

# MONTGOMERY COLLEGE STUDENT SERVICES CENTER

ROCKVILLE, MD

## ASHRAE STANDARDS 62.1 & 90.1 COMPLIANCE EVALUATION



Interior Rendering – Courtesy of Cho Benn Holback + Associates, Inc

Architectural Engineering 481W | Senior Thesis

### Technical Report 1

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## Executive Summary

This report discusses the compliance of the Montgomery College Student Services Center with ASHRAE Standards 62.1 and 90.1.

The construction documents for the Montgomery College Student Services Center were analyzed and compared to ASHRAE Standard 62.1. This includes sections five and six of the standard. Section five is in place to avoid health concerns caused by mold growth, building exhaust systems locations, condensate draining, supply air efficiencies, and air filtration. Montgomery College Student Services Center was found to be fully compliant with section five. Section six is in place to ensure compliance with the Ventilation Rate Procedure. Montgomery College Student Services Center was found to be fully compliant with section six as well.

Finally, the building was analyzed with sections five through ten of ASHRAE 90.1. Montgomery College Student Services Center was found to be compliant.

## Building Overview

The Student Services Center is being designed and constructed by Montgomery College to replace its existing facility. The new building will house various student services, intake functions and programs serving students. It will also contain one academic department (school of education), administrative offices, the campus security office and a central plant operation serving both this building and the campus. The proposed building will consist of four stories above grade and a basement, and will contain 70,227 nsf and 128,004 gsp. The mechanical equipment will be located on the roof and in the basement. Each department is located within the building such that they remain a cohesive unit on the same floor and near other departments that work together. An emphasis was put on making the space inviting and easy to navigate for students. A large atrium on the first floor has a welcome center to aid students with questions and direct them to whatever department they'd like to visit. The building will be located at the end of the mall that runs the NS length of the campus. Glazing on the southern exterior will create an appealing gateway to the campus.



Figure 1. Building Floor Plan – Courtesy of Cho Benn Holback + Associates, Inc

The main mechanical room is located on the basement level, which contains two water cooled chillers, five boilers, eleven pumps, and a network of piping and ducts. Two custom air handlers are located in on the roof, and they both serve a single main chase that travels the height of the building. A two-cell cooling tower and VRF units are also located on the roof.

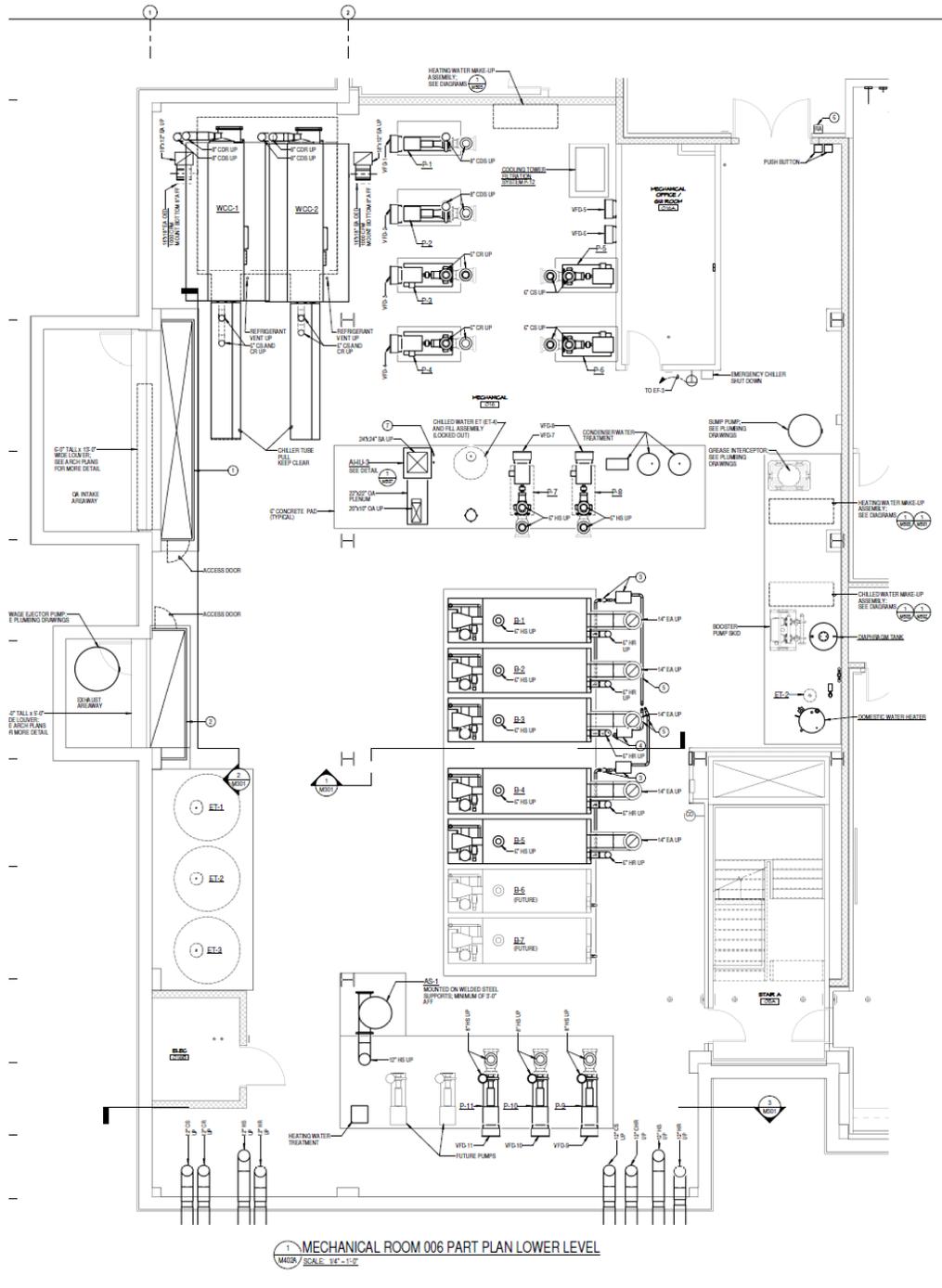


Figure 2. Mechanical Room Drawing – Courtesy of James Posey Associates

## ASHRAE Standard 62.1 – 2007 Analysis

### Section 5: Systems and Equipment

This section investigates the compliance of Montgomery College Student Services Center with ASHRAE Standard 62.1 – 2007.

#### 5.1 Natural Ventilation: *Satisfied*

No natural ventilation systems will be provided in the building. Ventilation will be provided through the use of mechanical air handling units.

#### 5.2 Ventilation Air Distribution: *Satisfied*

The building is in compliance with Section 5.2. Airflow schedules are provided by the designer that specify CFM values for the diffusers in each space. Each zone has a terminal box to allow the minimum ventilation air flow to be achieved at all times. An air balance will be conducted on the system after construction to ensure each space is properly ventilated.

#### 5.3 Exhaust Duct Locations: *Satisfied*

All exhaust duct systems are negatively pressurized relative to the spaces through which they travel in order to prevent harmful contaminants from leaking out into those spaces. EF-1 is a general exhaust fan designed to 4,850 CFM and located on the roof. EF-2 is located in the basement and serves the security suite by providing 1,000 CFM of exhaust. EF-3 is located in the basement as well, and it serves the mechanical room and provides the largest amount of air removal at 8,000 CFM.

#### 5.4 Ventilation System Controls: *Satisfied*

The Building Automation System (BAS) controls all VAV and VRF terminal units. The BAS adjusts the amount of air that flows into each space in order to meet the load. It also ensures that the proper amount of ventilation is being provided to each space based on that zone's current population.

#### 5.5 Airstream Surfaces: *Satisfied*

Sheet metal ductwork is used throughout the building. The gauge varies from 16 to 24, depending on the duct size. This material allows for sufficient resistance to mold growth and erosion.

## 5.6 Outdoor Air Intakes: Satisfied

Outdoor air intakes are constructed of operable louvers and a mesh screen in order to prevent snow, rain, and other debris from entering the building. These intakes are designed to be minimum distances away from possible sources of contamination, as seen in table 5-1. All outdoor air intakes have been properly designed to manage rain entrainment, rain intrusion, and snow entrainment. They also include corrosion resistant bird screens.

**TABLE 5-1 Air Intake Minimum Separation Distance**

Object	Minimum Distance, ft (m)
Significantly contaminated exhaust (Note 1)	15 (5)
Noxious or dangerous exhaust (Notes 2 and 3)	30 (10)
Vents, chimneys, and flues from combustion appliances and equipment (Note 4)	15 (5)
Garage entry, automobile loading area, or drive-in queue (Note 5)	15 (5)
Truck loading area or dock, bus parking/idling area (Note 5)	25 (7.5)
Driveway, street, or parking place (Note 5)	5 (1.5)
Thoroughfare with high traffic volume	25 (7.5)
Roof, landscaped grade, or other surface directly below intake (Notes 6 and 7)	1 (0.30)
Garbage storage/pick-up area, dumpsters	15 (5)
Cooling tower intake or basin	15 (5)
Cooling tower exhaust	25 (7.5)

Note 1: Significantly contaminated exhaust is exhaust air with significant contaminant concentration, significant sensory-irritation intensity, or offensive odor.

