | | |
| OA rate per unit area for zone | Raz | cfm/sf | | | | | 0.30 | 0.06 |
| OA rate per person | Rpz | cfm/p | | | | | 0.00 | 5.00 |
| Total supply air to zone (at condition being analyzed) | Vdz | cfm | | | | | 14400 | 0 |
| Unused OA reg'd to breathing zone | Vbz | cfm | = | Rpz Pz + Raz Az | = | | 2765.1 | 0.0 |
| Unused OA requirement for zone | Voz | cfm | = | Vbz/Ez | = | | 2765 | 0 |
| Fraction of zone supply not directly recirc. from zone | Fa | | = | Ep + (1-Ep)Er | = | | 1.00 | 1.00 |
| Fraction of zone supply from fully mixed primary air | Fb | | = | Ep | = | | 1.00 | 1.00 |
| Fraction of zone OA not directly recirc. from zone | Fc | | = | 1-(1-Ez)(1-Ep)(1-Er) | = | | 1.00 | 1.00 |
| Unused OA fraction required in supply air to zone | Zd | | = | Voz / Vdz | = | | 0.19 | 0.00 |
| Unused OA fraction required in primary air to zone | Zp | | = | Voz / Vpz | = | | 0.19 | 0.00 |
| System Ventilation Efficiency | | | | | | | | |
| Zone Ventilation Efficiency (App A Method) | Evz | | = | (Fa + FbXs - FcZ) / Fa | = | | 1.00 | 1.19 |
| System Ventilation Efficiency (App A Method) | Ev | | = | min (Evz) | = | 1.00 | | |
| Ventilation System Efficiency (Table 6.3 Method) | Év | | = | Value from Table 6.3 | = | 0.96 | | |
| Minimum outdoor air intake airflow | | | | | | | | |
| Outdoor Air Intake Flow required to System | Vot | ctm | = | Vou / Ev | = | 2765 | | |
| OA intake req'd as a fraction of primary SA | Y | - | = | Vot / Vps | = | 0.19 | | |
| Outdoor Air Intake Flow required to System (Table 6.3 Method) | Vot | ctm | = | VOU / EV | = | 2886 | | |
| OA Intake req d as a fraction of primary SA (Table 6.3 Method) | Y | | = | vot / vps | = | 0.20 | | |
| OAT below which OA Inteks flow is @ minimum | | Dog F | _ | (/Tp_dTef)_(1_V)*/TrudTr | _ | -17 | | |
| OAT BEIOW WHICH OA INTAKE TIOW IS @ MINIMUM | | Degr | = | {(IP-01SI)-(I-T) (IF+01F | = | -17 | | |

| Building: | GBHS | Buildina | E | | | | | |
|----------------------------------------------------------------|------------|----------------|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------|---------------|---------------|
| System Tag/Name: | AHU-6 | | - | | | | | |
| Operating Condition Description: | | | | | | | | |
| Units (select from pull-down list) | IP | | | | | | | |
| | | | | | | | | |
| Inputs for System | Name | <u>Units</u> | | | Sy | stem | | |
| Floor area served by system | As | sf | | | | 188 | | |
| Population of area served by system (including diversity) | Ps | Р | | 100% diversity | | 1 | | |
| Design primary supply fan airflow rate | Vpsd | cfm | | | - | 2,500 | | |
| OA req'd per unit area for system (Weighted average) | Ras | cfm/sf | | | - | 0.12 | | |
| OA req'd per person for system area (Weighted average) | Rps | cfm/p | | | | 5.0 | | |
| Inputs for Potentially Critical zones | _ | | | | | | Potentially C | ritical Zones |
| Zone Name | Zone tit | tle turns p | ourple | e italic for critical zone(s) | | | Laundry Rm | |
| Zone Tag | | | | | | | 46 | |
| | | | | | | | Laundry | Office space |
| Space type | | <u> </u> | | | | | rooms, | |
| | A – | Select f | rom | pull-down list | | | central | |
| Floor Area of zone | AZ D- | ST | (-1-6 | and the last flat of the state | | -) | 188 | |
| Design population of zone | PZ | P | (aer | auit value listed; may be o | verriadei | n) | 1 | |
| Design total supply to zone (primary plus local recirculated) | vaza | CIM | | | | | 2,500 | |
| Induction Terminal Unit, Dual Fan Dual Duct or Transfer Fan? | Er. | Select f | rom | pull-down list of leave blan | K IT IN/A | | 750/ | 750/ |
| Local recirc. all % representative of ave system return all | EI | | | | | | 10% | 70% |
| Porcent of total design airflow rate at conditioned analyzed | De | 9/ | | | | 100% | 100% | 100% |
| Air distribution type at conditioned analyzed | 05 | 70 Soloct f | rom | oull-down list | | 100 /6 | 100 % | 100% |
| Zono air distribution offortivonoss at conditioned analyzed | F 7 | Gelecti | IOIII | Sull-down list | | | 1.00 | 1.00 |
| Primary air fraction of supply air at conditioned analyzed | En | | | | | | 1.00 | 1.00 |
| Results | цр | | | | | | | |
| Ventilation System Efficiency | Ev | | | | | 1 00 | | |
| Outdoor air intake required for system | Vot | cfm | | | | 28 | | |
| Outdoor air make required for system | Vot/As | cfm/sf | | | | 0 15 | | |
| Outdoor air per person served by system (including diversity) | Vot/Ps | cfm/n | | | | 27.6 | | |
| Outdoor air as a % of design primary supply air | Ypd | cfm | | | | 1% | | |
| | | | | | | | | |
| Detailed Calculations | | | | | | | | |
| Initial Calculations for the System as a whole | | | | | | | | |
| Primary supply air flow to system at conditioned analyzed | Vps | cfm | = | VpdDs | = | 2500 | | |
| UncorrectedOA requirement for system | Vou | cfm | = | Rps Ps + Ras As | = | 28 | | |
| Uncorrected OA req'd as a fraction of primary SA | Xs | | = | Vou / Vps | = | 0.01 | | |
| Initial Calculations for individual zones | | | | | | | | |
| OA rate per unit area for zone | Raz | cfm/sf | | | | | 0.12 | 0.06 |
| OA rate per person | Rpz | cfm/p | | | | | 5.00 | 5.00 |
| Total supply air to zone (at condition being analyzed) | Vdz | cfm | | | | | 2500 | 0 |
| Unused OA req'd to breathing zone | Vbz | cfm | = | Rpz Pz + Raz Az | = | | 27.6 | 0.0 |
| Unused OA requirement for zone | Voz | cfm | = | Vbz/Ez | = | | 28 | 0 |
| Fraction of zone supply not directly recirc. from zone | Fa | | = | Ep + (1-Ep)Er | = | | 1.00 | 1.00 |
| Fraction of zone supply from fully mixed primary air | Fb | | = | Ep | = | | 1.00 | 1.00 |
| Fraction of zone OA not directly recirc. from zone | Fc | | = | 1-(1-Ez)(1-Ep)(1-Er) | = | | 1.00 | 1.00 |
| Unused OA fraction required in supply air to zone | Zd | | = | Voz / Vdz | = | | 0.01 | 0.00 |
| Unused OA fraction required in primary air to zone | Zp | | = | Voz / Vpz | = | | 0.01 | 0.00 |
| System Ventilation Efficiency | | | | | | | | |
| Zone Ventilation Efficiency (App A Method) | Evz | | = | (Fa + FbXs - FcZ) / Fa | = | | 1.00 | 1.01 |
| System Ventilation Efficiency (App A Method) | Év | | = | min (Evz) | = | 1.00 | | |
| Ventilation System Efficiency (Table 6.3 Method) | Ev | | = | Value from Table 6.3 | = | 1.14 | | |
| Minimum outdoor air intake airflow | | | | | | | | |
| Outdoor Air Intake Flow required to System | Vot | cfm | = | Vou / Ev | = | 28 | | |
| OA intake req'd as a fraction of primary SA | Y | | = | Vot / Vps | = | 0.01 | | |
| Outdoor Air Intake Flow required to System (Table 6.3 Method) | Vot | cfm | = | Vou / Ev | = | 24 | 3.36 | |
| OA intake req'd as a fraction of primary SA (Table 6.3 Method) | Y | | = | Vot / Vps | = | 0.01 | 0.12 | |
| OA Temp at which Min OA provides all cooling | | | | | | | | |
| OAT below which OA Intake flow is @ minimum | | Deg F | = | {(Ip-dIst)-(1-Y)*(Ir+dTr | = | -1470 | | |

| Building: | GBHS | Building | E | | | | | | |
|----------------------------------------------------------------|--------------|--------------------|-------|-------------------------------|----------------|-------|--------------|--------------------|-----------|
| System Tag/Name: | AHU-7 | | | | | | | | |
| Operating Condition Description: | | | | | | | | | |
| Units (select from pull-down list) | IP | | | | | | | | |
| | | | | | | | | | |
| Inputs for System | Name | <u>Units</u> | | | S | ystem | | | |
| Floor area served by system | As | st | | 1000/ | | 1449 | | | |
| Population of area served by system (including diversity) | PS | P, | | 100% diversity | | 6 | | | |
| Design primary supply fan airflow rate | vpsd | ctm | | | | 1,300 | | | |
| OA req'd per unit area for system (Weighted average) | Ras | ctm/st | | | | 0.06 | | | |
| OA req'd per person for system area (Weighted average) | Rps | cfm/p | | | | 5.0 | _ | | |
| Inputs for Potentially Critical zones | - | | | | | - | Poter | ntially Critical Z | ones |
| Zone Name | Zone ti | tie turns p | urple | e italic for critical zone(s) | | - | Lobby | Concessions | Coat Room |
| Zone Lag | | | | | | - | 106 | 107 | 105 |
| Space type | | Soloot f | | null down list | | | Lobbies | Office space | Storage |
| Electr Area of Jona | ۸- | of | om | pull-down list | | - | 1 155 | 176 | rooms |
| | AZ D= | 51 | (10 | foult volue listed, movies o | ر م ست ما ما . |) | 1,100 | 170 | 110 |
| Design population of zone | PZ V dend | P | (dei | lault value listed; may be ov | emaae | en) | C 1 110 | 145 | |
| Induction Terminal Unit, Dual Ean Dual Dust or Transfer Ean? | vaza | CIIII Soloot fi | | null down list or loove blood | . ;f NI/A | - | 1,110 | 115 | /5 |
| l ocal recirc, air % representative of ave system roturn air | Fr | Select II | | puil-down list of leave blan | N II IN/A | · F | 750/ | 750/ | 750/ |
| Inputs for Operating Condition Analyzed | LI | | | | | | 1 3 70 | 1 3 70 | 1 3 70 |
| Percent of total design airflow rate at conditioned analyzed | Ds | % | | | | 100% | 100% | 100% | 100% |
| Air distribution type at conditioned analyzed | | Select fr | om i | pull-down list | | | CS | CS | CS |
| Zone air distribution effectiveness at conditioned analyzed | Ez | | | | | - | 1.00 | 1.00 | 1.00 |
| Primary air fraction of supply air at conditioned analyzed | Ep | | | | | Ī | | | |
| Results | | | | | | | | | |
| Ventilation System Efficiency | Ev | | | | | 0.91 | | | |
| Outdoor air intake required for system | Vot | cfm | | | | 137 | | | |
| Outdoor air per unit floor area | Vot/As | cfm/sf | | | | 0.09 | | | |
| Outdoor air per person served by system (including diversity) | Vot/Ps | cfm/p | | | | 22.8 | | | |
| Outdoor air as a % of design primary supply air | Ypd | cfm | | | | 11% | | | |
| | | | | | | | | | |
| Detailed Calculations | | | | | | | | | |
| Primary supply air flow to system at conditioned analyzed | Vnc | cfm | _ | VodDe | _ | 1200 | | | |
| LincorrectedQA requirement for system | Vou | ofm | _ | Pro Po + Poo Ac | _ | 124 | | | |
| Uncorrected OA regulation of primary SA | Vou | CIIII | = | KpSFS + KdSAS | = | 0.10 | | | |
| Initial Calculations for individual zones | 72 | | - | vou / vps | - | 0.10 | | | |
| | Raz | cfm/sf | | | | | 0.06 | 0.06 | 0.12 |
| | Roz | cfm/n | | | | | 5.00 | 5.00 | 0.12 |
| Total supply air to zone (at condition being analyzed) | Vdz | cfm | | | | | 1110 | 115 | 75 |
| Linused Ω regid to breathing zone | Vuz | cfm | _ | Rnz Pz + Raz Az | _ | | 9/3 | 15.6 | 1/ 2 |
| Unused OA requirement for zono | Voz | ofm | _ | | _ | | 94.5 | 15.0 | 14.2 |
| Eraction of zone supply not directly regire from zone | V02 E0 | CIIII | _ | VDZ/LZ Ep + (1-Ep)Er | _ | | 1 00 | 1 00 | 1 00 |
| Fraction of zone supply from fully mixed primary air | Fb | | _ | | _ | | 1.00 | 1.00 | 1.00 |
| Fraction of zone OA pat directly regire from zone | Fo | | | $\frac{Lp}{1-(1-E_7)(1-E_7)}$ | _ | | 1.00 | 1.00 | 1.00 |
| Linused QA fraction required in supply air to zone | Zd | | = | $\sqrt{(1-E_2)(1-E_1)}$ | - | | 1.00 | 1.00 | 1.00 |
| Unused OA fraction required in supply all to zone | Zu Zn | | - | | _ | | 0.08 | 0.14 | 0.19 |
| System Ventilation Efficiency | zμ | | - | voz/vpz | - | | 0.00 | 0.14 | 0.19 |
| Zone Ventilation Efficiency (App A Method) | Evz | | _ | (Fa + FbXs - Fc7)/Fa | _ | | 1.01 | 0.06 | 0.01 |
| System Ventilation Efficiency (App A Method) | Ev | | - | min (Fvz) | _ | 0.91 | 1.01 | 0.90 | 0.91 |
| Ventilation System Efficiency (Table 6.3 Method) | Ev | | - | Value from Table 6.3 | _ | 0.96 | | | |
| Minimum outdoor air intake airflow | | | | | | 0.00 | | | |
| Outdoor Air Intake Flow required to System | Vot | cfm | = | Vou / Ev | = | 137 | | | |
| OA intake reg'd as a fraction of primary SA | Y | | = | Vot / Vps | = | 0.11 | | | |
| Outdoor Air Intake Flow required to System (Table 6.3 Method) | Vot | cfm | _ | Vou / Ev | - | 129 | 7 77 | | |
| OA intake reg'd as a fraction of primary SA (Table 6.3 Method) | Y | | - | Vot / Vps | = | 0.10 | <u>a</u> 0.0 | | |
| OA Temp at which Min OA provides all cooling | | | | | | | 0.00 | | |
| OAT below which OA Intake flow is @ minimum | | Deg F | = | {(Tp-dTsf)-(1-Y)*(Tr+dTr | = | -90 | | | |

| | | CDUC | Duilding | - | | | | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|---------------------------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------------------------------------|---------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| System Tag/Name: | | | sanding | - | | _ | | ł | |
| Operating Condition Description: | | A110-0 | | | | | • | | |
| Units (select from pull-down list) | | IP | | | | | | ł | |
| · · · | | | | | | | | | |
| Inputs for System | | Name | Units | | | 5 | System | I | |
| Floor area served by system | | As | sf | | | | 1417 | | |
| Population of area served by | v system (including diversity) | Ps | Р | | 100% diversity | | 5 | | |
| Design primary supply fan ai | rflow rate | Vpsd | cfm | | | | 900 | | |
| OA req'd per unit area for sy | stem (Weighted average) | Ras | cfm/sf | | | | 0.06 | | |
| OA req'd per person for syste | em area (Weighted average) | Rps | cfm/p | | | | 5.0 | | |
| Inputs for Potentially Critical zones | | | | | | | | Potentially C | ritical Zones |
| Zone Name | | | | | | | | 2nd Floor | |
| Zone Name | | Zone tit | le turns p | urple | italic for critical zone(s) | | | Office | |
| Zone Tag | | | | | | | | 204/5 | |
| Space type | | | Select fr | om p | oull-down list | | | Office space | Office space |
| Floor Area of zone | | Az | sf | | | | | 1,417 | |
| Design population of zone | | Pz | Р | (defa | ault value listed; may be ov | /errido | den) | 5 | |
| Design total supply to zone (| primary plus local recirculated) | Vdzd | cfm | | | | | 900 | |
| Induction Terminal Unit, Dua | I Fan Dual Duct or Transfer Fan? | | Select fr | om p | ull-down list or leave blank | k if N// | Ą | | |
| Local recirc. air % represent | ative of ave system return air | Er | | | | | | 75% | 75% |
| Inputs for Operating Condition Analy | zed | - | | | | - | | | |
| Percent of total design airflo | w rate at conditioned analyzed | Ds | % | | | | 100% | 100% | 100% |
| Air distribution type at condit | ioned analyzed | _ | Select fr | om p | oull-down list | | | CS | CS |
| Zone air distribution effective | eness at conditioned analyzed | Ez | | | | | | 1.00 | 1.00 |
| Primary air fraction of supply | air at conditioned analyzed | Ep | | | | | | | |
| Results | | E | | | | | 4 00 | | |
| Ventilation System Efficiency | / | EV | | | | | 1.00 | | |
| Outdoor air intake required f | or system | VOT | cim | | | | 110 | | |
| Outdoor air per unit floor are | a dhu uutaa (is dudia a diusaita) | VOU/AS | CIM/SI | | | | 0.08 | | |
| Outdoor air per person serve | a by system (including diversity) | VOT/PS | crm/p | | | | 22.0 | | |
| Outdoor air as a % or design | primary supply all | rpa | CIM | | | | 12% | | |
| Detailed Calculations | | | | | | | | | |
| Initial Calculations for the System as | a whole | | | | | | | | |
| Primary supply air flow to sy | stem at conditioned analyzed | Vps | cfm | = | VpdDs | = | 900 | | |
| UncorrectedOA requirement | for system | Vou | cfm | = | Rps Ps + Ras As | = | 110 | | |
| Uncorrected OA reg'd as a fr | action of primary SA | Xs | | = | Vou / Vps | = | 0.12 | | |
| Initial Calculations for individual zon | es | | | | | | | | |
| OA rate per unit area for zen | | | | | | | | | |
| | le | Raz | cfm/sf | | | | | 0.06 | 0.06 |
| OA rate per person | le | Raz Rpz | cfm/sf cfm/p | | | | | 0.06 5.00 | 0.06 5.00 |
| OA rate per trint area for 201 OA rate per person Total supply air to zone (at c | e ondition being analyzed) | Raz Rpz Vdz | cfm/sf cfm/p cfm | | | | | 0.06 5.00 900 | 0.06 5.00 0 |
| OA rate per person Total supply air to zone (at c Unused OA reg'd to breathin | e ondition being analyzed) g zone | Raz Rpz Vdz Vbz | cfm/sf cfm/p cfm cfm | = | Rpz Pz + Raz Az | = | | 0.06 5.00 900 110.0 | 0.06 5.00 0 0.0 |
| OA rate per on area for 201 OA rate per person Total supply air to zone (at c Unused OA req'd to breathin Unused OA requirement for 1 | e ondition being analyzed) g zone zone | Raz Rpz Vdz Vbz Voz | cfm/sf cfm/p cfm cfm cfm | = | Rpz Pz + Raz Az Vbz/Ez | = | | 0.06 5.00 900 110.0 110 | 0.06 5.00 0 0.0 0.0 |
| OA rate per person OA rate per person Total supply air to zone (at c Unused OA requirement for : Fraction of zone supply not c | e ondition being analyzed) g zone zone directly recirc. from zone | Raz Rpz Vdz Vbz Voz Fa | cfm/sf cfm/p cfm cfm cfm | = = | Rpz Pz + Raz Az Vbz/Ez Ep + (1-Ep)Er | = = | | 0.06 5.00 900 110.0 110 1.00 | 0.06 5.00 0 0.0 0 1.00 |
| OA rate per unit area to zone OA rate per person Total supply air to zone (at c Unused OA req'd to breathin Unused OA requirement for : Fraction of zone supply not c Fraction of zone supply from | e ondition being analyzed) g zone zone directly recirc. from zone fully mixed primary air | Raz Rpz Vdz Vbz Voz Fa Fb | cfm/sf cfm/p cfm cfm cfm | | Rpz Pz + Raz Az Vbz/Ez Ep + (1-Ep)Er Ep | = = = | | 0.06 5.00 900 110.0 110 1.00 | 0.06 5.00 0.0 0.0 1.00 1.00 |
| OA rate per person Total supply air to zone (at c Unused OA req'd to breathin Unused OA requirement for : Fraction of zone supply from Fraction of zone oA not dire | e ondition being analyzed) g zone zone firectly recirc. from zone fully mixed primary air ctly recirc. from zone | Raz Rpz Vdz Vbz Fa Fb Fc | cfm/sf cfm/p cfm cfm cfm | | Rpz Pz + Raz Az Vbz/Ez Ep + (1-Ep)Er Ep 1-(1-Ez)(1-Ep)(1-Er) | = = = = | | 0.06 5.00 900 110.0 1.00 1.00 1.00 | 0.06 5.00 0.0 0.0 1.00 1.00 1.00 |
| OA rate per unit area to 200 OA rate per person Total supply air to zone (at c Unused OA requirement for: Fraction of zone supply from Fraction of zone supply for d Fraction of zone OA not dire Unused OA fraction required | e ondition being analyzed) g zone zone directly recirc. from zone fully mixed primary air ctly recirc. from zone in supply air to zone | Raz Rpz Vdz Vbz Fa Fb Fc Zd | cfm/sf cfm/p cfm cfm cfm | | Rpz Pz + Raz Az Vbz/Ez Ep + (1-Ep)Er Ep 1-(1-Ez)(1-Ep)(1-Er) Voz / Vdz | | | 0.06 5.00 900 110.0 1.00 1.00 0.12 | 0.06 5.00 0.0 1.00 1.00 1.00 0.00 |
| OA rate per person Total supply air to zone (at c Unused OA requirement for : Fraction of zone supply not c Fraction of zone supply from Fraction of zone OA not dire Unused OA fraction required Unused OA fraction required | e ondition being analyzed) g zone directly recirc. from zone fully mixed primary air ctly recirc. from zone lin supply air to zone lin primary air to zone | Raz Rpz Vdz Vbz Fa Fb Fc Zd Zp | cfm/sf cfm/p cfm cfm cfm | | Rpz Pz + Raz Az Vbz/Ez Ep + (1-Ep)Er Ep 1-(1-Ez)(1-Ep)(1-Er) Voz / Vdz Voz / Vpz | | | 0.06 5.00 900 110.0 1.00 1.00 0.00 0.12 0.12 | 0.06 5.00 0.0 1.00 1.00 1.00 0.00 0.00 |
| OA rate per dint area to 20 OA rate per person Total supply air to zone (at c Unused OA req'd to breathin Unused OA req'd to breathin Fraction of zone supply not o Fraction of zone supply from Fraction of zone OA not dire Unused OA fraction required Unused OA fraction required System Ventilation Efficiency | e ondition being analyzed) g zone zone firectly recirc. from zone fully mixed primary air ctly recirc. from zone lin supply air to zone lin primary air to zone | Raz Rpz Vdz Vbz Fa Fb Fc Zd Zp | cfm/sf cfm/p cfm cfm cfm | | Rpz Pz + Raz Az Vbz/Ez Ep + (1-Ep)Er Ep 1-(1-Ez)(1-Ep)(1-Er) Voz / Vdz Voz / Vpz | | | 0.06 5.00 900 110.0 1.00 1.00 0.12 0.12 | 0.06 5.00 0 0.0 1.00 1.00 1.00 0.00 |
| OA rate per unit area to 200 OA rate per person Total supply air to zone (at c Unused OA requirement for Fraction of zone supply not c Fraction of zone supply from Fraction of zone OA not dire Unused OA fraction required Unused OA fraction required System Ventilation Efficiency (| e ondition being analyzed) g zone zone directly recirc. from zone fully mixed primary air ctly recirc. from zone l in supply air to zone l in primary air to zone App A Method) | Raz Rpz Vdz Vbz Fa Fb Fc Zd Zp | cfm/sf cfm/p cfm cfm cfm | | Rpz Pz + Raz Az Vbz/Ez Ep + (1-Ep)Er Ep 1-(1-Ez)(1-Ep)(1-Er) Voz / Vdz Voz / Vpz (Fa + FbXs - FcZ) / Fa | | | 0.06 5.00 900 110.0 1.00 1.00 0.12 0.12 1.00 | 0.06 5.00 0 0.0 0 0.00 1.00 1.00 0.00 0.00 0 |
| OA rate per person OA rate per person Total supply air to zone (at c Unused OA req'd to breathin Unused OA requirement for Fraction of zone supply not d Fraction of zone supply from Fraction of zone supply from Fraction of race OA not dire Unused OA fraction required Unused OA fraction required System Ventilation Efficiency Zone Ventilation Efficiency (| e ondition being analyzed) g zone zone directly recirc. from zone fully mixed primary air ctly recirc. from zone i in supply air to zone l in primary air to zone App A Method) ((App A Method) | Raz Rpz Vdz Vbz Fa Fb Fc Zd Zd Zp Evz Evz | cfm/sf cfm/p cfm cfm cfm | | Rpz Pz + Raz Az Vbz/Ez Ep + (1-Ep)Er Ep 1-(1-Ez)(1-Ep)(1-Er) Voz / Vdz Voz / Vpz (Fa + FbXs - FcZ) / Fa min (Evz) | | 1.00 | 0.06 5.00 900 110.0 1.00 1.00 1.00 0.12 0.12 1.00 | 0.06 5.00 0 0.0 1.00 1.00 0.00 0.00 1.12 |
| OA rate per unit area to 20 OA rate per person Total supply air to zone (at c Unused OA requirement for : Fraction of zone supply not c Fraction of zone supply from Fraction of zone OA not dire Unused OA fraction required Unused OA fraction required System Ventilation Efficiency Ventilation Efficiency Ventilation System Efficiency | e ondition being analyzed) g zone zone directly recirc. from zone fully mixed primary air ctly recirc. from zone in supply air to zone lin primary air to zone App A Method) ((App A Method) | Raz Rpz Vdz Vbz Fa Fb Fc Zd Zd Evz Ev Ev | cfm/sf cfm/p cfm cfm cfm | | Rpz Pz + Raz Az Vbz/Ez Ep + (1-Ep)Er Ep 1-(1-Ez)(1-Ep)(1-Er) Voz / Vdz Voz / Vpz (Fa + FbXs - FcZ) / Fa min (Evz) Value (rom Table 6-3 | | 1.00 1.03 | 0.06 5.00 900 110.0 1.00 1.00 1.00 0.12 0.12 1.00 | 0.06 5.00 0 0.0 1.00 1.00 0.00 0.00 1.12 |
| OA rate per unit area to zon OA rate per unit area to zon Total supply air to zone (at c Unused OA req'd to breathin Unused OA req'd to breathin Fraction of zone supply not o Fraction of zone supply from Fraction of zone OA not dire Unused OA fraction required Unused OA fraction required System Ventilation Efficiency Zone Ventilation Efficiency Ventilation System Efficiency Wentilation System Efficiency Minimum outdoor air intake airflow | e ondition being analyzed) g zone zone firectly recirc. from zone fully mixed primary air ctly recirc. from zone lin supply air to zone in primary air to zone App A Method) ((App A Method) (Table 6.3 Method) | Raz Rpz Vdz Vbz Fa Fb Fc Zd Zp Evz Ev Ev | cfm/sf cfm/p cfm cfm cfm | | Rpz Pz + Raz Az Vbz/Ez Ep + (1-Ep)Er Ep 1-(1-Ez)(1-Ep)(1-Er) Voz / Vdz Voz / Vpz (Fa + FbXs - FcZ) / Fa min (Evz) Value from Table 6.3 | | 1.00 1.03 | 0.06 5.00 900 110.0 1.00 1.00 0.12 0.12 1.00 | 0.06 5.00 0 0.0 1.00 1.00 0.00 0.00 1.12 |
| OA rate per person OA rate per person Total supply air to zone (at c Unused OA req'd to breathin Unused OA req'it to breathin Unused OA requirement for : Fraction of zone supply not of Fraction of zone oupply from Fraction of zone OA not dire Unused OA fraction required Unused OA fraction required Unused OA fraction required System Ventilation Efficiency Ventilation System Efficiency Ventilation System Efficiency Outdoor Air Intake Filow required | e ondition being analyzed) g zone zone fully recirc. from zone fully mixed primary air ctly recirc. from zone l in supply air to zone l in primary air to zone App A Method) / (App A Method) / (Table 6.3 Method) ifred to System | Raz Rpz Vdz Vbz Voz Fa Fb Fc Zd Zp Evz Ev Ev | cfm/sf cfm/p cfm cfm cfm | | Rpz Pz + Raz Az Vbz/Ez Ep + (1-Ep)Er Ep 1-(1-Ez)(1-Ep)(1-Er) Voz / Vdz Voz / Vpz (Fa + FbXs - FcZ) / Fa min (Evz) Value from Table 6.3 Vou / Ev | | 1.00 1.03 110 | 0.06 5.00 900 110.0 1.00 1.00 0.12 0.12 1.00 | 0.06 5.00 0 0.0 0 1.00 1.00 1.00 0.00 0.00 0 |
| OA rate per unit alter for bind OA rate per person Total supply air to zone (at c Unused OA requirement for : Fraction of zone supply not c Fraction of zone supply from Fraction of zone OA not dire Unused OA fraction required Unused OA fraction required System Ventilation Efficiency Zone Ventilation Efficiency Ventilation System Efficiency Ventilation System Efficiency Outdoor Air Intake Flow requ Outdoor Air Intake Flow requ OA intake regid as a fraction | e ondition being analyzed) g zone zone firectly recirc. from zone fully mixed primary air ctly recirc. from zone in supply air to zone lin primary air to zone App A Method) r (App A Method) r (Table 6.3 Method) aired to System of primary SA | Raz Rpz Vdz Vbz Voz Fa Fb Fc Zd Zp Evz Ev Ev Ev | cfm/sf cfm/p cfm cfm cfm cfm | | Rpz Pz + Raz Az Vbz/Ez Ep + (1-Ep)Er Ep 1-(1-Ez)(1-Ep)(1-Er) Voz / Vdz Voz / Vpz (Fa + FbXs - FcZ) / Fa min (Evz) Value from Table 6.3 Vou / Ev Vot / Vos | | 1.00 1.03 110 0.12 | 0.06 5.00 900 110.0 1.00 1.00 1.00 0.12 0.12 1.00 | 0.06 5.00 0 0.0 1.00 1.00 0.00 0.00 1.12 |
| OA rate per unit alter to 200 OA rate per person Total supply air to zone (at c Unused OA requirement for : Fraction of zone supply not c Fraction of zone supply from Fraction of zone OA not dire Unused OA fraction required Unused OA fraction required System Ventilation Efficiency Ventilation Efficiency Ventilation Efficiency Ventilation System Efficiency Minimum outdoor air intake airflow Outdoor Air Intake Flow requ OA intake req'd as a fraction Outdoor Air Intake Flow requ | e ondition being analyzed) g zone zone firectly recirc. from zone fully mixed primary air ctly recirc. from zone lin supply air to zone lin primary air to zone App A Method) / (App A Method) / (App A Method) y (Table 6.3 Method) sired to System of primary SA | Raz Rpz Vdz Vbz Fa Fb Fc Zd Zp Evz Ev Ev Ev Vot Y | cfm/sf cfm/p cfm cfm cfm cfm | | Rpz Pz + Raz Az Vbz/Ez Ep + (1-Ep)Er Ep 1-(1-Ez)(1-Ep)(1-Er) Voz / Vdz Voz / Vpz (Fa + FbXs - FcZ) / Fa min (Evz) Value from Table 6.3 Vou / Ev Vot / Vps Vou / Ev | | 1.00 1.03 110 0.12 | 0.06 5.00 900 110.0 1.00 1.00 0.12 0.12 1.00 | 0.06 5.00 0 0.0 1.00 1.00 1.00 0.00 0.00 1.12 |
| OA rate per unit area tor zon OA rate per person Total supply air to zone (at c Unused OA requirement for Fraction of zone supply not of Fraction of zone supply from Fraction of zone OA not dire Unused OA fraction required Unused OA fraction required Unused OA fraction required System Ventilation Efficiency (System Ventilation Efficiency (System Ventilation System Efficiency Ventilation System Efficiency Ventilation System Efficiency OA intake req'd as a fraction Outdoor Air Intake Flow requ OA intake req'd as a fraction | e ondition being analyzed) g zone zone fully recirc. from zone fully mixed primary air cttly recirc. from zone lin supply air to zone in primary air to zone App A Method) / (App A Method) / (Table 6.3 Method) sired to System of primary SA of primary SA (Table 6.3 Method) | Raz Rpz Vdz Vbz Voz Fa Fb Fc Zd Zp Evz Ev Ev Vot Y Vot | cfm/sf cfm/p cfm cfm cfm cfm | | Rpz Pz + Raz Az Vbz/Ez Ep + (1-Ep)Er Ep 1-(1-Ez)(1-Ep)(1-Er) Voz / Vdz Voz / Vpz (Fa + FbXs - FcZ) / Fa min (Evz) Value from Table 6.3 Vou / Ev Vot / Vps Vot / Vps | | 1.00 1.03 110 0.12 107 0,12 | 0.06 5.00 900 110.0 1.00 0.12 0.12 1.00 2.97 | 0.06 5.00 0 0.0 0 1.00 1.00 1.00 0.00 0.00 0 |
| OA rate per person Total supply air to zone (at c Unused OA requirement for : Fraction of zone supply not of Fraction of zone supply from Fraction of zone of a cone supply from Fraction of zone of the total Unused OA fraction required Unused OA fraction required Unused OA fraction required System Ventilation Efficiency (System Ventilation Efficiency Ventilation System Efficiency Outdoor Air Intake Flow requ OA intake req'd as a fraction Outdoor Air Intake Flow requ OA intake req'd as a fraction Other as a fraction OA temp at which Min OA provides a | e ondition being analyzed) g zone zone fully recirc. from zone fully mixed primary air ctly recirc. from zone lin supply air to zone lin primary air to zone App A Method) / (App A Method) / (Table 6.3 Method) iired to System of primary SA iired to System (Table 6.3 Method) of primary SA iired to System (Table 6.3 Method) all cooling | Raz Rpz Vdz Voz Fa Fb Fc Zd Zp Evz Ev Ev Vot Y Vot Y | cfm/sf cfm/p cfm cfm cfm cfm | | Rpz Pz + Raz Az Vbz/Ez Ep + (1-Ep)Er Ep 1-(1-Ez)(1-Ep)(1-Er) Voz / Vdz Voz / Vpz (Fa + FbXs - FcZ) / Fa min (Evz) Value from Table 6.3 Vou / Ev Vot / Vps Vou / Ev Vot / Vps | | 1.00 1.03 110 0.12 107 0.12 | 0.06 5.00 900 110.0 1.00 1.00 0.12 0.12 1.00 2.97 0.03 | 0.06 5.00 0 0.0 1.00 1.00 1.00 0.00 0.00 0.0 |