Note 2: Laboratory fume hood exhaust air outlets shall be in compliance with NFPA 45-1991<sup>3</sup> and ANSI/AIHA Z9.5-1992.<sup>4</sup>

Note 3: Noxious or dangerous exhaust is exhaust air with highly objectionable fumes or gases and/or exhaust air with potentially dangerous particles, bioaerosols, or gases at concentrations high enough to be considered harmful. Information on separation criteria for industrial environments can be found in the ACGIH Industrial Ventilation Manual<sup>5</sup> and in the ASHRAE Handbook—HVAC Applications.<sup>6</sup>

Note 4: Shorter separation distances are permitted when determined in accordance with (a) Chapter 7 of ANSI Z223.1/NFPA 54-2002<sup>7</sup> for fuel gas burning appliances and equipment, (b) Chapter 6 of NFPA 31-2001<sup>8</sup> for oil burning appliances and equipment, or (c) Chapter 7 of NFPA 211-2003<sup>9</sup> for other combustion appliances and equipment.

Note 5: Distance measured to closest place that vehicle exhaust is likely to be located.

Note 6: No minimum separation distance applies to surfaces that are sloped more than 45 degrees from horizontal or that are less than 1 in. (3 cm) wide.

Note 7: Where snow accumulation is expected, distance listed shall be increased by the expected average snow depth.

Figure 3. Table 5-1 – Courtesy of ASHRAE Standard 62.1 - 2007

## 5.7 Local Capture of Contaminants: Satisfied

Contaminants generated by mechanical or electrical equipment within the building are captured and removed from the building.

## 5.8 Combustion Air: Satisfied

Sufficient air is provided to fuel-burning appliances, such as the gas-fired condensing boilers in the basement. They require air for combustion, as well as removal of combustion products, which are vented to the outdoors.

## 5.9 Particulate Matter Removal: Satisfied

The two custom air handling units have MERV 8 pre-filters, with MERV 13 final filters being used as well. This exceeds the minimum ASHRAE Standard value of MERV 6.

## 5.10 Dehumidification Systems: Satisfied

The air handling units are designed to supply air at 50% relative humidity, which is below the prescribed 65% maximum relative humidity. The total minimum outdoor air is 30,000 CFM, which exceeds the general exhaust amount of 13,850 CFM. The design minimum outdoor air intake must be greater than the design maximum exhaust airflow.

### 5.11 Drain Pans: Satisfied

Equipment that creates condensation is specified with a drain pan that meets this sections requirements for slope, outlet, drain seal, pan size, and location.

### 5.12 Finned-Tube Coils and Heat Exchangers: Satisfied

Drain pans that meet the requirements of section 5.11 are included for all finned-tube and heat exchanger devices. In addition, at least 18 inches of access space must be provided to allow for cleaning.

### 5.13 Humidifiers and Water-Spray Systems: Satisfied

Quality water sources are used to supply all humidifier sources. All air cleaners or ductwork obstructions, such as turning vanes, volume dampers, and cut offsets greater than 15 degrees are install downstream of humidifiers at a distance specified by the manufacturer.

### 5.14 Access for Inspection, Cleaning, and Maintenance: Satisfied

All air handling units, exhaust fans, terminal units, and other equipment are designed in order to allow access for inspection, cleaning, and maintenance. Access doors will be provided to enter the two custom air handling units on the roof for ease of maintenance. The mechanical room on the basement level is also easily accessible.

### 5.15 Building Envelope and Interior Surfaces: Satisfied

The building envelope contains adequate weather and moisture barriers. This includes glazing and a vapor barrier to protect the building from condensation. Expansion joints are included as needed as well. See Figure 4.

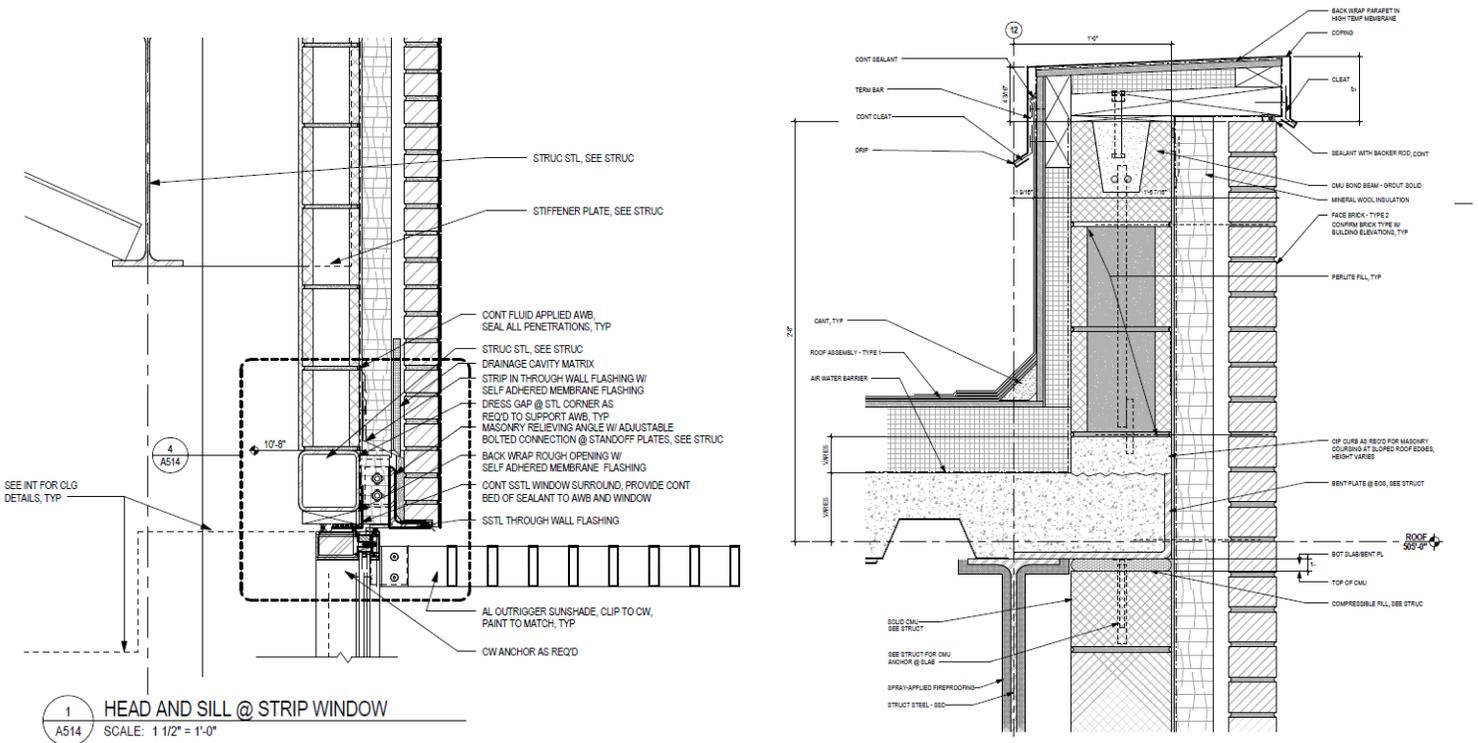


Figure 4. Envelope Sections – Courtesy of Cho Benn Holback + Associates, Inc

### 5.16 Building with Attached Parking Garages: Satisfied

The building does not have an attached parking garage.

### 5.17 Air Classification and Recirculation: Satisfied

All spaces within the building fall into either an air class of one or two. Class two air has moderate contamination and class one air has little contamination. Areas with low contamination can have their air recirculated, but spaces with high contamination levels have to have their air exhausted.

### 5.18 Requirements for Buildings Containing ETS and ETS-Free Areas: Satisfied

Smoking is not allowed in this building, therefore all spaces are classified as ETS-Free areas. Air intakes are located to avoid contamination from potential smoking areas outside the building.

## Section 6: Procedures

### 6.2 Ventilation Rate Procedure: Satisfied

The ventilation rate procedure is used in order to ensure that the proper amount of ventilation air is provided to each space. Information for each space on net area, occupancy, space type (defined by ASHRAE), and air distribution system are required for this calculation. The tables used for this calculation are shown in the Appendix.

The below equation (with variables defined) is used in order to calculate breathing zone air flows.

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

$R_p$ :	Outdoor airflow rate per person (Table 6-1)	[cfm/person]
$P_z$ :	Zone population during typical usage	[people]
$R_a$ :	Outdoor airflow rate per unit area (Table 6-1)	[cfm/ft <sup>2</sup> ]
$A_z$ :	Occupiable area of the zone	[ft <sup>2</sup> ]

After the breathing zone air flow is calculated, it is corrected by the zone air distribution effectiveness,  $E_z$ , to find the zone outdoor airflow ( $V_{oz}$ ).  $E_z$  is taken from Table 6-2.