| Building: | GBHS | Building | E | | | | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------------------------------------------------|--------|------------------------------|----------|----------------------------------------------|-----------------------|---------------|
| System Tag/Name: | AHU-9 | | | | | | | |
| Operating Condition Description: | IP | | | | | | | |
| onits (select from pan-down list) | IF | | | | | | | |
| Inputs for System Floor area served by system Population of area served by system (including diversi Design primary supply fan airflow rate OA req'd per unit area for system (Weighted average) OA req'd per person for system area (Weighted average) Inputs for Potentially Critical zones | Name As Vpsd Ras age) Rps | <u>Units</u> sf P cfm cfm/sf cfm/p | | 100% diversity | S | vstem 1966 20 1,300 0.06 20.0 | Potentially C | ritical Zones |
| Zone Name | Zono i | itla turna r | urole | talia for aritical zana(a) | | | Weight Room | |
| Zone Tag | Zone i | ue turns p | Juipie | | | | 20 | |
| Space type | | Select f | rom c | pull-down list | | | Health club/weight | Office space |
| Floor Area of zone | Az | sf | | | | | 1,966 | |
| Design population of zone | Pz | Р | (defa | ault value listed; may be ov | /erridde | en) | 20 | |
| Design total supply to zone (primary plus local recircul | lated) Vdzd | cfm | | | | | 1,300 | |
| Induction Terminal Unit, Dual Fan Dual Duct or Transf | er Fan? | Select f | rom p | oull-down list or leave blan | k if N/A | | | |
| Local recirc. air % representative of ave system return | air Er | | | | | | 75% | 75% |
| Percent of total design airflow rate at conditioned anal | vzed Ds | % | | | | 100% | 100% | 100% |
| Air distribution type at conditioned analyzed | , | Select f | rom p | oull-down list | | | CS | CS |
| Zone air distribution effectiveness at conditioned analy | yzed Ez | | | | | | 1.00 | 1.00 |
| Primary air fraction of supply air at conditioned analyze | ed Ep | | | | | | | |
| Results | | | | | | | | |
| Ventilation System Efficiency | Ev | | | | | 1.00 | | |
| Outdoor air intake required for system | Vot | cfm | | | | 518 | | |
| Outdoor air per unit floor area | Vot/As | cfm/sf | | | | 0.26 | | |
| Outdoor air per person served by system (including div | versity) Vot/Ps | cfm/p | | | | 25.9 | | |
| Outdoor all as a 76 or design primary supply all | ipu | CIIII | | | | 40 /8 | | |
| Detailed Calculations | | | | | | | | |
| Initial Calculations for the System as a whole | | | | | | | | |
| Primary supply air flow to system at conditioned analy: | zed Vps | cfm | = | VpdDs | = | 1300 | | |
| UncorrectedOA requirement for system | Vou | cfm | = | Rps Ps + Ras As | = | 518 | | |
| Uncorrected OA req'd as a fraction of primary SA | Xs | | = | Vou / Vps | = | 0.40 | | |
| Initial Calculations for individual zones | | | | | | | | |
| OA rate per unit area for zone | Raz | cfm/sr | | | | | 0.06 | 0.06 |
| Total supply air to zone (at condition being analyzed) | KµZ Vdz | cfm | | | | | 20.00 | 5.00 |
| Linused OA regid to breathing zone | Vuz Vbz | cfm | _ | Rnz Pz + Raz Az | _ | | 518.0 | 0.0 |
| Unused OA requirement for zone | Voz | cfm | _ | Vhz/Fz | _ | | 518 | 0.0 |
| Fraction of zone supply not directly recirc, from zone | Fa | onn | _ | $E_{D} + (1-E_{D})E_{T}$ | _ | | 1.00 | 1.00 |
| Fraction of zone supply from fully mixed primary air | Fb | | = | Ep | = | | 1.00 | 1.00 |
| Fraction of zone OA not directly recirc. from zone | Fc | | = | 1-(1-Ez)(1-Ep)(1-Er) | = | | 1.00 | 1.00 |
| Unused OA fraction required in supply air to zone | Zd | | = | Voz / Vdz | = | | 0.40 | 0.00 |
| Unused OA fraction required in primary air to zone | Zp | | = | Voz / Vpz | = | | 0.40 | 0.00 |
| System Ventilation Efficiency | | | | | | | | |
| Zone Ventilation Efficiency (App A Method) | Evz | | = | (Fa + FbXs - FcZ) / Fa | = | | 1.00 | 1.40 |
| System Ventilation Efficiency (App A Method) | Ev | | = | min (Evz) | = | 1.00 | | |
| Ventilation System Efficiency (Table 6.3 Method) | Ev | | = | Value from Table 6.3 | = | 0.75 | | |
| Outdoor Air Intake Airfiow | Vet | ofm | | | | E40 | | |
| OA intake regid as a fraction of primary SA | vot | Cim | = | Vot / Vos | = | 0.40 | | |
| Outdoor Air Intake Elow required to System (Table 6.3 | Method) Vot | cfm | = | Vou / Ev | _ | 680 | | |
| OA intake regid as a fraction of primary SA (Table 6.3 | Method) Y | onn | - | Vot / Vps | 2 | 0.53 | | |
| OA Temp at which Min OA provides all cooling | | Deg F | _ | {(Tp-dTsf)-(1-Y)*(Tr+dTr | _ | 29 | | |

| Building | 1 | GBHS | Building | F | | | | | | | | | |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------|-----------------------------------|----------|--------|-----------|-----------|------------|--------------|-----------|--------------|-----------|
| System | Fag/Name: | AHU-1 | | | | | | | | | | | |
| Operatin | g Condition Description: | | | | | | | | | | | | |
| Units (se | lect from pull-down list) | IP | | | | | | | | | | | |
| | • | | | | | | | | | | | | |
| Inputs fo | r System | Name | <u>Units</u> | | | System | | | | | | | |
| | Pitori area served by system Reputation of area partied by overtem (including diversity) | AS Do | SI D | 100% diversity | _ | 10362 | | | | | | | |
| | Population of area served by system (including diversity) | rs Vood | r ofm | 100% diversity | | 10.005 | | | | | | | |
| | OA regid per upit groe for evotor (Meighted everage) | vpsu Ree | ofm/of | | _ | 19,990 | | | | | | | |
| | OA regid per unit area for system area. (Weighted average) | Ras | cfm/n | | _ | 0.10 | | | | | | | |
| Innuts fo | r Potentially Critical zones | ixps | cini/p | | | 9.0 | | | | | | | |
| inputare | T Otentially Offical 20163 | | | | | | Entrance | Equipment | Passage 1 | PF Plan | Vestibule | PF Plan | Student |
| | 7 | | | | | | | Storage | i doodgo i | | roomaalo | | Lounge |
| | Zone Name | | | | | | | | | | | | Jan St |
| | | Zone t | itle turns p | urple italic for critical zone(s) | | | | | | | | | |
| | Zone Tag | | | | | | 102D | 106D | 109B | 109B | 133A | 134A | 136A |
| | On and the second secon | | | | | | Corridors | Storage | Corridors | Office space | Corridors | Office space | Corridors |
| | Space type | | Soloot f | rom null down list | | | | rooms | | | | | |
| | Floor Area of zone | Az | sf | om pull-uowin iiSt | | | 222 | 173 | 180 | 120 | 00 | 118 | 197 |
| | Design population of zone | Pz | P | (default value listed: may be ov | /erride | den) | 032 | 1/3 | 100 | 120 | 90 | 110 | 5 |
| | Design total supply to zone (primary plus local recirculated) | Vdzd | cfm | , | ac | , | 95 | 160 | 75 | 110 | 20 | 100 | 100 |
| | Induction Terminal Unit, Dual Fan Dual Duct or Transfer Fan? | | Select fr | om pull-down list or leave blan | k if N// | A | 00 | 100 | 10 | 110 | 20 | 100 | 100 |
| | Local recirc. air % representative of ave system return air | Er | | | | | 75% | 75% | 75% | 75% | 75% | 75% | 75% |
| Inputs fo | r Operating Condition Analyzed | | | | | | | | | | | | |
| | Percent of total design airflow rate at conditioned analyzed | Ds | % | | | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| | Air distribution type at conditioned analyzed | | Select fr | om pull-down list | | | CS | CS | CS | CS | CS | CS | CS |
| | Zone air distribution effectiveness at conditioned analyzed | Ez | | | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| _ | Primary air fraction of supply air at conditioned analyzed | Ep | | | | | | | | | | | |
| Results | Mandilation Oration Efficiency | F | | | | | | | | | | | |
| | Ventilation System Efficiency | EV | afaa | | | 0.81 | | | | | | | |
| | Outdoor air intake required for system | VOT | cim of m /of | | | 5/99 | | | | | | | |
| | Outdoor air per unit noor area | VOUAS | cfm/n | | | 16.9 | | | | | | | |
| | Outdoor air as a % of design primary supply air | Ynd | cfm | | | 29% | | | | | | | |
| | | . pu | 0 | | | _0 /0 | | | | | | | |
| Detailed | Calculations | | | | | | | | | | | | |
| Initial Ca | Iculations for the System as a whole | | | | | | | | | | | | |
| | Primary supply air flow to system at conditioned analyzed | Vps | cfm | = VpdDs | = | 19995 | | | | | | | |
| | UncorrectedOA requirement for system | Vou | cfm | = Rps Ps + Ras As | = | 4679 | | | | | | | |
| | Uncorrected OA req'd as a fraction of primary SA | Xs | | = Vou / Vps | = | 0.23 | | | | | | | |
| Initial Ca | Iculations for individual zones | - | | | | | | | | | | | |
| | OA rate per unit area for zone | Raz | ctm/st | | | | 0.06 | 0.12 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 |
| | OA rate per person | Rpz | ctm/p | | | | 0.00 | 0.00 | 0.00 | 5.00 | 0.00 | 5.00 | 0.00 |
| | I otal supply air to zone (at condition being analyzed) | Vaz | cim | Des De L Des As | | | 95 | 160 | 75 | 110 | 20 | 100 | 100 |
| | Unused OA requirement for zone | VDZ | cim | = KPZ PZ + KAZ AZ | = | | 19.9 | 20.8 | 10.8 | 17.2 | 5.4 | 7.1 | 11.2 |
| | Erection of zone supply not directly regire from zone | VOZ Fo | CIM | = VDZ/EZ | = | | 20 | 21 | 1 00 | 1.00 | 5 1 00 | 1.00 | 1 00 |
| | Fraction of zone supply flot directly recirc. from zone | га | | = Ep + (1-Ep)Ei | = | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | Fraction of zone OA not directly regire from zone | Fo | | - LP - 1-(1-Ez)(1-Ep)(1-Er) | _ | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | 1 action of 2016 OA flot directly recirc. from 2016 | Zd | | $= \sqrt{(1-2)}(1-2)(1-2)$ | _ | | 0.21 | 0.13 | 0.14 | 0.16 | 0.27 | 0.07 | 0.11 |
| | Unused OA fraction required in primary air to zone | Zu Zn | | = V02/V02 | _ | | 0.21 | 0.13 | 0.14 | 0.10 | 0.27 | 0.07 | 0.11 |
| System | /entilation Efficiency | -p | | | | | 0.21 | 0.15 | 0.14 | 0.10 | 0.27 | 0.07 | 0.11 |
| | Zone Ventilation Efficiency (App A Method) | Evz | | = (Fa + FbXs - FcZ) / Fa | = | | 1.02 | 1.10 | 1.09 | 1.08 | 0.96 | 1.16 | 1.12 |
| | System Ventilation Efficiency (App A Method) | Ev | | = min (Evz) | = | 0.81 | | | | | 5.00 | | |
| | Ventilation System Efficiency (Table 6.3 Method) | Ev | | = Value from Table 6.3 | = | 0.72 | | | | | | | |
| Minimun | outdoor air intake airflow | | | | | | | | | | | | |
| | Outdoor Air Intake Flow required to System | Vot | cfm | = Vou / Ev | = | 5799 | | | | | | | |
| | OA intake req'd as a fraction of primary SA | Y | | = Vot / Vps | = | 0.29 | | | | | | | |
| | Outdoor Air Intake Flow required to System (Table 6.3 Method) | Vot | cfm | = Vou / Ev | = | 6473 | | | | | | | |
| | OA intake req'd as a fraction of primary SA (Table 6.3 Method) | Y | | = Vot / Vps | = | 0.32 | | | | | | | |
| OA Tem | o at which Min OA provides all cooling | | | | | | | | | | | | |
| | OAT below which OA Intake flow is @ minimum | | Deg F | = ${(Tp-dTsf)-(1-Y)*(Tr+dTr)}$ | = | 13 | | | | | | | |