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

The system type must be determined next. It could be single-zone, 100% outdoor air, or a multiple-zone recirculating system. This building is a multiple-zone recirculating system, therefore the primary outdoor air fraction  $Z_p$  is determined with:

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

$V_{oz}$ :	Outdoor airflow rate per person (Table 6-1)	[cfm/person]
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Next, the uncorrected outdoor air intake ( $V_{ou}$ ) can be calculated. This includes a diversity factor that accounts for overall system population and population differences between spaces.

$$V_{ou} = D * \sum_{\text{all zones}} (R_p + P_z) + \sum_{\text{all zones}} (R_a + A_z)$$

$$D = P_s / \sum_{\text{all zones}} P_z$$

$V_{ou}$ :	Uncorrected outdoor air intake	[cfm]
D:	Occupant diversity	[unitless]
$P_s$ :	System population	[people]

Finally, the outdoor air intake flow ( $V_{ot}$ ) is calculated as seen below

$$V_{ot} = V_{ou} / E_v$$

The calculations for Montgomery College Student Services Center are shown in the Appendix (Ventilation Code Compliance Calculation).

### **6.2.8 Exhaust Ventilation: Satisfied**

Exhaust airflow is provided as specified in Table 6-4 shown in the Appendix. Calculations for this building are shown in the Appendix as well (Ventilation Code Compliance Calculation).

## ASHRAE Standard 90.1 – 2007 Analysis

### Section 5: Building Envelope

Montgomery College Student Services Center is located in Zone 4a of the ASHRAE 90.1 – 2007 climate map and is defined as mixed-humid from Table B-4 (see Appendix).

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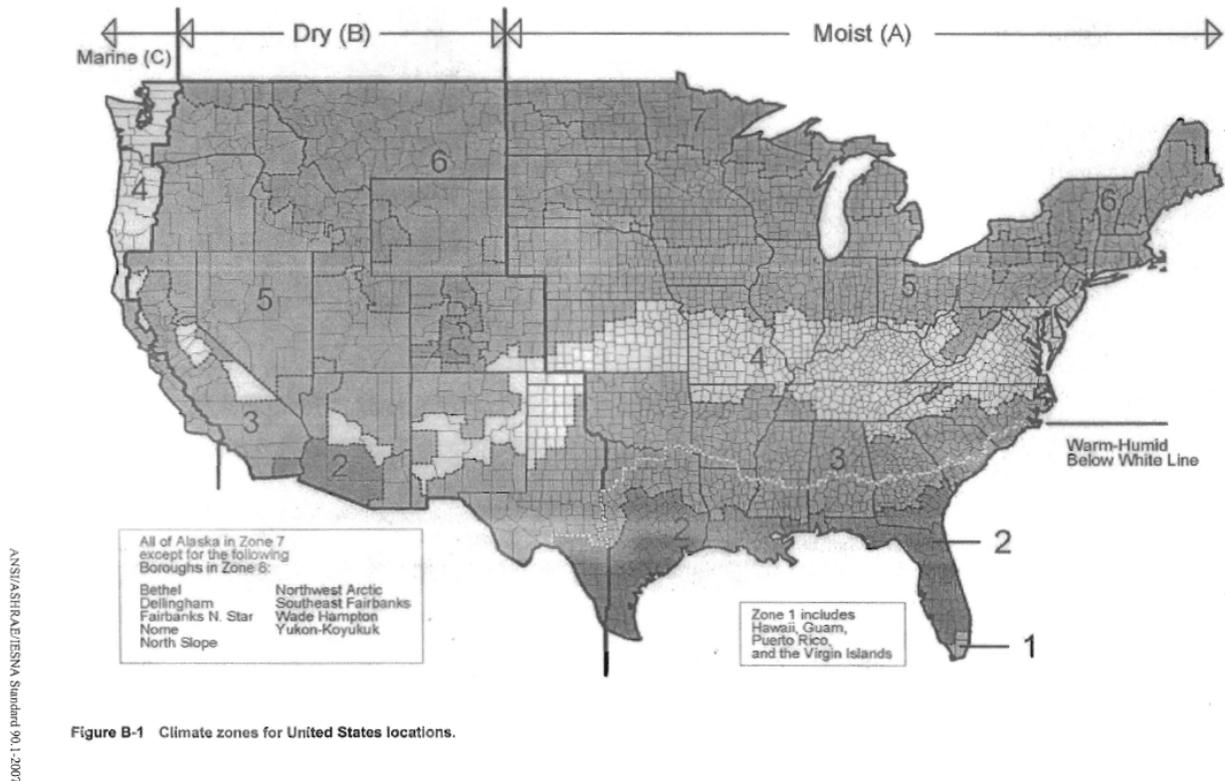


Figure 4. Climate Zones - Courtesy of ASHRAE Standard 62.1 - 2007

### 5.2 Compliance Paths: Satisfied

Vertical fenestration does not exceed 40% of the gross wall area, and skylight fenestration does not exceed 5% of the gross roof area, meaning that Compliance Path A is able to be used.

### 5.4 Mandatory Provisions: Satisfied

The building is compliant with fenestration and air leakage standards. Exterior doors will close automatically to prevent doors from staying open accidentally. Entrances that are in excess of 1000 SF are required to have a vestibule in order to minimize the amount of air that can enter and leave the building. Vestibules have to have a minimum distance of 7 feet between the interior and exterior doors. Air and weather barriers are provided in the building envelop to prevent air leakage, and insulation provides thermal protection.

### 5.5 Prescriptive Building Envelope: Satisfied

Baseline ASHRAE prescribed thermal values are shown below, as compared to the proposed building thermal values. The building meets the required values.

Opaque Elements	Envelope Thermal Values		Compliance
	Baseline	Proposed	
Roof	R-25	R-25	Yes
Walls	R-15.6	R-19	Yes
Glazing	U-0.38 ; SC-0.40	U-0.29 ; SC-0.39	Yes

Figure 5. Building Envelope Requirements for Climate Zone 4a

## Section 6: Heating, Ventilating, and Air Conditioning

### 6.4 Mandatory Provisions:

Equipment selected for Montgomery College Student Services Center meets the efficiency standards prescribed in this section. This includes tables 6.8.1A through 6.8.1G. Load calculations have been performed with the proper method, and each zone is controlled by thermostatic controls. Other energy saving methods, such as off-hour controls, automatic shutdown, and optimum start are included.

### 6.5 Prescriptive Path:

Air handling equipment utilizes control systems, economizers, and energy wheels in accordance with this standard. Air side economizers on both air handling units are used to provide free cooling to the building. Fan power levels comply with this section. Outdoor air quantities are in the Appendix (Ventilation Code Compliance Calculation).

## Section 7: Service Water Heating

### 7.4 Mandatory Provisions:

There are five gas-fired condensing boilers located in the basement of Montgomery College Student Services Center. These boilers will serve this building and also act as a district plant, providing hot water for other buildings at Montgomery College. Design loads were determined in accordance with the manufacturers sizing guidelines. Performance requirements for water heating equipment is also met.

### 7.5 Prescriptive Path:

Heating in the building is provided via the air supplied to each space from the two custom air handlers. They are supplied by heating coils, which are fed from the condensing boilers. Reheat coils are also available at VAV boxes, also served by the boilers.

## Section 8: Power

### 8.4 Mandatory Provisions:

Feeder conductors are sized for a maximum voltage drop of 2% at design load, and branch circuits are sized for a maximum voltage drop of 3% at design load. Normal power for the entire building will be provided by a 3000-amp main fused bolted pressure switch. Branch panelboards will be either 480Y/277 volt or 208Y/120 volt with main circuit breakers, and bolt-on type branch breakers. Branch circuit panelboards will feed lighting receptacle, and equipment loads.

Dry-type transformers will be served with 208Y/120 volt, 3-phase,4-wire secondary distribution. Branch circuit panelboards and dry-type transformers will be placed throughout the building. All three-phase motor loads will be provided with variable frequency drives.

## Section 9: Lighting

### 9.2 Compliance Path:

The Building Area Method was used for lighting density calculations.

### 9.4 Mandatory Provisions:

The BAS controls lighting through the use of occupancy sensors; lights turn off after a space is unoccupied for a certain time. Each space has at least one control device for general lighting.

### 9.5 Building Area Method Compliance Path:

Table 9.5.1 specifies that for a school/university building, the allowable LPD is 1.2 W/ft<sup>2</sup>.

$$128,000 \text{ ft}^2 * 1.2 \text{ W/ft}^2 = 153,600 \text{ W}$$

The documents have every space specifically modeled with a LPD of only 0.6 W/ft<sup>2</sup>. This means that this building is in compliance, as it is assumed to use half of the allowable power.

### Section 10.4.1: Electric Motors

Electric motors are required to comply with the specifications of the Energy Policy Act of 1992, as set forth in Table 10.8 in ASHRAE Standard 90.1 – 2007 (see Appendix). This table specifies minimum nominal efficiencies for general purpose Design A and Design B motors. The building is in compliance based on the design documentation and the requirements set forth in Table 10.8.

## References:

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

ANSI/ASHRAE. (2007). *Standard 90.1-2007, Ventilation for Buildings Except Low Rise Residential*. Atlanta, GA. American Society of Heating Refrigeration and Air Conditioning Engineers, Inc.

## Appendix:

### Table 6-1

**TABLE 6-1 MINIMUM VENTILATION RATES IN BREATHING ZONE**  
(This table is not valid in isolation; it must be used in conjunction with the accompanying notes.)

Occupancy Category	People Outdoor Air Rate $R_p$		Area Outdoor Air Rate $R_a$		Notes	Default Values		Air Class	
	cfm/person	L/s-person	cfm/ft <sup>2</sup>	L/s-m <sup>2</sup>		Occupant Density (see Note 4)	Combined Outdoor Air Rate (see Note 5)		
						#/1000 ft <sup>2</sup> or #/100 m <sup>2</sup>	cfm/person		L/s-person
<b>Correctional Facilities</b>									
Cell	5	2.5	0.12	0.6		25	10	4.9	2
Dayroom	5	2.5	0.06	0.3		30	7	3.5	1
Guard stations	5	2.5	0.06	0.3		15	9	4.5	1
Booking/waiting	7.5	3.8	0.06	0.3		50	9	4.4	2
<b>Educational Facilities</b>									
Daycare (through age 4)	10	5	0.18	0.9		25	17	8.6	2
Daycare sickroom	10	5	0.18	0.9		25	17	8.6	3
Classrooms (ages 5–8)	10	5	0.12	0.6		25	15	7.4	1
Classrooms (age 9 plus)	10	5	0.12	0.6		35	13	6.7	1
Lecture classroom	7.5	3.8	0.06	0.3		65	8	4.3	1
Lecture hall (fixed seats)	7.5	3.8	0.06	0.3		150	8	4.0	1
Art classroom	10	5	0.18	0.9		20	19	9.5	2
Science laboratories	10	5	0.18	0.9		25	17	8.6	2
University/college laboratories	10	5	0.18	0.9		25	17	8.6	2
Wood/metal shop	10	5	0.18	0.9		20	19	9.5	2
Computer lab	10	5	0.12	0.6		25	15	7.4	1
Media center	10	5	0.12	0.6	A	25	15	7.4	1
Music/theater/dance	10	5	0.06	0.3		35	12	5.9	1
Multi-use assembly	7.5	3.8	0.06	0.3		100	8	4.1	1
<b>Food and Beverage Service</b>									
Restaurant dining rooms	7.5	3.8	0.18	0.9		70	10	5.1	2
Cafeteria/fast-food dining	7.5	3.8	0.18	0.9		100	9	4.7	2
Bars, cocktail lounges	7.5	3.8	0.18	0.9		100	9	4.7	2
<b>General</b>									
Break rooms	5	2.5	0.06	0.3		25	10	5.1	1
Coffee stations	5	2.5	0.06	0.3		20	11	5.5	1
Conference/meeting	5	2.5	0.06	0.3		50	6	3.1	1
Corridors	–	–	0.06	0.3		–			1
Storage rooms	–	–	0.12	0.6	B	–			1
<b>Hotels, Motels, Resorts, Dormitories</b>									
Bedroom/living room	5	2.5	0.06	0.3		10	11	5.5	1
Barracks sleeping areas	5	2.5	0.06	0.3		20	8	4.0	1
Laundry rooms, central	5	2.5	0.12	0.6		10	17	8.5	2
Laundry rooms within dwelling units	5	2.5	0.12	0.6		10	17	8.5	1
Lobbies/prefunction	7.5	3.8	0.06	0.3		30	10	4.8	1
Multipurpose assembly	5	2.5	0.06	0.3		120	6	2.8	1

**TABLE 6-1 MINIMUM VENTILATION RATES IN BREATHING ZONE** *(continued)*  
 (This table is not valid in isolation; it must be used in conjunction with the accompanying notes.)

Occupancy Category	People Outdoor Air Rate $R_p$		Area Outdoor Air Rate $R_a$		Notes	Default Values		Air Class	
	cfm/person	L/s-person	cfm/ft <sup>2</sup>	L/s-m <sup>2</sup>		Occupant Density (see Note 4)	Combined Outdoor Air Rate (see Note 5)		
						#/1000 ft <sup>2</sup> or #/100 m <sup>2</sup>	cfm/person		L/s-person
<b>Office Buildings</b>									
Office space	5	2.5	0.06	0.3		5	17	8.5	1
Reception areas	5	2.5	0.06	0.3		30	7	3.5	1
Telephone/data entry	5	2.5	0.06	0.3		60	6	3.0	1
Main entry lobbies	5	2.5	0.06	0.3		10	11	5.5	1
<b>Miscellaneous Spaces</b>									
Bank vaults/safe deposit	5	2.5	0.06	0.3		5	17	8.5	2
Computer (not printing)	5	2.5	0.06	0.3		4	20	10.0	1
Electrical equipment rooms	–	–	0.06	0.3	B	–			1
Elevator machine rooms	–	–	0.12	0.6	B	–			1
Pharmacy (prep. area)	5	2.5	0.18	0.9		10	23	11.5	2
Photo studios	5	2.5	0.12	0.6		10	17	8.5	1
Shipping/receiving	–	–	0.12	0.6	B	–			1
Telephone closets	–	–	0.00	0.0		–			1
Transportation waiting	7.5	3.8	0.06	0.3		100	8	4.1	1
Warehouses	–	–	0.06	0.3	B	–			2
<b>Public Assembly Spaces</b>									
Auditorium seating area	5	2.5	0.06	0.3		150	5	2.7	1
Places of religious worship	5	2.5	0.06	0.3		120	6	2.8	1
Courtrooms	5	2.5	0.06	0.3		70	6	2.9	1
Legislative chambers	5	2.5	0.06	0.3		50	6	3.1	1
Libraries	5	2.5	0.12	0.6		10	17	8.5	1
Lobbies	5	2.5	0.06	0.3		150	5	2.7	1
Museums (children's)	7.5	3.8	0.12	0.6		40	11	5.3	1
Museums/galleries	7.5	3.8	0.06	0.3		40	9	4.6	1
<b>Residential</b>									
Dwelling unit	5	2.5	0.06	0.3	F,G	F			1
Common corridors	–	–	0.06	0.3					1
<b>Retail</b>									
Sales (except as below)	7.5	3.8	0.12	0.6		15	16	7.8	2
Mall common areas	7.5	3.8	0.06	0.3		40	9	4.6	1
Barbershop	7.5	3.8	0.06	0.3		25	10	5.0	2
Beauty and nail salons	20	10	0.12	0.6		25	25	12.4	2
Pet shops (animal areas)	7.5	3.8	0.18	0.9		10	26	12.8	2
Supermarket	7.5	3.8	0.06	0.3		8	15	7.6	1
Coin-operated laundries	7.5	3.8	0.06	0.3		20	11	5.3	2

**TABLE 6-1 MINIMUM VENTILATION RATES IN BREATHING ZONE (continued)**  
(This table is not valid in isolation; it must be used in conjunction with the accompanying notes.)

Occupancy Category	People Outdoor Air Rate		Area Outdoor Air Rate		Notes	Default Values		Air Class
	$R_p$		$R_a$			Occupant Density (see Note 4)	Combined Outdoor Air Rate (see Note 5)	
	cfm/person	L/s/person	cfm/ft <sup>2</sup>	L/s-m <sup>2</sup>		#/1000 ft <sup>2</sup> or #/100 m <sup>2</sup>	cfm/person L/s-person	
<b>Sports and Entertainment</b>								
Sports arena (play area)	–	–	0.30	1.5	E	–		1
Gym, stadium (play area)	–	–	0.30	1.5		30		2
Spectator areas	7.5	3.8	0.06	0.3		150	8 4.0	1
Swimming (pool & deck)	–	–	0.48	2.4	C	–		2
Disco/dance floors	20	10	0.06	0.3		100	21 10.3	1
Health club/aerobics room	20	10	0.06	0.3		40	22 10.8	2
Health club/weight rooms	20	10	0.06	0.3		10	26 13.0	2
Bowling alley (seating)	10	5	0.12	0.6		40	13 6.5	1
Gambling casinos	7.5	3.8	0.18	0.9		120	9 4.6	1
Game arcades	7.5	3.8	0.18	0.9		20	17 8.3	1
Stages, studios	10	5	0.06	0.3	D	70	11 5.4	1

## GENERAL NOTES FOR TABLE 6-1

- Related requirements:** The rates in this table are based on all other applicable requirements of this standard being met.
- Smoking:** This table applies to no-smoking areas. Rates for smoking-permitted spaces must be determined using other methods. See Section 6.2.9 for ventilation requirements in smoking areas.
- Air density:** Volumetric airflow rates are based on an air density of 0.075 lb<sub>m</sub>/ft<sup>3</sup> (1.2 kg<sub>m</sub>/m<sup>3</sup>), which corresponds to dry air at a barometric pressure of 1 atm (101.3 kPa) and an air temperature of 70°F (21°C). Rates may be adjusted for actual density but such adjustment is not required for compliance with this standard.
- Default occupant density:** The default occupant density shall be used when actual occupant density is not known.
- Default combined outdoor air rate (per person):** This rate is based on the default occupant density.
- Unlisted occupancies:** If the occupancy category for a proposed space or zone is not listed, the requirements for the listed occupancy category that is most similar in terms of occupant density, activities and building construction shall be used.
- Health-care facilities:** Rates shall be determined in accordance with Appendix E.

## ITEM-SPECIFIC NOTES FOR TABLE 6-1

- For high school and college libraries, use values shown for Public Assembly Spaces—Libraries.
- Rate may not be sufficient when stored materials include those having potentially harmful emissions.
- Rate does not allow for humidity control. Additional ventilation or dehumidification may be required to remove moisture.
- Rate does not include special exhaust for stage effects, e.g., dry ice vapors, smoke.
- When combustion equipment is intended to be used on the playing surface, additional dilution ventilation and/or source control shall be provided.
- Default occupancy for dwelling units shall be two persons for studio and one-bedroom units, with one additional person for each additional bedroom.
- Air from one residential dwelling shall not be recirculated or transferred to any other space outside of that dwelling.