| Building | | GBHS | Building | F | | | | | | | | | |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|--------------------------------------------|---------------------------------------------|-------------|------------------------------------------------------------------------------------|-------------------|-----------------|----------------------|-------------------|----------------------|----------------------|----------------------|
| System | Fag/Name: | AHU-1 | | | | | | | | | | | |
| Operatin | g Condition Description: | 10 | | | | | | | | | | | |
| Units (se | lect from pull-down list) | IP | | | | | | | | | | | |
| Inputs fo | r System Floor area served by system Population of area served by system (including diversity) Design primary supply fan airflow rate OA req'd per unit area for system (Weighted average) OA req'd per person for system area (Weighted average) r Potentially Critical zones | <u>Name</u> As Ps Vpsd Ras Rps | Units sf P cfm cfm/sf cfm/p | 100% diversity | ~ | System 15382 345 19,995 0.10 9.0 | | | | | | | |
| | | | | | | | Corridor | Health | Secretary | Corridor | Bookkeeper | Asst Principal | Intern |
| | Zone Name | Zono t | itlo turns n | | | | | | | | | | |
| | Zone Tag | 20110-0 | nie turns p | | | | 139D Corridors | 147A Davcare | 148A Office space | 150A Corridors | 151A Office space | 152A Office space | 153A Office space |
| | Space type | | Select fr | om pull-down list | | | | sickroom | | | | | |
| | Floor Area of zone | Az | sf | | | | 680 | 550 | 210 | 700 | 100 | 150 | 180 |
| | Design population of zone | Pz | P | (default value listed; may be o | verrido | den) | 0 | 3 | 1 | 0 | 1 | 2 | 1 |
| | Induction Terminal Unit Dual Fan Dual Duct or Transfer Fan? | vaza | Select fr | om pull-down list or leave blan | k if N/ | Α | 575 | 950 | 280 | 330 | 180 | 265 | 70 |
| | Local recirc. air % representative of ave system return air | Er | 00100111 | | | | 75% | 75% | 75% | 75% | 75% | 75% | 75% |
| Inputs fo | r Operating Condition Analyzed | | | | | | | | | | | | |
| | Percent of total design airflow rate at conditioned analyzed | Ds | % | | | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| | Air distribution type at conditioned analyzed | F -7 | Select fi | om pull-down list | | | CS | CS | CS | CS | CS | CS | CS |
| | Primary air fraction of supply air at conditioned analyzed | Ez | | | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Results | | -F | | | | | | | | | | | |
| | Ventilation System Efficiency Outdoor air intake required for system Outdoor air per unit floor area Outdoor air per person served by system (including diversity) Outdoor air as a % of design primary supply air | Ev Vot Vot/As Vot/Ps Ypd | cfm cfm/sf cfm/p cfm | | | 0.81 5799 0.38 16.8 29% | | | | | | | |
| Detailed | Calculations | | | | | | | | | | | | |
| <u>Initial Ca</u> Initial Ca | Iculations for the System as a whole Primary supply air flow to system at conditioned analyzed UncorrectedOA requirement for system Uncorrected OA req'd as a fraction of primary SA Iculations for individual zones | Vps Vou Xs | cfm cfm | = VpdDs = Rps Ps + Ras As = Vou / Vps | = = = | 19995 4679 0.23 | | | | | | | |
| | OA rate per unit area for zone | Raz | cfm/sf | | | | 0.06 | 0.18 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 |
| | OA rate per person | Rpz | cfm/p | | | | 0.00 | 10.00 | 5.00 | 0.00 | 5.00 | 5.00 | 5.00 |
| | Linused OA reg'd to breathing zone | Vuz Vhz | cfm | - Roz Pz + Raz Az | _ | | 575 40.8 | 950 129.0 | 280 | 330 42 0 | 180 | 200 | 15.8 |
| | Unused OA requirement for zone | Voz | cfm | = Vbz/Ez | = | | 41 | 120.0 | 18 | 42.0 | 11 | 19 | 16 |
| | Fraction of zone supply not directly recirc. from zone | Fa | | = Ep + (1-Ep)Er | = | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | Fraction of zone supply from fully mixed primary air | Fb | | = Ep | = | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | Fraction of zone OA not directly recirc. from zone | FC Zd | | = 1-(1-Ez)(1-Ep)(1-Er) | = | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | Unused OA fraction required in supply an to zone | Zp | | $= V_{0Z} / V_{0Z}$ | _ | | 0.07 | 0.14 | 0.06 | 0.13 | 0.06 | 0.07 | 0.23 |
| System ' | /entilation Efficiency | | | | | | | | | | | | |
| | Zone Ventilation Efficiency (App A Method) | Evz | | = (Fa + FbXs - FcZ) / Fa | = | | 1.16 | 1.10 | 1.17 | 1.11 | 1.17 | 1.16 | 1.01 |
| | System Ventilation Efficiency (App A Method) | Év | | = min (Evz) | = | 0.81 | | | | | | | |
| Minimun | ventilation System Efficiency (Table 6.3 Method) | EV | | = value from Table 6.3 | = | 0.72 | | | | | | | |
| Minintun | Outdoor Air Intake Flow required to System | Vot | cfm | = Vou / Ev | = | 5799 | | | | | | | |
| | OA intake req'd as a fraction of primary SA | Y | | = Vot / Vps | = | 0.29 | | | | | | | |
| | Outdoor Air Intake Flow required to System (Table 6.3 Method) | Vot | cfm | = Vou / Ev | = | 6473 | | | | | | | |
| 04 T. | OA intake req'd as a fraction of primary SA (Table 6.3 Method) | Y | | = Vot / Vps | = | 0.32 | | | | | | | |
| <u>OA Têm</u> | OAT below which OA Intake flow is @ minimum | | Deg F | = {(Tp-dTsf)-(1-Y)*(Tr+dTr | = | 13 | | | | | | | |

| Building | | GBHS | Building | F | | | | | | | | | |
|-----------------|-------------------------------------------------------------------------|------------|----------------------------|---------------------------------------------|-----------|--------------|--------------|--------------|--------------|---------------|---------------|---------------|--------------|
| System 1 | Tag/Name: | AHU-1 | | | | | | | | | | | |
| Operatin | g Condition Description: lect from pull-down list) | IP | | | | | | | | | | | |
| 01113 (30 | | | | | | | | | | | | | |
| Inputs fo | r System | Name | Units | | S | ystem | [| | | | | | |
| | Floor area served by system | As | st | 100% divoraity | | 15382 | | | | | | | |
| | Design primary supply fan airflow rate | PS Vosd | P cfm | 100% diversity | _ | 19 995 | | | | | | | |
| | OA regid per unit area for system (Weighted average) | Ras | cfm/sf | | | 0.10 | | | | | | | |
| | OA req'd per person for system area (Weighted average) | Rps | cfm/p | | | 9.0 | | | | | | | |
| Inputs fo | r Potentially Critical zones | | | | | | _ | | | Potentially C | ritical Zones | | |
| | | | | | | | Intern | Basic Math | Business | Advanced | Bookkeeping | Office | Model Office |
| | Zone Name | | | | | | | | Math | Math | | I raining Lab | |
| | | Zone ti | tle turns p | ourple italic for critical zone(s) | | | | | | | | | |
| | Zone Tag | | | | | | 154A | 155A | 156A | 156B | 157A | 159A | 159A |
| | | | | | | | Office space | Classrooms | Classrooms | Classrooms | Classrooms | Classrooms | Office space |
| | Space type | | Colorth | مسمه مسال والمسم | | | | (age 9 plus) | (age 9 plus) | (age 9 plus) | (age 9 plus) | (age 9 plus) | |
| | Floor Area of zone | A7 | sf | iom pull-down list | | | 160 | 725 | 442 | 780 | 725 | 1360 | 300 |
| | Design population of zone | Pz | P | (default value listed; may be | overridd | en) | 100 | 40 | 2 | 40 | 2 | 40 | 500 |
| | Design total supply to zone (primary plus local recirculated) | Vdzd | cfm | | | , | 70 | 1140 | 660 | 1250 | 560 | 1380 | 475 |
| | Induction Terminal Unit, Dual Fan Dual Duct or Transfer Fan? | _ | Select fr | rom pull-down list or leave bla | nk if N/A | ۱. | | | | | | | |
| han the for | Local recirc. air % representative of ave system return air | Er | | | | | 75% | 75% | 75% | 75% | 75% | 75% | 75% |
| Inputs fo | r Operating Condition Analyzed | De | 0/. | | _ | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| | Air distribution type at conditioned analyzed | 05 | ⁷⁰ Select fi | rom pull-down list | | 100 /8 | 00% | | CS | CS | 100% CS | CS | |
| | Zone air distribution effectiveness at conditioned analyzed | Ez | 00.000 | | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | Primary air fraction of supply air at conditioned analyzed | Ep | | | | | | | | | | | |
| Results | Ventilation System Efficiency Outdoor air intake required for system | Ev Vot | cfm | | | 0.81 5799 | | | | | | | |
| | Outdoor air per unit floor area | Vot/As | cfm/sf | | | 0.38 | | | | | | | |
| | Outdoor air per person served by system (including diversity) | Vot/Ps | cfm/p | | | 16.8 | | | | | | | |
| | Outdoor air as a % of design primary supply air | Ypd | cfm | | | 29% | | | | | | | |
| Detailed | Calculations | | | | | | | | | | | | |
| Initial Ca | Iculations for the System as a whole | | | | | | | | | | | | |
| | Primary supply air flow to system at conditioned analyzed | Vps | cfm | = VpdDs | = | 19995 | | | | | | | |
| | UncorrectedOA requirement for system | Vou | cfm | = Rps Ps + Ras As | = | 4679 | | | | | | | |
| Initial Ca | Iculations for individual zones | AS | | = vou/vps | = | 0.23 | | | | | | | |
| initial Ga | OA rate per unit area for zone | Raz | cfm/sf | | | | 0.06 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.06 |
| | OA rate per person | Rpz | cfm/p | | | | 5.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 5.00 |
| | Total supply air to zone (at condition being analyzed) | Vdz | cfm | | | | 70 | 1140 | 660 | 1250 | 560 | 1380 | 475 |
| | Unused OA req'd to breathing zone | Vbz | cfm | = Rpz Pz + Raz Az | = | | 14.6 | 487.0 | 73.0 | 493.6 | 107.0 | 563.2 | 43.0 |
| | Unused OA requirement for zone | Voz | cfm | = Vbz/Ez | = | | 15 | 487 | 73 | 494 | 107 | 563 | 43 |
| | Fraction of zone supply from fully mixed primary air | Fa Fb | | = Ep + (1-Ep)Er | = | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | Fraction of zone OA not directly recirc, from zone | Fc | | = 1-(1-Ez)(1-Ep)(1-Er) | _ | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | Unused OA fraction required in supply air to zone | Zd | | = Voz / Vdz | = | | 0.21 | 0.43 | 0.11 | 0.39 | 0.19 | 0.41 | 0.09 |
| | Unused OA fraction required in primary air to zone | Zp | | = Voz / Vpz | = | | 0.21 | 0.43 | 0.11 | 0.39 | 0.19 | 0.41 | 0.09 |
| System V | /entilation Efficiency | F | | | | | | | | | | | |
| | Zone Ventilation Efficiency (App A Method) | EVZ | | = $(Fa + FbXs - FcZ) / Fa$ = min (Fvz) | = | 0.94 | 1.03 | 0.81 | 1.12 | 0.84 | 1.04 | 0.83 | 1.14 |
| | Ventilation System Efficiency (Table 6.3 Method) | Ev | | = $Value from Table 6.3$ | - | 0.01 | | | | | | | |
| Minimum | outdoor air intake airflow | | | | | 0.12 | | | | | | | |
| | Outdoor Air Intake Flow required to System | Vot | cfm | = Vou / Ev | = | 5799 | | | | | | | |
| | OA intake req'd as a fraction of primary SA | Y | | = Vot / Vps | = | 0.29 | | | | | | | |
| | Outdoor Air Intake Flow required to System (Table 6.3 Method) | Vot | cfm | = Vou / Ev | = | 6473 | | | | | | | |
| | OA Intake req d as a fraction of primary SA (Table 6.3 Method) | Y | | = vot / vps | = | 0.32 | | | | | | | |
| <u>OA Telli</u> | OAT below which OA Intake flow is @ minimum | | Deg F | = {(Tp-dTsf)-(1-Y)*(Tr+dT | r = | 13 | | | | | | | |