## Table 6-2 &amp; 6-3

TABLE 6-2 Zone Air Distribution Effectiveness

Air Distribution Configuration	$E_z$
Ceiling supply of cool air.	1.0
Ceiling supply of warm air and floor return.	1.0
Ceiling supply of warm air 15°F (8°C) or more above space temperature and ceiling return.	0.8
Ceiling supply of warm air less than 15°F (8°C) above space temperature and ceiling return provided that the 150 fpm (0.8 m/s) supply air jet reaches to within 4.5 ft (1.4 m) of floor level. <i>Note:</i> For lower velocity supply air, $E_z = 0.8$ .	1.0
Floor supply of cool air and ceiling return provided that the 150 fpm (0.8 m/s) supply jet reaches 4.5 ft (1.4 m) or more above the floor. <i>Note:</i> Most underfloor air distribution systems comply with this proviso.	1.0
Floor supply of cool air and ceiling return, provided low-velocity displacement ventilation achieves unidirectional flow and thermal stratification.	1.2
Floor supply of warm air and floor return.	1.0
Floor supply of warm air and ceiling return.	0.7
Makeup supply drawn in on the opposite side of the room from the exhaust and/or return.	0.8
Makeup supply drawn in near to the exhaust and/or return location.	0.5

1. "Cool air" is air cooler than space temperature.
2. "Warm air" is air warmer than space temperature.
3. "Ceiling" includes any point above the *breathing zone*.
4. "Floor" includes any point below the *breathing zone*.
5. As an alternative to using the above values,  $E_z$  may be regarded as equal to air change effectiveness determined in accordance with ANSI/ASHRAE Standard 129<sup>16</sup> for all air distribution configurations except unidirectional flow.

TABLE 6-3 System Ventilation Efficiency

Max ( $Z_p$ )	$E_v$
≤0.15	1.0
≤0.25	0.9
≤0.35	0.8
≤0.45	0.7
≤0.55	0.6
>0.55	Use Appendix A

1. "Max  $Z_p$ " refers to the largest value of  $Z_p$ , calculated using Equation 6-5, among all the zones served by the system.
2. For values of  $Z_p$  between 0.15 and 0.55, one may determine the corresponding value of  $E_v$  by interpolating the values in the table.
3. The values of  $E_v$  in this table are based on a 0.15 average outdoor air fraction for the system (i.e., the ratio of the *uncorrected outdoor air intake*  $V_{oa}$  to the total *zone primary airflow* for all the zones served by the air handler). For systems with higher values of the average outdoor air fraction, this table may result in unrealistically low values of  $E_v$ , and the use of Appendix A may yield more practical results.

Table 6-4

TABLE 6-4 Minimum Exhaust Rates

Occupancy Category	Exhaust Rate, cfm/unit	Exhaust Rate, cfm/ft <sup>2</sup>	Notes	Exhaust Rate, L/s·unit	Exhaust Rate, L/s·m <sup>2</sup>	Air Class
Arenas	—	0.50	B	—	—	1
Art classrooms	—	0.70		—	3.5	2
Auto repair rooms	—	1.50	A	—	7.5	2
Barber shops	—	0.50		—	2.5	2
Beauty and nail salons	—	0.60		—	3.0	2
Cells with toilet	—	1.00		—	5.0	2
Copy, printing rooms	—	0.50		—	2.5	2
Darkrooms	—	1.00		—	5.0	2
Educational science laboratories	—	1.00		—	5.0	2
Janitor closets, trash rooms, recycling	—	1.00		—	5.0	3
Kitchenettes	—	0.30		—	1.5	2
Kitchens—commercial	—	0.70		—	3.5	2
Locker/dressing rooms	—	0.25		—	1.25	2
Locker rooms	—	0.50		—	2.5	2
Paint spray booths	—	—	F	—	—	4
Parking garages	—	0.75	C	—	3.7	2
Pet shops (animal areas)	—	0.90		—	4.5	2
Refrigerating machinery rooms	—	—	F	—	—	3
Residential kitchens	50/100	—	G	25/50	—	2
Soiled laundry storage rooms	—	1.00	F	—	5.0	3
Storage rooms, chemical	—	1.50	F	—	7.5	4
Toilets—private	25/50	—	E	12.5/25	—	2
Toilets—public	50/70	—	D	25/35	—	2
Woodwork shop/classrooms	—	0.50		—	2.5	2

A Stands where engines are run shall have exhaust systems that directly connect to the engine exhaust and prevent escape of fumes.

B When combustion equipment is intended to be used on the playing surface additional dilution ventilation and/or source control shall be provided.

C Exhaust not required if two or more sides comprise walls that are at least 50% open to the outside.

D Rate is per water closet and/or urinal. Provide the higher rate where periods of heavy use are expected to occur, e.g., toilets in theatres, schools, and sports facilities. The lower rate may be used otherwise.

E Rate is for a toilet room intended to be occupied by one person at a time. For continuous system operation during normal hours of use, the lower rate may be used. Otherwise use the higher rate.

F See other applicable standards for exhaust rate.

G For continuous system operation, the lower rate may be used. Otherwise use the higher rate.

## Table B-4

TABLE B-4 International Climate Zone Definitions

Zone Number	Name	Thermal Criteria
1	Very Hot-Humid (1A), Dry (1B)	$9000 < \text{CDD}_{50^{\circ}\text{F}}$
2	Hot-Humid (2A), Dry (2B)	$6300 < \text{CDD}_{50^{\circ}\text{F}} \leq 9000$
3A and 3B	Warm-Humid (3A), Dry (3B)	$4500 < \text{CDD}_{50^{\circ}\text{F}} \leq 6300$
3C	Warm-Marine	$\text{CDD}_{50^{\circ}\text{F}} \leq 4500$ and $\text{HDD}_{65^{\circ}\text{F}} \leq 3600$
4A and 4B	Mixed-Humid (4A), Dry (4B)	$\text{CDD}_{50^{\circ}\text{F}} \leq 4500$ and $3600 < \text{HDD}_{65^{\circ}\text{F}} \leq 5400$
4C	Mixed-Marine	$3600 < \text{HDD}_{65^{\circ}\text{F}} \leq 5400$
5A, 5B and 5C	Cool-Humid (5A), Dry (5B), Marine (5C)	$5400 < \text{HDD}_{65^{\circ}\text{F}} \leq 7200$
6A and 6B	Cold-Humid (6A), Dry (6B)	$7200 < \text{HDD}_{65^{\circ}\text{F}} \leq 9000$
7	Very Cold	$9000 < \text{HDD}_{65^{\circ}\text{F}} \leq 12600$
8	Subarctic	$12600 < \text{HDD}_{65^{\circ}\text{F}}$