| Building | | GBHS | Building | F | | | | | | | | | |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|--------------------------------------------|---------------------------------------------|-------------|-------------------------------------------------|---------|------------------------|--------------------------------|-----------------------------------|-------------------------|-------------------------|--------------------------|
| System | Fag/Name: | AHU-1 | | | | | | | | | | | |
| Operatir | g Condition Description: | ID | | | | | | | | | | | |
| Units (Se | | IF | | | | | | | | | | | |
| Inputs fo | r System Floor area served by system Population of area served by system (including diversity) Design primary supply fan airflow rate OA req'd per unit area for system (Weighted average) OA req'd per person for system area (Weighted average) r Potentially Critical zones | <u>Name</u> As Ps Vpsd Ras Rps | Units sf P cfm cfm/sf cfm/p | 100% diversity | 5 | System 15382 345 19,995 0.10 9.0 | | | | | | | |
| | Zone Name | | | | | | Storage | Reproduction Center | Typing and Shorthand Lab | Data Processing Instruction | Coordinator's Office | Coordinator's Office | Computer Training Lab |
| | Zone Tag | Zone ti | itle turns p | urple italic for critical zone(s) | | | 160A | 163A | 164A | Area 167A | 168A | 169A | 160E |
| | Space type | | Select fr | om pull-down list | | | rooms | Office space | Computer lab | Computer lab | Office space | Office space | Computer lab |
| | Floor Area of zone | Az | sf | • | | | 108 | 255 | 1500 | 1485 | 150 | 120 | 910 |
| | Design population of zone | Pz | Р | (default value listed; may be ov | /errido | len) | 0 |) 5 | 30 | 40 | 2 | 2 | 40 |
| | Design total supply to zone (primary plus local recirculated) | Vdzd | cfm | | | | 40 | 460 | 1710 | 1880 | 100 | 340 | 1680 |
| | Induction Terminal Unit, Dual Fan Dual Duct or Transfer Fan? | Er | Select fi | om pull-down list or leave blan | K IT N// | A . | 75% | 75% | 75% | 75% | 75% | 75% | 75% |
| Inputs fo | r Operating Condition Analyzed | | | | | | 1376 | 7070 | 1076 | 1370 | 1376 | 7076 | 1070 |
| puto | Percent of total design airflow rate at conditioned analyzed | Ds | % | | | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| | Air distribution type at conditioned analyzed | | Select fr | om pull-down list | | | CS | CS | CS | CS | CS | CS | CS |
| | Zone air distribution effectiveness at conditioned analyzed | Ez | | | | Ļ | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Desults | Primary air fraction of supply air at conditioned analyzed | Ep | | | | | | | | | | | |
| | Ventilation System Efficiency Outdoor air intake required for system Outdoor air per unit floor area Outdoor air per person served by system (including diversity) Outdoor air as a % of design primary supply air | Ev Vot Vot/As Vot/Ps Ypd | cfm cfm/sf cfm/p cfm | | | 0.81 5799 0.38 16.8 29% | | | | | | | |
| Detailed | Calculations | | | | | | | | | | | | |
| Initial Ca | Iculations for the System as a whole Primary supply air flow to system at conditioned analyzed UncorrectedOA requirement for system Uncorrected OA req'd as a fraction of primary SA Iculations for individual zones | Vps Vou Xs | cfm cfm | = VpdDs = Rps Ps + Ras As = Vou / Vps | = = = | 19995 4679 0.23 | | | | | | | |
| | OA rate per unit area for zone | Raz | cfm/sf | | | | 0.12 | 0.06 | 0.12 | 0.12 | 0.06 | 0.06 | 0.12 |
| | OA rate per person | Rpz | cfm/p | | | | 0.00 | 5.00 | 10.00 | 10.00 | 5.00 | 5.00 | 10.00 |
| | Linused ΩA regid to breathing zone | Vuz Vbz | cfm | - RD7 P7 + R97 A7 | _ | | 40 | 400 | 480.0 | 578.2 | 100 | 340 | 509.2 |
| | Unused OA requirement for zone | Voz | cfm | = Vbz/Ez | _ | | 13.0 | 40.5 | 480 | 578 | 19.0 | 17.2 | 509 |
| | Fraction of zone supply not directly recirc. from zone | Fa | | = Ep + (1-Ep)Er | = | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | Fraction of zone supply from fully mixed primary air | Fb | | = Ep | = | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | Fraction of zone OA not directly recirc. from zone | Fc | | = 1-(1-Ez)(1-Ep)(1-Er) | = | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | Unused OA fraction required in supply air to zone | Zd | | = Voz / Vdz | = | | 0.32 | 0.09 | 0.28 | 0.31 | 0.19 | 0.05 | 0.30 |
| System | /entilation Efficiency | zμ | | = voz/vpz | = | | 0.32 | 0.09 | 0.20 | 0.51 | 0.19 | 0.05 | 0.30 |
| e jetem | Zone Ventilation Efficiency (App A Method) | Evz | | = (Fa + FbXs - FcZ) / Fa | = | | 0.91 | 1.15 | 0.95 | 0.93 | 1.04 | 1.18 | 0.93 |
| | System Ventilation Efficiency (App A Method) | Ev | | = min (Evz) | = | 0.81 | | | | | | | |
| | Ventilation System Efficiency (Table 6.3 Method) | Ev | | = Value from Table 6.3 | = | 0.72 | | | | | | | |
| Minimun | Outdoor air intake airflow | Vet | alm | | | 5700 | | | | | | | |
| | Outdoor Air Imake Flow required to System | VOT | cim | = VOU / EV | = | 5/99 | | | | | | | |
| | Outdoor Air Intake Flow required to System (Table 6.3 Method) | Vot | cfm | = Vou / Ev | - | 6473 | | | | | | | |
| | OA intake req'd as a fraction of primary SA (Table 6.3 Method) | Y | | = Vot / Vps | = | 0.32 | | | | | | | |
| OA Tem | o at which Min OA provides all cooling | | | | | | | | | | | | |
| | OAT below which OA Intake flow is @ minimum | | Deg F | = ${(Tp-dTsf)-(1-Y)*(Tr+dTr)}$ | = | 13 | | | | | | | |

| Building | | GBHS | Building | F | | | | | | | | | |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|--------------------------------------------|------------------------------------------------------------|-------------|-------------------------------------------------|---------------------|-----------------------------|------------------|--------------|---------------------------|-----------------|--------------|
| System | Fag/Name: | AHU-1 | | | | | | | | | | | |
| Operatin | g Condition Description: | 10 | | | | | | | | | | | |
| Units (se | lect from pull-down list) | IP | | | | | | | | | | | |
| Inputs fo | r System Floor area served by system Population of area served by system (including diversity) Design primary supply fan airflow rate OA req'd per unit area for system (Weighted average) OA req'd per person for system area (Weighted average) Patentially Critical zones | <u>Name</u> As Ps Vpsd Ras Rps | Units sf P cfm cfm/sf cfm/p | 100% diversity | | System 15382 345 19,995 0.10 9.0 | | | | | | | |
| mputore | Zone Name | | | | | | Teacher Planning | Elevator Machine Room | Electric Room | DE Storage | Distributive Education | Supply | School Store |
| | Zone Tag | Zone ti | itle turns p | urple italic for critical zone(s) | | | 171A | 179E | 180E | New zone ID | 182A | 184A Storago | 187B |
| | Space type | | Select fr | om pull-down list | | | Office space | machine | equipment | rooms | (age 9 plus) | rooms | as below) |
| | Floor Area of zone | Az | sf | ••••• | | | 750 | 64 | 78 | 80 | 845 | 100 | 575 |
| | Design population of zone | Pz | Р | (default value listed; may be or | verride | den) | 25 | 0 | 0 | 0 | 30 | 0 | 25 |
| | Design total supply to zone (primary plus local recirculated) | Vdzd | cfm | | | | 1380 | 50 | 150 | 135 | 1590 | 30 | 1310 |
| | Induction Terminal Unit, Dual Fan Dual Duct or Transfer Fan? | _ | Select fr | om pull-down list or leave blan | k if N/ | A | 7.5.0/ | | 750/ | 750/ | 750/ | | 750/ |
| Innuto fe | Local recirc. air % representative of ave system return air | Er | | | | | 75% | 75% | /5% | /5% | /5% | /5% | /5% |
| inputs it | Percent of total design airflow rate at conditioned analyzed | Ds | % | | | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| | Air distribution type at conditioned analyzed | 23 | Select fr | om pull-down list | | 10070 | CS | CS | CS | CS | CS | CS | CS |
| | Zone air distribution effectiveness at conditioned analyzed | Ez | | ••••• | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | Primary air fraction of supply air at conditioned analyzed | Ep | | | | | | | | | | | |
| | Outdoor air intake required for system Outdoor air per unit floor area Outdoor air per person served by system (including diversity) Outdoor air as a % of design primary supply air | Vot Vot/As Vot/Ps Ypd | cfm cfm/sf cfm/p cfm | | | 5799 0.38 16.8 29% | | | | | | | |
| Detailed | Calculations | | | | | | | | | | | | |
| <u>Initial Ca</u> Initial Ca | Iculations for the System as a whole Primary supply air flow to system at conditioned analyzed UncorrectedOA requirement for system Uncorrected OA req'd as a fraction of primary SA Iculations for individual zones | Vps Vou Xs | cfm cfm | = VpdDs = Rps Ps + Ras As = Vou / Vps | = = = | 19995 4679 0.23 | | | | | | | |
| | OA rate per unit area for zone OA rate per person | Raz Rpz | cfm/sf cfm/p | | | | 0.06 5.00 | 0.12 0.00 | 0.06 0.00 | 0.12 0.00 | 0.12 10.00 | 0.12 0.00 | 0.12 7.50 |
| | I otal supply air to zone (at condition being analyzed) | Vdz | ctm | - Boz Dz + Boz Az | | | 1380 | 50 | 150 | 135 | 1590 | 30 | 1310 |
| | Unused OA requirement for zone | Voz | cfm | $= \sqrt{p_z P_z + \kappa_{az} A_z}$ = $\sqrt{p_z/F_z}$ | = | | 170.0 | 7.7 | 4.7 | 9.6 | 401.4 | 12.0 | 250.5 |
| | Fraction of zone supply not directly recirc, from zone | Fa | onn | $= E_{p} + (1-E_{p})E_{r}$ | _ | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | Fraction of zone supply from fully mixed primary air | Fb | | = Ep | = | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | Fraction of zone OA not directly recirc. from zone | Fc | | = 1-(1-Ez)(1-Ep)(1-Er) | = | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | Unused OA fraction required in supply air to zone | Zd | | = Voz / Vdz | = | | 0.12 | 0.15 | 0.03 | 0.07 | 0.25 | 0.40 | 0.20 |
| Sustan | Unused OA fraction required in primary air to zone | Zp | | = Voz / Vpz | = | | 0.12 | 0.15 | 0.03 | 0.07 | 0.25 | 0.40 | 0.20 |
| System | Zone Ventilation Efficiency (App A Method) | Evz | | = (Fa + FbXs - Fc7) / Fa | = | | 1 11 | 1.08 | 1.20 | 1 16 | 0.98 | 0.83 | 1 04 |
| | System Ventilation Efficiency (App A Method) | Ev | | = min (Evz) | = | 0.81 | | 1.00 | 1.20 | 1.10 | 5.50 | 5.05 | 1.04 |
| | Ventilation System Efficiency (Table 6.3 Method) | Ev | | = Value from Table 6.3 | = | 0.72 | | | | | | | |
| Minimun | outdoor air intake airflow | | | | | | | | | | | | |
| | Outdoor Air Intake Flow required to System | Vot | cfm | = Vou / Ev | = | 5799 | | | | | | | |
| | OA Intake regid as a fraction of primary SA | Y | ofm | = Vot / Vps | = | 0.29 | | | | | | | |
| | OA intake red as a fraction of primary SA (Table 6.3 Method) | Y | CITI | = Vot / Vos | - | 0473 | | | | | | | |
| OA Tem | at which Min OA provides all cooling | | | 1011 100 | | 0.02 | | | | | | | |
| | OAT below which OA Intake flow is @ minimum | | Deg F | = {(Tp-dTsf)-(1-Y)*(Tr+dTr | = | 13 | | | | | | | |

| Building: | GBHS | Building | F | | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|--------------------------------------------|--------|-------------------------------|-------------------------------------------------|----------------------|
| System Tag/Name: | AHU-1 | | | | | |
| Operating Condition Description: | ID | | | | | |
| Units (select from pull-down list) | IP | | | | | l |
| Inputs for System Floor area served by system Population of area served by system (including diversity) Design primary supply fan airflow rate OA req'd per unit area for system (Weighted average) OA req'd per person for system area (Weighted average) Inputs for Potentially Critical zones | <u>Name</u> As Ps Vpsd Ras Rps | Units sf P cfm cfm/sf cfm/p | | 100% diversity | System 15382 345 19,995 0.10 9.0 | |
| | | | | | | Office |
| Zone Name | | | | | | |
| Zone Tag | Zone ti | tle turns p | ourple | e italic for critical zone(s) | | 188A Office space |
| Space type | | | | | | |
| Floor Area of zone | Δ-7 | Select fi | rom p | oull-down list | | 100 |
| Design population of zone | Pz | P | (def | ault value listed; may be o | verridden) | 100 |
| Design total supply to zone (primary plus local recirculated) | Vdzd | cfm | | | | 295 |
| Induction Terminal Unit, Dual Fan Dual Duct or Transfer Fan? | Er | Select f | om p | oull-down list or leave blar | nk if N/A | 759/ |
| Inputs for Operating Condition Analyzed | E1 | | | | | 1370 |
| Percent of total design airflow rate at conditioned analyzed | Ds | % | | | 100% | 100% |
| Air distribution type at conditioned analyzed | _ | Select f | om p | oull-down list | | CS |
| Zone air distribution effectiveness at conditioned analyzed | Ez | | | | | 1.00 |
| Results | ∟р | | | | | II |
| Ventilation System Efficiency | Ev | | | | 0.81 | |
| Outdoor air intake required for system | Vot | cfm | | | 5799 | |
| Outdoor air per unit floor area | Vot/As | cfm/sf | | | 0.38 | |
| Outdoor air as a % of design primary supply air | Ypd | cfm | | | 29% | |
| | | | | | | |
| Detailed Calculations | | | | | | |
| Primary supply air flow to system at conditioned analyzed | Vne | cfm | _ | VodDs | - 10005 | |
| UncorrectedOA requirement for system | Vou | cfm | = | Rps Ps + Ras As | = 4679 | |
| Uncorrected OA req'd as a fraction of primary SA | Xs | | = | Vou / Vps | = 0.23 | |
| Initial Calculations for individual zones | - | | | | | 0.00 |
| OA rate per unit area for zone | Raz | cfm/st | | | | 0.06 |
| Total supply air to zone (at condition being analyzed) | Vdz | cfm | | | | 295 |
| Unused OA reg'd to breathing zone | Vbz | cfm | = | Rpz Pz + Raz Az | = | 11.0 |
| Unused OA requirement for zone | Voz | cfm | = | Vbz/Ez | = | 11 |
| Fraction of zone supply not directly recirc. from zone | Fa | | = | Ep + (1-Ep)Er | = | 1.00 |
| Fraction of zone supply from fully mixed primary air | FD | | = | Ep 1-(1-Ez)(1-Ec)(1-Ec) | = | 1.00 |
| Unused OA fraction required in supply air to zone | Zd | | - | Voz / Vdz | = | 0.04 |
| Unused OA fraction required in primary air to zone | Zp | | = | Voz / Vpz | = | 0.04 |
| System Ventilation Efficiency | _ | | | | | |
| Zone Ventilation Efficiency (App A Method) | Evz | | = | (Fa + FbXs - FcZ) / Fa | = | 1.20 |
| Ventilation System Efficiency (Table 6.3 Method) | Ev | | = | Value from Table 6.3 | = 0.81 | |
| Minimum outdoor air intake airflow | | | | | 0.72 | |
| Outdoor Air Intake Flow required to System | Vot | cfm | = | Vou / Ev | = 5799 | |
| OA intake req'd as a fraction of primary SA | Y | | = | Vot / Vps | = 0.29 | |
| Outdoor Air Intake Flow required to System (Table 6.3 Method) |) Vot | cfm | = | Vou / Ev | = 6473 | |
| OA make requires a fraction of primary SA (Table 6.3 Method) OA Temp at which Min OA provides all cooling | T | | = | vot/vps | = 0.32 | |
| the second | | Dog E | _ | //Tp-dTef)-(1-V)*/Tr+dTr | - 12 | |