## Ventilation Code Compliance Calculation:

VAV Box	Name	Zone	Space Occupancy Category	Space Area	Space Occupancy	People OA Rate	Area OA Rate	Zone Ventilation Efficiency	Zone OA Flow Rate	Total Zone OA Flow	Supply Air Provided	Total Zone Min	Zone OA Fraction	Zone Vent Efficiency
				A <sub>Z</sub> (sf)	P <sub>Z</sub> (ppl)	R <sub>P</sub> (cfm/per)	R <sub>A</sub> (cfm/sf)	E <sub>Z</sub>	V <sub>OZ</sub> (cfm)	(cfm)	(cfm)	(cfm)	Z <sub>D</sub>	E <sub>VZ</sub>
VAV-0-01	CUSTODIAL STORAGE	017D	Storage rooms (Inactive)	373	0	0	0	0.8	0	42	500	400	0.10	0.90
VAV-0-01	CUSTODIAL OFFICE	017E	Office Space	200	1	5	0.06	0.8	21					
VAV-0-01	TOOL STORAGE	017F	Storage rooms (Inactive)	136	0	0	0	0.8	0					
VAV-0-01	CORRIDOR	17	Corridors	271	0	0	0.06	0.8	20					
VAV-0-02	LOCKERS	017A	Exhaust	191	0	0	0	0.8	0	50	450	250	0.20	0.80
VAV-0-02	LOCKSMITH	017B	Office Space	200	1	5	0.06	0.8	21					
VAV-0-02	PURCHASING OFFICE	017C	Office Space	210	2	5	0.06	0.8	28					
VAV-0-03	EMR	18	Elevator machine rooms	73	0	0	0.12	0.8	11	11	850	300	0.04	0.96
VAV-0-04	UNFINISHED SPACE-2	001-2	Office Space	2052	11	5	0.06	0.8	223	223	1775	600	0.37	0.63
VAV-0-05	CORRIDOR	91	Corridors	389	0	0	0.06	0.8	29	48	225	225	0.21	0.79
VAV-0-05	MECHANICAL OFFICE / GUI ROOM	016A	Office Space	166	1	5	0.06	0.8	19					
VAV-0-06	CORRIDOR	92	Corridors	277	0	0	0.06	0.8	21	21	600	275	0.08	0.92
VAV-0-06	WOMEN	11	Exhaust	182	0	0	0	0.8	0					
VAV-0-06	MEN	13	Exhaust	176	0	0	0	0.8	0					
VAV-0-07	UNFINISHED SPACE-1	001-1	Office Space	2052	11	5	0.06	0.8	223	223	1700	600	0.37	0.63
VAV-0-07	MATERIALS STORAGE	7	Storage rooms (Inactive)	675	0	0	0	0.8	0					
VAV-0-08	STUDENT SENATE CONFERENCE	006G	Conference/meeting	914	20	5	0.06	0.8	194	194	900	500	0.39	0.61
VAV-0-09	SENATE EXECUTIVE COMMITTEE	006H	Conference/meeting	323	4	5	0.06	0.8	49	49	400	150	0.33	0.67
VAV-0-09	EMR	006N	Elevator machine rooms	65	0	0	0.12	0.8	10	10	750	300	0.03	0.97
VAV-0-11	STUDENT ACTIVITIES LOUNGE	006M	Break rooms	1644	42	5	0.06	0.8	386	386	1725	1000	0.39	0.61
VAV-0-11	STORAGE	006P	Storage rooms (Inactive)	64	0	0	0	0.8	0					
VAV-0-12	CONFERENCE ROOM	006J	Conference/meeting	132	7	5	0.06	0.8	54	90	475	300	0.30	0.70
VAV-0-12	BREAK ROOM	006K	Break rooms	146	4	5	0.06	0.8	36					
VAV-0-13	NEWSROOM	006L	Office Space	300	2	5	0.06	0.8	35	79	600	200	0.39	0.61
VAV-0-13	NEWS STORAGE	006Q	Conference/meeting	86	6	5	0.06	0.8	44					
VAV-0-14	OFFICE	006C	Office Space	117	1	5	0.06	0.8	15	30	275	100	0.30	0.70
VAV-0-14	STUDENT CLUBS	006D	Office Space	112	1	5	0.06	0.8	15					
VAV-0-15	CORRIDOR	006A	Corridors	386	0	0	0.06	0.8	29	48	425	425	0.11	0.89
VAV-0-15	CLUB STORAGE	006E	Storage rooms (Inactive)	480	0	0	0	0.8	0					
VAV-0-15	ICC WORKROOM	006F	Office Space	167	1	5	0.06	0.8	19					
VAV-0-16	MDF	004A	Electrical equipment rooms	365	0	0	0.06	0.8	27	27	3000	900	0.03	0.97
VAV-0-17	ECR	3	Electrical equipment rooms	85	0	0	0.06	0.8	6	6	750	300	0.02	0.98
VAV-0-18	IT STAGING REPAIR	004E	Office Space	713	4	5	0.06	0.8	78	78	350	300	0.26	0.74
VAV-0-19	IT OFFICE	004C	Office Space	132	1	5	0.06	0.8	16	45	400	250	0.18	0.82
VAV-0-19	STORAGE	004D	Storage rooms (Inactive)	165	0	0	0	0.8	0					
VAV-0-19	CORRIDOR	4	Corridors	173	0	0	0.06	0.8	13					
VAV-0-19	IT OFFICE	004B	Office Space	133	1	5	0.06	0.8	16					
VAV-0-20	DISPATCH	002A	Office Space	403	3	5	0.06	0.8	49	49	300	175	0.28	0.72
VAV-0-21	CORRIDOR	2	Corridors	135	0	0	0.06	0.8	10	10	250	200	0.05	0.95
VAV-0-21	LOCKER	002J	Exhaust	152	0	0	0	0.8	0					
VAV-0-21	LOCKER	002D	Exhaust	152	0	0	0	0.8	0					
VAV-0-22	CORRIDOR	90	Corridors	1398	0	0	0.06	0.8	105	105	600	600	0.17	0.83
VAV-0-23	KITCHENETTE	002B	Break rooms	153	2	5	0.06	0.8	24	24	150	100	0.24	0.76
VAV-0-24	PASS-ON CONFERENCE	002C	Conference/meeting	204	6	5	0.06	0.8	53	53	300	150	0.35	0.65
VAV-1-01	CORRIDOR	196	Corridors	387	0	0	0.06	0.8	29	29	400	300	0.10	0.90
VAV-1-01	WOMEN	111	Exhaust	182	0	0	0	0.8	0					
VAV-1-01	MEN	113	Exhaust	176	0	0	0	0.8	0					
VAV-1-02	SHARED OFFICES	106C	Office Space	346	2	5	0.06	0.8	38	83	600	325	0.26	0.74
VAV-1-02	WORK AREA	106B	Office Space	207	2	5	0.06	0.8	28					
VAV-1-02	CORRIDOR	106A	Corridors	223	0	0	0.06	0.8	17					
VAV-1-03	INTAKE	106	Reception areas	181	6	5	0.06	0.8	51	83	400	250	0.33	0.67
VAV-1-03	VESTIBULE-1	199-1	Corridors	419	0	0	0.06	0.8	31					
VAV-1-04	CASHIER SUPERVISOR	106D	Office Space	109	1	5	0.06	0.8	14	35	450	150	0.24	0.76
VAV-1-04	WORKROOM	106E	Office Space	196	1	5	0.06	0.8	21					
VAV-1-05	GRADUATION COORDINATOR	105P	Office Space	192	1	5	0.06	0.8	21	51	550	300	0.17	0.83
VAV-1-05	ENROLLMENT SERVICES SPECIAL	105N	Office Space	118	1	5	0.06	0.8	15					
VAV-1-05	A+R SUPERVISOR	105M	Office Space	117	1	5	0.06	0.8	15					
VAV-1-06	STORAGE	105Q	Storage rooms (Inactive)	93	0	0	0	0.8	0	17	200	100	0.17	0.83
VAV-1-06	CAMPUS REGISTRAR	105R	Office Space	149	1	5	0.06	0.8	17					
VAV-1-07	CORRIDOR	105G	Corridors	904	8	0	0.06	0.8	68	68	450	375	0.18	0.82
VAV-1-08	SHEDULING WORKROOM	105B	Office Space	177	4	5	0.06	0.8	38	95	375	250	0.38	0.62
VAV-1-08	WORKROOM	105E	Office Space	196	6	5	0.06	0.8	52					
VAV-1-08	CORRIDOR	105D	Corridors	63	0	0	0.06	0.8	5					
VAV-1-09	TRANSCRIPT EVALUATOR	105L	Office Space	113	1	5	0.06	0.8	15	44	450	225	0.20	0.80
VAV-1-09	COURSE SCHEDULING SUPERVISOR	105K	Office Space	113	1	5	0.06	0.8	15					
VAV-1-09	ROCKVILLE SCHEDULING ASSIST	105J	Office Space	115	1	5	0.06	0.8	15					
VAV-1-10	ROCKVILLE SCHEDULING ASSIST	105H	Office Space	114	1	5	0.06	0.8	15	15	200	100	0.15	0.85
VAV-1-11	WORKSTATIONS	105C	Office Space	829	12	5	0.06	0.8	137	137	750	350	0.39	0.61
VAV-1-12	SHARED OFFICE	105F	Office Space	121	1	5	0.06	0.8	15	15	200	100	0.15	0.85
VAV-1-13	STUDENT PC AREA	105	Computer lab	404	7	10	0.12	0.8	148	208	750	525	0.40	0.60