| Building: | GBHS | Building | F | | | | | | | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|---------------------------------------------------|-----------------------------------|--------|--------------------------------------------------|------------|--------------|--------------|--------------|-------------|-----------|--------------|
| System Tag/Name: | AHU-2 | | | | | | | | | | | |
| Operating Condition Description: | | | | | | | | | | | | |
| Units (select from pull-down list) | IP | | | | | | | | | | | |
| Inputs for System Floor area served by system Population of area served by system (including diversity) Design primary supply fan airflow rate OA req'd per unit area for system (Weighted average) OA req'd per person for system area (Weighted average) | <u>Name</u> As Ps Vpsd Ras Rps | <u>Units</u> sf P cfm cfm/sf cfm/p | 100% diversity | S | 5ystem 17103 302 18,590 0.10 10.3 | | | | | | | |
| Inputs for Potentially Critical zones | · | | | | | Elec | Typewriting | Typewriting | Typewriting | Gymnastics | Corridor | Typewriting |
| Zone Tag | Zone t | itle turns p | urple italic for critical zone(s) | | | 203 4 | Lab | Lab | Lab | 213.6 | 215.4 | Lab |
| | | | | | | Flectrical | Classrooms | Classrooms | Classrooms | Disco/dance | Corridors | Classrooms |
| Space type | | Select f | om pull-down list | | | equipment | (age 9 plus) | (age 9 plus) | (age 9 plus) | floors | Comucia | (age 9 plus) |
| Floor Area of zone | Az | sf | • | | | 25 | 1050 | 1050 | 1075 | 1900 | 910 | 1222 |
| Design population of zone | Pz | Р | (default value listed; may be ov | erridd | len) | 0 | 25 | 25 | 25 | 20 | 0 | 25 |
| Design total supply to zone (primary plus local recirculated) | Vdzd | cfm | | | | 280 | 1170 | 1110 | 1050 | 2360 | 265 | 1255 |
| Induction Terminal Unit, Dual Fan Dual Duct or Transfer Fan? | | Select f | om pull-down list or leave blank | if N/A | ۹. | | | | | | | |
| Local recirc. air % representative of ave system return air | Er | | | | | 75% | 75% | 75% | 75% | 75% | 75% | 75% |
| Inputs for Operating Condition Analyzed | _ | | | _ | | | | | | | | |
| Percent of total design airflow rate at conditioned analyzed | Ds | % | | | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| Air distribution type at conditioned analyzed | - | Select f | om pull-down list | | | CS | CS | CS | CS | CS | CS | CS |
| Zone air distribution effectiveness at conditioned analyzed | EZ | | | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Primary all fraction of supply all at conditioned analyzed | ЕΡ | | | | | | | | | | | |
| Outdoor air intake required for system Outdoor air per unit floor area Outdoor air per person served by system (including diversity) Outdoor air as a % of design primary supply air | Vot Vot/As Vot/Ps Ypd | cfm cfm/sf cfm/p cfm | | | 5608 0.33 18.6 30% | | | | | | | |
| Detailed Calculations | | | | | | | | | | | | |
| Initial Calculations for the System as a whole | | | | | | | | | | | | |
| Primary supply air flow to system at conditioned analyzed | Vps | cfm | = VpdDs | = | 18590 | | | | | | | |
| UncorrectedOA requirement for system | Vou | cfm | = Rps Ps + Ras As | = | 4873 | | | | | | | |
| Uncorrected OA req'd as a fraction of primary SA | Xs | | = Vou / Vps | = | 0.26 | | | | | | | |
| Initial Calculations for individual zones | | | | | | | | | | | | |
| OA rate per unit area for zone | Raz | cfm/sf | | | | 0.06 | 0.12 | 0.12 | 0.12 | 0.06 | 0.06 | 0.12 |
| OA rate per person | Rpz | cfm/p | | | | 0.00 | 10.00 | 10.00 | 10.00 | 20.00 | 0.00 | 10.00 |
| Total supply air to zone (at condition being analyzed) | Vdz | cfm | | | | 280 | 1170 | 1110 | 1050 | 2360 | 265 | 1255 |
| Unused OA regid to breathing zone | Vbz | cfm | = Rpz Pz + Raz Az | = | | 1.5 | 376.0 | 376.0 | 379.0 | 514.0 | 54.6 | 396.6 |
| Unused OA requirement for zone | VOZ Fo | cim | = VDZ/EZ | = | | 1.00 | 3/6 | 3/6 | 3/9 | 514 | 55 | 397 |
| Fraction of zone supply from fully mixed primary air | Fb | | = Ep + (1-Ep)El | - | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Fraction of zone OA not directly recirc, from zone | Fc | | $= 1-(1-E_7)(1-E_7)(1-E_7)$ | _ | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Unused OA fraction required in supply air to zone | Zd | | = Voz / Vdz | = | | 0.01 | 0.32 | 0.34 | 0.36 | 0.22 | 0.21 | 0.32 |
| Unused OA fraction required in primary air to zone | Zp | | = Voz / Vpz | = | | 0.01 | 0.32 | 0.34 | 0.36 | 0.22 | 0.21 | 0.32 |
| System Ventilation Efficiency | | | | | | | | | | | | |
| Zone Ventilation Efficiency (App A Method) | Evz | | = (Fa + FbXs - FcZ) / Fa | = | | 1.26 | 0.94 | 0.92 | 0.90 | 1.04 | 1.06 | 0.95 |
| System Ventilation Efficiency (App A Method) | Ev | | = min (Evz) | = | 0.87 | | | | | | | |
| Ventilation System Efficiency (Table 6.3 Method) | Ev | | = Value from Table 6.3 | = | 0.76 | | | | | | | |
| Minimum outdoor air intake airflow | Mat | ala | | | FOOD | | | | | | | |
| Outdoor Air Intake Flow required to System | vot | cim | | = | 5608 | | | | | | | |
| Outdoor Air Intake Flow required to System (Table 6.3 Method | Vot | cfm | | _ | 6420 | | | | | | | |
| OA intake reg'd as a fraction of primary SA (Table 6.3 Method) | Y | Unit | = Vot / Vps | 2 | 0.35 | | | | | | | |
| OA Temp at which Min OA provides all cooling | | | | | 0.00 | | | | | | | |
| OAT below which OA Intake flow is @ minimum | | Deg F | = {(Tp-dTsf)-(1-Y)*(Tr+dTr | = | 16 | | | | | | | |

| Building: | GBHS | Building | | | | | | | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|--------------------------------------------|---------------------------------------------|---------------------------------------------|-----------------------|-------------|--------------|--------------------|-------------|--------------|--------------|
| System Tag/Name: | AHU-2 | | | | | | | | | | |
| Operating Condition Description: | 10 | | | | 4 | | | | | | |
| Units (select from pull-down list) | IP | | | | | | | | | | |
| Inputs for System Floor area served by system Population of area served by system (including diversity) Design primary supply fan airflow rate OA req'd per unit area for system (Weighted average) OA req'd per person for system area (Weighted average) Inputs for Potentially Critical zones | <u>Name</u> As Ps Vpsd Ras Rps | Units sf P cfm cfm/sf cfm/p | 100% diversity | System 1710 30 18,59 0.1 10. | 3 2 5 5 3 | | Pote | ntially Critical 2 | Zones | | |
| | | | | | Typewriting | Model | Child | Storage | Observation | Lecture | Foods and |
| Zone Name | Zone ti | itle turns p | urple italic for critical zone(s) | | Lab | Kitchen | Development | | | | Nutrition |
| Zone Tag | | | | | 217A | 224A | 226A | 227A | 228A | 229A | 231A |
| Or and the second se | | | | | Classrooms | Break rooms | Classrooms | Storage | Corridors | Classrooms | Classrooms |
| Space type | | Select fr | om pull-down list | | (age 9 plus) | | (age 9 plus) | rooms | | (age 9 plus) | (age 9 plus) |
| Floor Area of zone | Az | sf | | | 1248 | 1410 | 880 | 171 | 90 | 839 | 1340 |
| Design population of zone | Pz | Р | (default value listed; may be ove | erridden) | 25 | 15 | 20 | 0 | 0 | 20 | 20 |
| Design total supply to zone (primary plus local recirculated) | Vdzd | cfm | | | 2010 | 560 | 885 | 210 | 30 | 925 | 1680 |
| Induction Terminal Unit, Dual Fan Dual Duct or Transfer Fan? | F - | Select fr | om pull-down list or leave blank | if N/A | 750/ | 750/ | 750/ | 750/ | 750/ | 750/ | 750/ |
| Local recirc. air % representative of ave system return air | Er | | | | /5% | /5% | /5% | 75% | /5% | /5% | /5% |
| Percent of total design airflow rate at conditioned analyzed | Ds | % | | 1009 | 6 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| Air distribution type at conditioned analyzed | 03 | Select fr | om pull-down list | 1007 | CS | CS | CS | CS | CS | CS | CS |
| Zone air distribution effectiveness at conditioned analyzed | Ez | | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Primary air fraction of supply air at conditioned analyzed | Ep | | | | | | | | | | |
| Outdoor air intake required for system Outdoor air per unit floor area Outdoor air per person served by system (including diversity) Outdoor air as a % of design primary supply air | Vot Vot/As Vot/Ps Ypd | cfm cfm/sf cfm/p cfm | | 5608 0.33 18.6 309 | 6 | | | | | | |
| Detailed Calculations | | | | | | | | | | | |
| Initial Calculations for the System as a whole Primary supply air flow to system at conditioned analyzed UncorrectedOA requirement for system Uncorrected OA require as a fraction of primary SA | Vps Vou Xs | cfm cfm | = VpdDs = Rps Ps + Ras As = Vou / Vps | = 1859 = 487 = 0.2 | 0 3 6 | | | | | | |
| Initial Calculations for individual zones | | | | | | | | | | | |
| OA rate per unit area for zone | Raz | cfm/sf | | | 0.12 | 0.06 | 0.12 | 0.12 | 0.06 | 0.12 | 0.12 |
| OA rate per person | Rpz | cfm/p | | | 10.00 | 5.00 | 10.00 | 0.00 | 0.00 | 10.00 | 10.00 |
| Total supply air to zone (at condition being analyzed) | Vdz | cfm | | | 2010 | 560 | 885 | 210 | 30 | 925 | 1680 |
| Unused OA req'd to breathing zone | Vbz | ctm | = Rpz Pz + Raz Az | = | 399.8 | 159.6 | 305.6 | 20.5 | 5.4 | 300.7 | 360.8 |
| Eraction of zone supply not directly recirc from zone | V02 Fa | CIM | = VD2/E2 = Ep + (1-Ep)Er | - | 400 | 1.00 | 306 | 1.00 | ວ 1.00 | 1.00 | 1.00 |
| Fraction of zone supply from fully mixed primary air | Fb | | = Ep ((Ep)E) | = | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Fraction of zone OA not directly recirc. from zone | Fc | | = 1-(1-Ez)(1-Ep)(1-Er) | = | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Unused OA fraction required in supply air to zone | Zd | | = Voz / Vdz | = | 0.20 | 0.29 | 0.35 | 0.10 | 0.18 | 0.33 | 0.21 |
| Unused OA fraction required in primary air to zone | Zp | | = Voz / Vpz | = | 0.20 | 0.29 | 0.35 | 0.10 | 0.18 | 0.33 | 0.21 |
| System Ventilation Efficiency | F | | | | | c | 6.00 | | | | |
| System Ventilation Efficiency (App A Method) | EVZ | | = $(Fa + FDAS - FCZ) / Fa$ = min (Evz) | - 0.97 | 1.06 | 0.98 | 0.92 | 1.16 | 1.08 | 0.94 | 1.05 |
| Ventilation System Efficiency (Table 6.3 Method) | Ev | | = Value from Table 6.3 | = 0.87 | | | | | | | |
| Minimum outdoor air intake airflow | | | | 0.70 | | | | | | | |
| Outdoor Air Intake Flow required to System | Vot | cfm | = Vou / Ev | = 560 | в | | | | | | |
| OA intake req'd as a fraction of primary SA | Y | | = Vot / Vps | = 0.3 | D | | | | | | |
| Outdoor Air Intake Flow required to System (Table 6.3 Method |) Vot | cfm | = Vou / Ev | = 643 | 9 | | | | | | |
| OA intake req'd as a traction of primary SA (Table 6.3 Method) | Y | | = Vot / Vps | = 0.3 | 0 | | | | | | |
| OAT below which OA Intake flow is @ minimum | | Deg F | = {(Tp-dTsf)-(1-Y)*(Tr+dTr | = 1 | 6 | | | | | | |

| Building: | GBHS | Building | F | | | | | | | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|--------------------------------|---------------------------------------|---------------------|-------------------------|--------------|--------------|--------------|------------|------------------|------------------|--------------|
| System Tag/Name: | AHU-2 | | - | | - | | | | | | | |
| Operating Condition Description: | | | | | _ | | | | | | | |
| Units (select from pull-down list) | IP | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Inputs for System Floor area served by system Population of area served by system (including diversity) Design primary supply fan airflow rate | <u>Name</u> As Ps Vpsd | <u>Units</u> sf P cfm | 100% diversity | Syste 17 18,5 | em 103 302 590 | | | | | | | |
| OA regid per unit area for system (Weighted average) | Ras | cfm/sf | | 0 | 0.10 | | | | | | | |
| OA regid per person for system area (Weighted average) | Rps | cfm/p | | 1 | 10.3 | | | | | | | |
| Inputs for Potentially Critical zones | | | | | | | 01 | Hama and | 01 | Links Interim | Delat Of any set | Teerban |
| Zone Name | Zone ti | itle turns p | urple italic for critical zone(s) | | Ĺ | Textiles | Classroom | Family Life | Storage | and Work Area | Paint Storage | Planning |
| Zone Tag | | | | | | 232A | 234A | 235A | 236A | 237A | 239A | 241A |
| | | | | | | Classrooms | Classrooms | Classrooms | Storage | Classrooms | Storage | Office space |
| Space type | A | Select fr | om pull-down list | | | (age 9 plus) | (age 9 plus) | (age 9 plus) | rooms | (age 9 plus) | rooms | 400 |
| Floor Area of zone | AZ D- | ST | (defends veloce listed, even has even | | _ | 1000 | 351 | 350 | 344 | 1145 | 223 | 480 |
| Design population of zone | PZ | P | (default value listed; may be ove | erridden) | _ | 20 | 10 | 20 | 0 | 25 | 0 | / |
| Leduction Terminal Unit, Dual For Dual Duct or Transfer For 2 | vaza | Cilli | an null down list or loove blook | :4 NI/A | _ | 925 | 400 | 660 | 105 | 1170 | 620 | 920 |
| Local regire, gir 9/ representative of eve evetem return gir | Er | Select II | on pull-down list of leave blank | II IN/A | _ | 750/ | 750/ | 750/ | 750/ | 750/ | 750/ | 750/ |
| Local recirc. all % representative of ave system return an | EI | | | | | 10% | 70% | 70% | 70% | 70% | 70% | 10% |
| Percent of total design airflow rate at conditioned analyzed | De | % | | 10 | 0% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| Air distribution type at conditioned analyzed | 03 | Select fr | om pull-down list | 10 | 10 /0 | 8001 80 | 100% CS | 100% | 0000 CS | 10070 | 100% CS | 100% |
| Zone air distribution effectiveness at conditioned analyzed | F7 | Oelectin | | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Primary air fraction of supply air at conditioned analyzed | Ep | | | | - | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Results | Ξp | | | | | 1 | I | | | | | |
| Ventilation System Efficiency | Ev | | | 0. | .87 | | | | | | | |
| Outdoor air intake required for system | Vot | cfm | | 56 | 608 | | | | | | | |
| Outdoor air per unit floor area | Vot/As | cfm/sf | | 0. | .33 | | | | | | | |
| Outdoor air per person served by system (including diversity) | Vot/Ps | cfm/p | | 18 | 8.6 | | | | | | | |
| Outdoor air as a % of design primary supply air | Ypd | cfm | | 3 | 30% | | | | | | | |
| | | | | | | | | | | | | |
| Detailed Calculations | | | | | | | | | | | | |
| Initial Calculations for the System as a whole | | | | | | | | | | | | |
| Primary supply air flow to system at conditioned analyzed | Vps | cfm | = VpdDs | = 18 | 590 | | | | | | | |
| UncorrectedOA requirement for system | Vou | cfm | = Rps Ps + Ras As | = 48 | 873 | | | | | | | |
| Uncorrected OA req'd as a fraction of primary SA | Xs | | = Vou / Vps | = 0 |).26 | | | | | | | |
| Initial Calculations for individual zones | _ | | | | | | | | | | | |
| OA rate per unit area for zone | Raz | cfm/sf | | | | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.06 |
| OA rate per person | Rpz | cfm/p | | | | 10.00 | 10.00 | 10.00 | 0.00 | 10.00 | 0.00 | 5.00 |
| I otal supply air to zone (at condition being analyzed) | Vdz | ctm | | | | 925 | 400 | 660 | 105 | 1170 | 620 | 920 |
| Unused OA req'd to breathing zone | Vbz | ctm | = Rpz Pz + Raz Az | = | | 320.0 | 142.1 | 242.0 | 41.3 | 387.4 | 26.8 | 63.8 |
| Unused OA requirement for zone | Voz | ctm | = VDZ/EZ | = | | 320 | 142 | 242 | 41 | 387 | 27 | 64 |
| Fraction of zone supply not directly recirc. from zone | Fa | | = Ep + (1-Ep)Er | = | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Fraction of zone supply from fully mixed primary air | FD | | = EP = 1 (1 Ez)(1 Ez)(1 Ez) | = | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Fraction of zone OA not directly recirc. from zone | FC Zd | | $= 1-(1-E_2)(1-E_p)(1-E_p)$ | = | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Lipused OA fraction required in supply air to zone | Zu Zn | | | _ | | 0.35 | 0.36 | 0.37 | 0.39 | 0.33 | 0.04 | 0.07 |
| System Ventilation Efficiency | Ζþ | | - v0z/vpz | - | | 0.35 | 0.36 | 0.37 | 0.39 | 0.33 | 0.04 | 0.07 |
| Zone Ventilation Efficiency (App & Method) | Evz | | = $(Fa + FbXs - FcZ)/Fa$ | _ | | 0.02 | 0.01 | 0.00 | 0.97 | 0.03 | 1 22 | 1 10 |
| System Ventilation Efficiency (App A Method) | Ev | | = min (Fyz) | - 0 | 87 | 0.92 | 0.91 | 0.90 | 0.07 | 0.93 | 1.22 | 1.19 |
| Ventilation System Efficiency (Table 6.3 Method) | Ev | | = Value from Table 6.3 | = 0 | 76 | | | | | | | |
| Minimum outdoor air intake airflow | | | | 0. | | | | | | | | |
| Outdoor Air Intake Elow required to System | Vot | cfm | = Vou / Ev | = 50 | 608 | | | | | | | |
| OA intake regid as a fraction of primary SA | Y | 5111 | = Vot / Vps | = 0 | 0.30 | | | | | | | |
| Outdoor Air Intake Flow required to System (Table 6.3 Method |) Vot | cfm | = Vou / Ev | = 6 | 439 | | | | | | | |
| OA intake regid as a fraction of primary SA (Table 6.3 Method) | Y | | = Vot / Vps | = 0 | 0.35 | | | | | | | |
| OA Temp at which Min OA provides all cooling | | | | | | | | | | | | |
| OAT below which OA Intake flow is @ minimum | | Deg F | = {(Tp-dTsf)-(1-Y)*(Tr+dTr | = | 16 | | | | | | | |

| Building | | GBHS | Building | F | | | | | | |
|------------|----------------------------------------------------------------|----------|-------------|------|-----------------------------------|------------|-----|--------------|--------------------|-------------|
| System T | aα/Name: | AHU-3 | & 4 | - | | | | | | |
| Operating | a Condition Description: | | | | | | | | | |
| Units (se | lect from pull-down list) | IP | | | | | | | | |
| , | · · · · · | | | | | | | | | |
| Inputs fo | r Svstem | Name | Units | | | Syste | m | | | |
| | Floor area served by system | As | sf | | | 7 | 954 | | | |
| | Population of area served by system (including diversity) | Ps | P | | 100% diversity | | 30 | | | |
| | Design primary supply fan airflow rate | Vosd | cfm | | <u> </u> | 10 | 500 | | | |
| | OA regid per unit area for system (Weighted average) | Ras | cfm/sf | | | , | 27 | | | |
| | OA rea'd per ann area for system area (Weighted average) | Rns | cfm/n | | | | 0.0 | | | |
| Inputs fo | r Potentially Critical zones | itp3 | cinit | | | | 0.0 | Poter | atially Critical 7 | ones |
| inputs to | Zono Nomo | Zono ti | tla turne n | urnk | o italic for critical zono(s) | | - | Cum | Lookor Bm 1 | Lookor Bm 2 |
| | | 20110 11 | ue turns p | urpi | | | ŀ | 121E | 1205 | |
| | Zone rag | | | | | | - | 121E | 129E | 114E |
| | Change time | | | | | | | Gym, stadium | Spectator | Spectator |
| | Space type | | 0-1 | | and dama tat | | | (play area) | areas | areas |
| | | A | Select II | om | pull-down list | | - | 7 000 | 00.4 | 000 |
| | Proof Area of Zone | AZ D- | SI | (| and the Refer down and the second | | - | 7,000 | 324 | 630 |
| | Design population of zone | PZ | P | (def | ault value listed; may be ov | /erridden) | - | 30 | 0 | 0 |
| | Design total supply to zone (primary plus local recirculated) | Vdzd | ctm | | | | Ļ | 8,360 | 1070 | 1070 |
| | Induction Terminal Unit, Dual Fan Dual Duct or Transfer Fan? | _ | Select fr | om p | pull-down list or leave blan | k it N/A | Ļ | | | |
| - | Local recirc. air % representative of ave system return air | Er | | | | | | 75% | 75% | 75% |
| Inputs fo | r Operating Condition Analyzed | | | | | | | | | |
| | Percent of total design airflow rate at conditioned analyzed | Ds | % | | | 10 | 0% | 100% | 100% | 100% |
| | Air distribution type at conditioned analyzed | | Select fr | om p | pull-down list | | | CS | CS | CS |
| | Zone air distribution effectiveness at conditioned analyzed | Ez | | | | | | 1.00 | 1.00 | 1.00 |
| | Primary air fraction of supply air at conditioned analyzed | Ep | | | | | | | | |
| Results | | | | | | | | | | |
| | Ventilation System Efficiency | Ev | | | | 0. | 95 | | | |
| | Outdoor air intake required for system | Vot | cfm | | | 22 | 61 | | | |
| | Outdoor air per unit floor area | Vot/As | cfm/sf | | | 0. | 28 | | | |
| | Outdoor air per person served by system (including diversity) | Vot/Ps | cfm/p | | | 7 | 5.4 | | | |
| | Outdoor air as a % of design primary supply air | Ypd | cfm | | | 2 | 2% | | | |
| | | | | | | | | | | |
| Detailed | Calculations | | | | | | | | | |
| Initial Ca | culations for the System as a whole | | | | | | | | | |
| | Primary supply air flow to system at conditioned analyzed | Vps | cfm | = | VpdDs | = 10 | 500 | | | |
| | UncorrectedOA requirement for system | Vou | cfm | = | Rps Ps + Ras As | = 2 | 157 | | | |
| | Uncorrected OA reg'd as a fraction of primary SA | Xs | | = | Vou / Vps | = 0 | 21 | | | |
| Initial Ca | culations for individual zones | , | | | tou, tpo | - 0 | | | | |
| initial Oa | | Raz | cfm/ef | | | | | 0.30 | 0.06 | 0.06 |
| | | Pnz | ofm/n | | | | | 0.00 | 7.50 | 7.50 |
| | Total supply air to zone (at condition being analyzed) | Vdz | ofm | | | | | 8360 | 1070 | 1070 |
| | Lipused OA regid to broothing zone | Vuz | ofm | | Boz Dz I Boz Az | _ | | 0300 | 1070 | 27.0 |
| | Unused OA requirement for any | VDZ | cim | = | Kpz Pz + Kaz Az | = | | 2100.0 | 19.4 | 37.8 |
| | Unused OA requirement for zone | voz | cim | = | | = | | 2100 | 19 | 38 |
| | Fraction of zone supply not directly recirc. from zone | Fa | | = | Ep + (1-Ep)Er | = | | 1.00 | 1.00 | 1.00 |
| | Fraction of zone supply from fully mixed primary air | Fb | | = | Ep | = | | 1.00 | 1.00 | 1.00 |
| | Fraction of zone OA not directly recirc. from zone | Fc | | = | 1-(1-Ez)(1-Ep)(1-Er) | = | | 1.00 | 1.00 | 1.00 |
| | Unused OA fraction required in supply air to zone | Zd | | = | Voz / Vdz | = | | 0.25 | 0.02 | 0.04 |
| | Unused OA fraction required in primary air to zone | Zp | | = | Voz / Vpz | = | | 0.25 | 0.02 | 0.04 |
| System V | entilation Efficiency | | | | | | | | | |
| | Zone Ventilation Efficiency (App A Method) | Evz | | = | (Fa + FbXs - FcZ) / Fa | = | | 0.95 | 1.19 | 1.17 |
| | System Ventilation Efficiency (App A Method) | Ev | | = | min (Evz) | = 0. | 95 | | | |
| | Ventilation System Efficiency (Table 6.3 Method) | Ev | | = | Value from Table 6.3 | = 0. | 90 | | | |
| Minimum | outdoor air intake airflow | | | | | | | | | |
| | Outdoor Air Intake Flow required to System | Vot | cfm | = | Vou / Ev | = 2 | 261 | | | |
| | OA intake reg'd as a fraction of primary SA | Y | | = | Vot / Vps | = 0 | .22 | | | |
| | Outdoor Air Intake Flow required to System (Table 6.3 Method) | Vot | cfm | = | Vou / Ev | = 2 | 400 | | | |
| | OA intake regid as a fraction of primary SA (Table 6.3 Method) | Y | | = | Vot / Vps | = 0 | .23 | | | |
| OA Temp | at which Min OA provides all cooling | | | | | | | | | |
| | OAT below which OA Intake flow is @ minimum | | Deg F | = | {(Tp-dTsf)-(1-Y)*(Tr+dTr | = | -7 | | | |