VAV Box	Name	Zone	Space Occupancy Category	Space Area A <sub>Z</sub> (sf)	Space Occupancy P <sub>Z</sub> (ppl)	People OA Rate R <sub>P</sub> (cfm/per)	Area OA Rate R <sub>A</sub> (cfm/sf)	Zone Ventilation Efficiency E <sub>Z</sub>	Zone OA Flow Rate V <sub>OZ</sub> (cfm)	Total Zone OA Flow (cfm)	Supply Air Provided (cfm)	Total Zone Min (cfm)	Zone OA Fraction Z <sub>O</sub>	Zone Vent Efficiency E <sub>VZ</sub>
VAV-1-13	INTAKE	105A	Reception areas	213	7	5	0.06	0.8	60					
VAV-1-14	STUDENT LIFE OFFICE	104D	Office Space	130	1	5	0.06	0.8	16	47	300	150	0.31	0.69
VAV-1-14	STUDENT LIFE OFFICE	104E	Office Space	124	1	5	0.06	0.8	16					
VAV-1-14	STUDENT LIFE OFFICE	104F	Office Space	124	1	5	0.06	0.8	16					
VAV-1-15	STUDENT LIFE OFFICE	104G	Office Space	125	1	5	0.06	0.8	16	16	150	75	0.21	0.79
VAV-1-16	WORKROOM	104C	Office Space	207	2	5	0.06	0.8	28	60	275	275	0.22	0.78
VAV-1-16	VESTIBULE 2	199-2	Corridors	431	0	0	0.06	0.8	32					
VAV-1-17	STUDENT LIFE LOUNGE	104A	Media center	369	7	10	0.12	0.8	143	211	1800	1050	0.20	0.80
VAV-1-17	CORRIDOR	104H	Corridors	222	0	0	0.06	0.8	17					
VAV-1-17	RECEPTION	104B	Reception areas	216	2	5	0.06	0.8	29					
VAV-1-17	STAIR E	1SE	Corridors	303	0	0	0.06	0.8	23					
VAV-1-18	WORKROOM	107	Office Space	284	2	5	0.06	0.8	34	59	450	250	0.24	0.76
VAV-1-18	CORRIDOR	194	Corridors	338	0	0	0.06	0.8	25					
VAV-1-19	RECRUIT OFFICE	115	Office Space	114	1	5	0.06	0.8	15	30	200	100	0.30	0.70
VAV-1-19	RECRUIT OFFICE	116	Office Space	117	1	5	0.06	0.8	15					
VAV-1-20	MBI CAFE	103	Coffee Stations	253	3	5	0.06	0.8	38	38	250	125	0.30	0.70
VAV-1-21	RECRUIT OFFICE	118	Office Space	114	1	5	0.06	0.8	15	30	200	100	0.30	0.70
VAV-1-21	RECRUIT OFFICE	119	Office Space	120	1	5	0.06	0.8	15					
VAV-1-22	MATERIAL STORAGE	108B	Exhaust	594	0	0	0	0.8	0	0	600	600	0.00	1.00
VAV-1-22	LOADING DOCK 'B'	108	Exhaust	354	0	0	0	0.8	0					
VAV-1-22	LOADING DOCK 'A'	108	Exhaust	311	0	0	0	0.8	0					
VAV-1-22	FIRE PUMP	108C	Exhaust	296	0	0	0	0.8	0					
VAV-1-23	CAFE OFFICE	103A	Office Space	133	1	5	0.06	0.8	16	74	300	200	0.37	0.63
VAV-1-23	MBI CAFE COUNTER	103B	Coffee Stations	264	6	5	0.06	0.8	57					
VAV-1-24	IDF	117	Electrical equipment rooms	151	0	0	0.06	0.8	11	11	2500	750	0.02	0.98
VAV-1-25	FIN AID OFFICE	121Y	Office Space	117	1	5	0.06	0.8	15	54	400	200	0.27	0.73
VAV-1-25	FIN AID OFFICE	121V	Office Space	109	1	5	0.06	0.8	14					
VAV-1-25	CORRIDOR	121X	Corridors	143	0	0	0.06	0.8	11					
VAV-1-25	FIN AID OFFICE	121Z	Office Space	103	1	5	0.06	0.8	14					
VAV-1-26	WORKROOM	121W	Office Space	371	2	5	0.06	0.8	40	40	600	400	0.10	0.90
VAV-1-27	FIN AID DIRECTOR OFFICE	121U	Office Space	150	1	5	0.06	0.8	18	18	200	100	0.18	0.83
VAV-1-28	FIN AID OFFICE	121S	Office Space	122	1	5	0.06	0.8	15	46	375	150	0.31	0.69
VAV-1-28	FIN AID OFFICE 121Q	121CC	Office Space	125	1	5	0.06	0.8	16					
VAV-1-28	FIN AID OFFICE	121P	Office Space	117	1	5	0.06	0.8	15					
VAV-1-29	FIN AID OFFICE	121T	Office Space	117	1	5	0.06	0.8	15	79	500	325	0.24	0.76
VAV-1-29	FIN. AID OFFICE	121N	Office Space	113	1	5	0.06	0.8	15					
VAV-1-29	FIN AID OFFICE	121M	Office Space	113	1	5	0.06	0.8	15					
VAV-1-29	CORRIDOR	121D	Corridors	458	0	0	0.06	0.8	34					
VAV-1-30	WORK AREA	121E	Office Space	204	2	5	0.06	0.8	28	125	750	325	0.38	0.62
VAV-1-30	RECEPTION	121	Reception areas	194	3	5	0.06	0.8	33					
VAV-1-30	INTAKE	121A	Reception areas	184	4	5	0.06	0.8	39					
VAV-1-30	INTAKE WORKSTATION	121B	Reception areas	166	2	5	0.06	0.8	25					
VAV-1-31	FIN AID OFFICE	121L	Office Space	121	1	5	0.06	0.8	15	45	375	150	0.30	0.70
VAV-1-31	FIN AID OFFICE	121K	Office Space	115	1	5	0.06	0.8	15					
VAV-1-31	FIN AID OFFICE	121H	Office Space	117	1	5	0.06	0.8	15					
VAV-1-32	FIN AID OFFICE	121G	Office Space	115	1	5	0.06	0.8	15	45	375	150	0.30	0.70
VAV-1-32	FIN AID OFFICE	121F	Office Space	116	1	5	0.06	0.8	15					
VAV-1-32	SECURITY ADMIN AID	122J	Office Space	124	1	5	0.06	0.8	16					
VAV-1-33	SECURITY SERVICE DESK	122A	Office Space	117	1	5	0.06	0.8	15	43	400	175	0.25	0.75
VAV-1-33	CORRIDOR	122B	Corridors	134	0	0	0.06	0.8	10					
VAV-1-33	INTAKE OFFICE	121C	Office Space	157	1	5	0.06	0.8	18					
VAV-1-34	RECOVERED PROPERTY	122F	Storage rooms (Inactive)	82	0	0	0	0.8	0	11	250	125	0.09	0.91
VAV-1-34	FILE	122K	Storage rooms (Inactive)	47	0	0	0	0.8	0					
VAV-1-34	CORRIDOR	122D	Corridors	144	0	0	0.06	0.8	11					
VAV-1-35	SECURITY SUPERVISOR	122G	Office Space	107	1	5	0.06	0.8	14	30	250	100	0.30	0.70
VAV-1-35	SECURITY MANAGER	122H	Office Space	123	1	5	0.06	0.8	15					
VAV-1-36	INTERVIEW	122E	Office Space	98	1	5	0.06	0.8	14	29	200	100	0.29	0.71
VAV-1-36	INTERVIEW	122B	Office Space	117	1	5	0.06	0.8	15					
VAV-1-37	ELEC	016C	Electrical equipment rooms	41	0	0	0.06	0.8	3	3	225	100	0.03	0.97
VAV-1-38	WELCOME CTR OFFICE	102C	Office Space	84	1	5	0.06	0.8	13	13	125	50	0.25	0.75
VAV-1-39	WORKROOM	102D	Office Space	128	1	5	0.06	0.8	16	44	450	150	0.29	0.71
VAV-1-39	WELCOME CTR OFFICE	102E	Office Space	102	1	5	0.06	0.8	14					
VAV-1-39	WELCOME CTR OFFICE	102F	Office Space	102	1	5	0.06	0.8	14					
VAV-1-40	CORRIDOR	192	Corridors	406	0	0	0.06	0.8	30	76	425	425	0.18	0.82
VAV-1-40	WELCOME CENTER DIR OFFICE	102A	Office Space	128	1	5	0.06	0.8	16					
VAV-1-40	CORRIDOR	193	Corridors	402	0	0	0.06	0.8	30					
VAV-1-41	WELCOME CENTER-1	102-1	Media center	428	11	10	0.12	0.8	202	202	1125	525	0.38	0.62
VAV-1-42	WELCOME CENTER-2	102-2	Media center	540	14	10	0.12	0.8	256	256	900	650	0.39	0.61
VAV-1-43	WELCOME CTR OFFICE	102G	Office Space	105	1	5	0.06	0.8	14	14	275	100	0.14	0.86
VAV-2-01	COUNSELOR OFFICE	206WW	Office Space	118	1	5	0.06	0.8	15	15	200	100	0.15	0.85