| | | GBHS | Building | F | | | | |
|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| System T | an/Name. | | Janung | | | | + | |
| Oporating | agritante. | AI10-5 | | | | | + | |
| Uperating | loct from pull-down list) | ID | | | | | + | |
| 01113 (38 | | La | | | | | | |
| Innuts for | r System | Name | Units | | | System | Т | |
| inputo io | Floor area served by system | As | sf | | | 3000 | | |
| | Population of area served by system (including diversity) | Ps | P | | 100% diversity | 0000 | | |
| | Design primary supply fan airflow rate | Vned | cfm | | 10076 diversity | 3.800 | | |
| | OA rog/d por unit area for system (Weighted average) | Pac | ofm/of | | | 0.13 | 2 | |
| | OA regid per barrage for system (Weighted average) | Dee | ofm/n | | | 0.10 | | |
| Innute for | r Potontially Critical zonas | крs | cini/p | | | 0.0 | Potentially C | ritical Zanac |
| inputs to | r Potentially Critical zones | | | | | | Potentially C | Crowlenson |
| | Zone Name | Zone ti | le turns n | urnle | e italic for critical zone(s) | | Boller Roolli | Offices |
| | Zone Tag | 20110 11 | ie turns p | urpic | | | | 129F |
| | - | | | | | | Wood/metal | Office space |
| | Space type | | Select fr | om r | oull-down list | | shop | onice space |
| | Floor Area of zone | Az | sf | | | | 1 750 | 1250 |
| | Design population of zone | Pz | P | (def: | ault value listed: may be ov | (erridden) | 1,100 | 0 |
| | Design total supply to zone (primary plus local recirculated) | Vdzd | cfm | (00) | | onnaaon, | 3 000 | 800 |
| | Induction Terminal Unit, Dual Fan Dual Duct or Transfer Fan? | | Select fr | om r | oull-down list or leave blank | k if N/A | 0,000 | 000 |
| | Local recirc, air % representative of ave system return air | Er | 20100111 | F | an addition of fourth bidin | | 75% | 75% |
| Inputs for | r Operating Condition Analyzed | | | | | | 7070 | 1070 |
| | Percent of total design airflow rate at conditioned analyzed | Ds | % | | | 100% | 100% | 100% |
| | Air distribution type at conditioned analyzed | 2.0 | Select fr | om r | oull-down list | | CS | .30% CS |
| | Zone air distribution effectiveness at conditioned analyzed | F7 | Coloot II | 0111 6 | | | 1.00 | 1 00 |
| | Primary air fraction of supply air at conditioned analyzed | Ep | | | | | | |
| Results | | Ξþ | | | | | | |
| ittoutto | Ventilation System Efficiency | Ev | | | | 1.00 | | |
| | Outdoor air intake required for system | Vot | cfm | | | 391 | | |
| | Outdoor air ner unit floor area | Vot/As | cfm/sf | | | 0 13 | | |
| | Outdoor air per unit noor area | Vot/Pe | cfm/n | | | #DIV/01 | | |
| | | VUUF 5 | ciiii/p | | | ******** | | |
| | Outdoor air as a % of design primary supply air | Ynd | cfm | | | 10% | | |
| | Outdoor air as a % of design primary supply air | Ypd | cfm | | | 10% | b | |
| Detailed | Outdoor air as a % of design primary supply air | Ypd | cfm | | | 10% | , D | |
| Detailed (Initial Cal | Outdoor air as a % of design primary supply air <u>Calculations</u> culations for the System as a whole | Ypd | cfm | | | 10% | | |
| Detailed Initial Cal | Outdoor air as a % of design primary supply air Calculations Iculations for the System as a whole Primary supply air flow to system at conditioned analyzed | Ypd Vps | cfm cfm | = | VpdDs | = 3800 |) | |
| Detailed Initial Cal | Outdoor air as a % of design primary supply air Calculations Culations for the System as a whole Primary supply air flow to system at conditioned analyzed UncorrectedOA requirement for system | Ypd Vps Vou | cfm cfm cfm | = | VpdDs Ros Ps + Ras As | = 3800 = 390 |) | |
| <u>Detailed</u> Initial Cal | Outdoor air as a % of design primary supply air Calculations Culations for the System as a whole Primary supply air flow to system at conditioned analyzed UncorrectedOA requirement for system Uncorrected OA requirement for system Uncorrected OA requirement for system | Ypd Vps Vou Xs | cfm cfm cfm | = = | VpdDs Rps Ps + Ras As Vou / Vps | = 3800 = 390 = 0.10 |) | |
| <u>Detailed</u> Initial Cal | Outdoor air as a % of design primary supply air Calculations Iculations for the System as a whole Primary supply air flow to system at conditioned analyzed UncorrectedOA requirement for system Uncorrected OA req'd as a fraction of primary SA Iculations for individual zones | Ypd Vps Vou Xs | cfm cfm cfm | = = = | VpdDs Rps Ps + Ras As Vou / Vps | = 3800 = 390 = 0.10 |) | |
| Detailed (Initial Cal | Outdoor air as a % of design primary supply air Calculations Iculations for the System as a whole Primary supply air flow to system at conditioned analyzed UncorrectedOA requirement for system Uncorrected OA req'd as a fraction of primary SA Iculations for individual zones OA rate per unit area for zone | Ypd Vps Vou Xs Raz | cfm cfm cfm | = = = | VpdDs Rps Ps + Ras As Vou / Vps | = 3800 = 390 = 0.10 | 0.18 | 0.06 |
| <u>Detailed (</u> Initial Cal | Outdoor air as a % of design primary supply air Calculations Iculations for the System as a whole Primary supply air flow to system at conditioned analyzed UncorrectedOA requirement for system Uncorrected OA req'd as a fraction of primary SA Iculations for individual zones OA rate per unit area for zone OA rate per unit area for zone OA rate per unit area for zone | Ypd Vps Vou Xs Raz Roz | cfm cfm cfm cfm/sf cfm/p | = = = | VpdDs Rps Ps + Ras As Vou / Vps | = 3800 = 390 = 0.10 | 0.18 | 0.06 |
| <u>Detailed (</u> Initial Cal | Outdoor air as a % of design primary supply air Calculations Culations for the System as a whole Primary supply air flow to system at conditioned analyzed UncorrectedOA requirement for system Uncorrected OA requ'a as a fraction of primary SA Culations for individual zones OA rate per unit area for zone OA rate per person Total supply air to zone (at condition being analyzed) | Ypd Vps Vou Xs Raz Rpz Vdz | cfm cfm cfm/sf cfm/p cfm | = = = | VpdDs Rps Ps + Ras As Vou / Vps | 10% = 3800 = 399 = 0.10 | 0.18 | 0.06 5.00 800 |
| <u>Detailed (</u> Initial Cal | Outdoor air as a % of design primary supply air Calculations Culations for the System as a whole Primary supply air flow to system at conditioned analyzed UncorrectedOA requirement for system Uncorrected OA req'd as a fraction of primary SA Culations for individual zones OA rate per unit area for zone OA rate per person Total supply air to zone (at condition being analyzed) Unused OA req'd to breathing zone | Ypd Vps Vou Xs Raz Rpz Vdz Vdz | cfm cfm cfm/sf cfm/p cfm cfm | = = = | VpdDs Rps Ps + Ras As Vou / Vps Rpz Pz + Raz Az | 10% = 3800 = 0.10 | 0.18 10.00 3000 315.0 | 0.06 5.00 800 75.0 |
| <u>Detailed (</u> Initial Cal | Outdoor air as a % of design primary supply air Calculations Culations for the System as a whole Primary supply air flow to system at conditioned analyzed UncorrectedOA requirement for system Uncorrected OA req'd as a fraction of primary SA Iculations for individual zones OA rate per unit area for zone OA rate per person Total supply air to zone (at condition being analyzed) Unused OA requirement for zone Unused OA requirement for zone | Ypd Vps Vou Xs Raz Rpz Vdz Vbz Voz | cfm cfm cfm/sf cfm/p cfm cfm cfm | = = = | VpdDs Rps Ps + Ras As Vou / Vps Rpz Pz + Raz Az Vbz/Ez | = 3800 = 390 = 0.10 | 0) 0) 1000 3000 315.0 315.0 | 0.06 5.00 800 75.0 |
| <u>Detailed (</u> Initial Cal | Outdoor air as a % of design primary supply air Calculations Culations for the System as a whole Primary supply air flow to system at conditioned analyzed UncorrectedOA requirement for system Uncorrected OA requid as a fraction of primary SA Culations for individual zones OA rate per unit area for zone OA rate per person Total supply air to zone (at condition being analyzed) Unused OA requirement for zone Unused OA requirement for zone Fraction of zone supply air to zone for zone | Ypd Vps Vou Xs Raz Rpz Vdz Vdz Vdz Voz Fa | cfm cfm cfmsf cfm/p cfm cfm cfm cfm | = | VpdDs Rps Ps + Ras As Vou / Vps Rpz Pz + Raz Az Vbz/Ez Ep + (1-En)Fr | = 3800 = 390 = 0.10 | 0 0 10.00 3000 315.0 315 100 | 0.06 5.00 800 75.0 75 1.00 |
| <u>Detailed (</u> Initial Cal | Outdoor air as a % of design primary supply air Calculations Culations for the System as a whole Primary supply air flow to system at conditioned analyzed UncorrectedOA requirement for system UncorrectedOA req'd as a fraction of primary SA Culations for individual zones OA rate per unit area for zone OA rate per person Total supply air to zone (at condition being analyzed) Unused OA req'd to breathing zone Unused OA requirement for zone Fraction of zone supply not directly recirc. from zone Fraction of zone supply not directly recirc. from zone Fraction of zone supply not directly recirc. from zone | Ypd Vps Vou Xs Raz Rpz Vdz Vbz Vbz Voz Fa Eb | cfm cfm cfm cfm/sf cfm/p cfm cfm cfm | | VpdDs Rps Ps + Ras As Vou / Vps Rpz Pz + Raz Az Vbz/Ez Ep + (1-Ep)Er En | = 3800 = 390 = 0.10 = - | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0.06 5.00 75.0 75.0 75 1.00 |
| Detailed Initial Cal | Outdoor air as a % of design primary supply air Calculations Calculations Calculations for the System as a whole Primary supply air flow to system at conditioned analyzed UncorrectedOA requirement for system Uncorrected OA req'd as a fraction of primary SA Loulations for individual zones OA rate per unit area for zone OA rate per person Total supply air to zone (at condition being analyzed) Unused OA req'd to breathing zone Unused OA requirement for zone Fraction of zone supply not directly recirc. from zone Fraction of zone supply for fully mixed primary air Fraction of zone on the supply for the supply air | Ypd Vps Vou Xs Raz Rpz Vdz Vbz Vbz Voz Fa Fb Fc | cfm cfm cfm/sf cfm/p cfm cfm cfm | | VpdDs Rps Ps + Ras As Vou / Vps Rpz Pz + Raz Az Vbz/Ez Ep + (1-Ep)Er Ep L(1-E2)(1-E0)(1-E0) | = 3800 = 390 = 0.10 = = = | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0.06 5.00 800 75.0 75 1.00 1.00 |
| Detailed Initial Cal | Outdoor air as a % of design primary supply air Calculations Culations for the System as a whole Primary supply air flow to system at conditioned analyzed UncorrectedOA requirement for system Uncorrected OA require das a fraction of primary SA Culations for individual zones OA rate per unit area for zone OA rate per person Total supply air to zone (at condition being analyzed) Unused OA requirement for zone Fraction of zone supply not directly recirc. from zone Fraction of zone OA not directly recirc. from zone Unused OA fraction required in the conduct of the zone | Ypd Vou Xs Raz Rpz Vdz Vbz Voz Fa Fb Fc Zd | cfm cfm cfm cfm/sf cfm/p cfm cfm cfm cfm | | VpdDs Rps Ps + Ras As Vou / Vps Rpz Pz + Raz Az Vbz/Ez Ep + (1-Ep)Er Ep 1-(1-Ez)(1-Ep)(1-Er) Voz / (/dz | = 3800 = 390 = 0.10 = = = = | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0.06 5.00 800 75.0 1.00 1.00 1.00 |
| Detailed 1 Initial Cal | Outdoor air as a % of design primary supply air Calculations Culations for the System as a whole Primary supply air flow to system at conditioned analyzed UncorrectedOA requirement for system UncorrectedOA reqvia as a fraction of primary SA Culations for individual zones OA rate per person OA rate per person Total supply air to zone (at condition being analyzed) Unused OA reqvirement for zone Fraction of zone supply not directly recirc. from zone Fraction of zone OA not directly recirc. from zone Unused OA fraction required in supply air to zone Unused OA fraction required in supply air to zone | Ypd Vps Vou Xs Raz Rpz Vdz Vbz Vbz Voz Fa Fb Fc Zd Zp | cfm cfm cfm/sf cfm/sf cfm/p cfm cfm cfm | | VpdDs Rps Ps + Ras As Vou / Vps Rpz Pz + Raz Az Vbz/Ez Ep + (1-Ep)Er Ep 1-(1-Ez)(1-Ep)(1-Er) Voz / Vdz | = 3800 = 390 = 0.10 = = = = = = = = = = = = = = = = = = = | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0.06 5.00 75.0 75 1.00 1.00 1.00 0.09 |
| Detailed I Initial Cal | Outdoor air as a % of design primary supply air Calculations Culations for the System as a whole Primary supply air flow to system at conditioned analyzed UncorrectedOA requirement for system UncorrectedOA reqid as a fraction of primary SA Culations for individual zones OA rate per person Total supply air to zone (at condition being analyzed) Unused OA reqid to breathing zone Unused OA requirement for zone Fraction of zone supply from fully mixed primary air Fraction of zone OA not directly recirc. from zone Unused OA fraction required in supply air to zone Unused OA fraction required in supply air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone | Ypd Vou Xs Raz Rpz Vdz Vbz Vbz Voz Fa Fb Fc Zd Zp | cfm cfm cfm cfm/sf cfm/p cfm cfm cfm | | VpdDs Rps Ps + Ras As Vou / Vps Rpz Pz + Raz Az Vbz/Ez Ep + (1-Ep)Er Ep 1-(1-Ez)(1-Ep)(1-Er) Voz / Vdz Voz / Vpz | = 3800 = 390 = 0.10 = = = = = = = | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0.06 5.00 75.0 75 1.00 1.00 1.00 0.09 0.09 |
| Detailed Initial Cal Initial Cal | Outdoor air as a % of design primary supply air Calculations Culations for the System as a whole Primary supply air flow to system at conditioned analyzed UncorrectedOA requirement for system UncorrectedOA requirement for system Uncorrected OA req'd as a fraction of primary SA CoA rate per unit area for zone OA rate per unit area for zone OA rate per person Total supply air to zone (at condition being analyzed) Unused OA req'd to breathing zone Unused OA requirement for zone Fraction of zone supply not directly recirc. from zone Fraction of zone supply for directly recirc. from zone Unused OA fraction required in supply air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction required in primary air to zone Unused OA fraction to to | Ypd Vps Vou Xs Raz Rpz Vdz Vdz Vdz Vdz Voz Fa Fb Fc Zd Zp | cfm cfm cfm/sf cfm/p cfm cfm cfm cfm | | VpdDs Rps Ps + Ras As Vou / Vps Rpz Pz + Raz Az Vbz/Ez Ep + (1-Ep)Er Ep 1-(1-Ez)(1-Ep)(1-Er) Voz / Vdz Voz / Vpz (Ea + ENS - Ec2) / Ec | = 3800 = 390 = 0.10 = = = = = = | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0.06 5.00 800 75.0 75 1.00 1.00 1.00 0.09 0.09 |
| Detailed Initial Cal | Outdoor air as a % of design primary supply air Calculations Culations for the System as a whole Primary supply air flow to system at conditioned analyzed UncorrectedOA requirement for system UncorrectedOA requirement for system OA rate per unit area for zone OA rate per person OA rate per person Total supply air to zone (at condition being analyzed) Unused OA requirement for zone Fraction of zone supply not directly recirc. from zone Fraction of zone OA not directly recirc. from zone Unused OA fraction required in supply air to zone Unused OA fraction required in supply air to zone Unused OA fraction required in primary air Fraction of zone Ventilation Efficiency Zone Ventilation Efficiency (App A Method) | Ypd Vps Vou Xs Raz Rpz Vdz Vdz Voz Fa Fb Fc Zd Zp Evz | cfm cfm cfm cfm/sf cfm/p cfm cfm cfm | | VpdDs Rps Ps + Ras As Vou / Vps Rpz Pz + Raz Az Vbz/Ez Ep + (1-Ep)Er Ep 1-(1-Ez)(1-Ep)(1-Er) Voz / Vdz Voz / Vpz (Fa + FbXs - FcZ) / Fa min (Eirc) | = 3800 = 390 = 0.10 = = = = = = = = = = = = = = = = = = = | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0.06 5.00 800 75.0 75 1.00 1.00 1.00 0.09 0.09 |
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