VAV Box	Name	Zone	Space Occupancy Category	Space Area A <sub>Z</sub> (sf)	Space Occupancy P <sub>Z</sub> (ppl)	People OA Rate R <sub>P</sub> (cfm/per)	Area OA Rate R <sub>A</sub> (cfm/sf)	Zone Ventilation Efficiency E <sub>Z</sub>	Zone OA Flow Rate V <sub>OZ</sub> (cfm)	Total Zone OA Flow (cfm)	Supply Air Provided (cfm)	Total Zone Min (cfm)	Zone OA Fraction Z <sub>O</sub>	Zone Vent Efficiency E <sub>VZ</sub>
VAV-2-02	COUNSELOR OFFICE	206XX	Office Space	118	1	5	0.06	0.8	15	19	150	100	0.19	0.81
VAV-2-02	CORRIDOR-2	206MM-2	Corridors	57	0	0	0.06	0.8	4					
VAV-2-03	COUNSELOR OFFICE	206UU	Office Space	116	1	5	0.06	0.8	15	45	450	225	0.20	0.80
VAV-2-03	COUNSELOR OFFICE	206SS	Office Space	119	1	5	0.06	0.8	15					
VAV-2-03	COUNSELOR OFFICE	206QQ	Office Space	117	1	5	0.06	0.8	15					
VAV-2-04	CORRIDOR-1	206MM-1	Corridors	367	0	0	0.06	0.8	28	73	500	300	0.24	0.76
VAV-2-04	COUNSELOR OFFICE	206VV	Office Space	118	1	5	0.06	0.8	15					
VAV-2-04	COUNSELOR OFFICE	206TT	Office Space	118	1	5	0.06	0.8	15					
VAV-2-04	COUNSELOR OFFICE	206RR	Office Space	118	1	5	0.06	0.8	15					
VAV-2-05	COUNSELOR OFFICE	206NN	Office Space	117	1	5	0.06	0.8	15	30	300	125	0.24	0.76
VAV-2-05	COUNSELOR OFFICE	206PP	Office Space	116	1	5	0.06	0.8	15					
VAV-2-06	WORKROOM	206C	Office Space	231	2	5	0.06	0.8	30	30	200	100	0.30	0.70
VAV-2-07	COUNSELOR OFFICE	206LL	Office Space	115	1	5	0.06	0.8	15	45	475	175	0.26	0.75
VAV-2-07	COUNSELOR OFFICE	206KK	Office Space	116	1	5	0.06	0.8	15					
VAV-2-07	COUNSELOR OFFICE	206HH	Office Space	114	1	5	0.06	0.8	15					
VAV-2-08	CORRIDOR-1	206U-1	Corridors	163	0	0	0.06	0.8	12	33	300	150	0.22	0.78
VAV-2-08	COUNSELOR ADMIN AIDES	206B	Office Space	195	1	5	0.06	0.8	21					
VAV-2-09	COUNSELOR OFFICE	206FF	Office Space	113	1	5	0.06	0.8	15	45	450	175	0.26	0.74
VAV-2-09	COUNSELOR OFFICE	206DD	Office Space	118	1	5	0.06	0.8	15					
VAV-2-09	COUNSELOR OFFICE	206CC	Office Space	118	1	5	0.06	0.8	15					
VAV-2-10	COUNSELOR OFFICE	206JJ	Office Space	116	1	5	0.06	0.8	15	71	500	300	0.24	0.76
VAV-2-10	COUNSELOR OFFICE	206GG	Office Space	116	1	5	0.06	0.8	15					
VAV-2-10	COUNSELOR OFFICE	206EE	Office Space	116	1	5	0.06	0.8	15					
VAV-2-10	CORRIDOR	206L	Corridors	141	0	0	0.06	0.8	11					
VAV-2-10	CORRIDOR-2	206U-2	Corridors	214	0	0	0.06	0.8	16					
VAV-2-11	COUNSELOR OFFICE	206J	Office Space	116	1	5	0.06	0.8	15	74	400	250	0.30	0.70
VAV-2-11	COUNSELOR OFFICE	206G	Office Space	116	1	5	0.06	0.8	15					
VAV-2-11	COUNSELOR OFFICE	206E	Office Space	116	1	5	0.06	0.8	15					
VAV-2-11	CORRIDOR-1	206D-1	Office Space	226	2	5	0.06	0.8	29					
VAV-2-12	COUNSELOR OFFICE	206F	Office Space	121	1	5	0.06	0.8	15	60	400	200	0.30	0.70
VAV-2-12	COUNSELOR OFFICE	206H	Office Space	121	1	5	0.06	0.8	15					
VAV-2-12	COUNSELOR OFFICE	206K	Office Space	115	1	5	0.06	0.8	15					
VAV-2-12	COUNSELOR OFFICE	206M	Office Space	116	1	5	0.06	0.8	15					
VAV-2-13	COUNSELOR OFFICE	206AA	Office Space	113	1	5	0.06	0.8	15	44	450	225	0.20	0.80
VAV-2-13	COUNSELOR OFFICE	206Z	Office Space	114	1	5	0.06	0.8	15					
VAV-2-13	COUNSELOR OFFICE	206W	Office Space	116	1	5	0.06	0.8	15					
VAV-2-14	COUNSELOR OFFICE	206BB	Office Space	116	1	5	0.06	0.8	15	72	500	300	0.24	0.76
VAV-2-14	COUNSELOR OFFICE	206Y	Office Space	116	1	5	0.06	0.8	15					
VAV-2-14	COUNSELOR OFFICE	206X	Office Space	117	1	5	0.06	0.8	15					
VAV-2-14	CORRIDOR	206R	Corridors	140	0	0	0.06	0.8	11					
VAV-2-14	CORRIDOR-3	206U-3	Corridors	215	0	0	0.06	0.8	16					
VAV-2-15	COUNSELOR OFFICE	206N	Office Space	116	1	5	0.06	0.8	15	56	400	200	0.28	0.72
VAV-2-15	COUNSELOR OFFICE	206P	Office Space	116	1	5	0.06	0.8	15					
VAV-2-15	COUNSELOR OFFICE	206Q	Office Space	117	1	5	0.06	0.8	15					
VAV-2-15	CORRIDOR-2	206D-2	Corridors	151	0	0	0.06	0.8	11					
VAV-2-16	COUNSELOR OFFICE	206V	Office Space	114	1	5	0.06	0.8	15	15	200	175	0.08	0.92
VAV-2-17	COUNSELOR DIRECTOR OFFICE	206S	Office Space	190	1	5	0.06	0.8	21	36	500	275	0.13	0.87
VAV-2-17	COUNSELOR OFFICE	206T	Office Space	124	1	5	0.06	0.8	16					
VAV-2-18	WAITING	203	Reception areas	570	18	5	0.06	0.8	155	327	1350	1150	0.28	0.72
VAV-2-18	CORRIDOR	292	Corridors	1901	0	0	0.06	0.8	143					
VAV-2-18	CORRIDOR	293	Corridors	393	0	0	0.06	0.8	29					
VAV-2-19	C2C OFFICE	204B	Office Space	120	1	5	0.06	0.8	15	31	200	100	0.31	0.69
VAV-2-19	VETERANS STUDY	204C	Office Space	131	1	5	0.06	0.8	16					
VAV-2-20	STORAGE	204D	Storage rooms (Inactive)	64	0	0	0	0.8	0	60	425	225	0.27	0.73
VAV-2-20	VETERANS LOUNGE	204	Office Space	402	3	5	0.06	0.8	49					
VAV-2-20	RECEPTION	204E	Office Space	70	1	5	0.06	0.8	12					
VAV-2-21	TRAINING ROOM	205C	Break rooms	283	6	5	0.06	0.8	59	59	625	200	0.29	0.71
VAV-2-22	RECEPTION	205A	Reception areas	347	5	5	0.06	0.8	57	57	275	200	0.29	0.71
VAV-2-22	STORAGE ROOM	205J	Storage rooms (Inactive)	132	0	0	0	0.8	0					
VAV-2-23	CS OFFICE	205G	Storage rooms (Inactive)	123	0	0	0	0.8	0	16	350	175	0.09	0.91
VAV-2-23	CS OFFICE	205H	Office Space	129	1	5	0.06	0.8	16					
VAV-2-24	CAREER TRANSFER CENTER	205D	Media center	943	24	10	0.12	0.8	441	441	1200	1100	0.40	0.60
VAV-2-25	INTERVIEW RM	205B	Office Space	129	1	5	0.06	0.8	16	32	500	350	0.09	0.91
VAV-2-25	INTERVIEW RM	205E	Office Space	129	1	5	0.06	0.8	16					
VAV-2-26	CS OFFICE	205F	Office Space	132	1	5	0.06	0.8	16	16	400	125	0.13	0.87

VAV Box	Name	Zone	Space Occupancy Category	Space Area	Space Occupancy	People OA Rate	Area OA Rate	Zone Ventilation Efficiency	Zone OA Flow Rate	Total Zone OA Flow	Supply Air Provided	Total Zone Min	Zone OA Fraction	Zone Vent Efficiency	F <sub>A</sub>	F <sub>B</sub>	F <sub>C</sub>
				A <sub>z</sub> (sf)	P <sub>z</sub> (ppl)	R <sub>p</sub> (cfm/per)	R <sub>a</sub> (cfm/sf)	E <sub>z</sub>	V <sub>oz</sub> (cfm)	(cfm)	(cfm)	(cfm)	Z <sub>o</sub>	E <sub>vz</sub>			
VAV-2-27	CORRIDOR	294	Corridors	349	0	0	0.06	0.8	26	115	950	300	0.38	0.62	1	1	1
VAV-2-27	CONFERENCE	214	Conference/meeting	357	10	5	0.06	0.8	89								
VAV-2-28	WOMEN	211	Exhaust	181	0	0	0	0.8	0	0	200	150	0.00	1.00	1	1	1
VAV-2-28	MEN	213	Exhaust	176	0	0	0	0.8	0								
VAV-2-29	IDF	216	Electrical equipment rooms	142	0	0	0.06	0.8	11	11	2500	750	0.01	0.99	1	1	1
VAV-2-30	HELP DESK	217A	Reception areas	112	2	5	0.06	0.8	21	50	300	125	0.40	0.60	1	1	1
VAV-2-30	RECEPTION	217	Reception areas	141	3	5	0.06	0.8	29								
VAV-2-31	O+M OFFICE	217C	Office Space	109	1	5	0.06	0.8	14	29	375	125	0.23	0.77	1	1	1
VAV-2-31	SR ADMIN ASSIST	217D	Office Space	106	1	5	0.06	0.8	14								
VAV-2-32	SCHEDULER	217F	Office Space	116	1	5	0.06	0.8	15	49	500	175	0.28	0.72	1	1	1
VAV-2-32	CUSTODIAL OFFICE	217G	Office Space	116	1	5	0.06	0.8	15								
VAV-2-32	FACILITIES DIR	217J	Office Space	168	1	5	0.06	0.8	19								
VAV-2-33	CORRIDOR	217E	Corridors	208	0	0	0.06	0.8	16	35	400	175	0.20	0.80	1	1	1
VAV-2-33	WORK ROOM	217H	Office Space	172	1	5	0.06	0.8	19								
VAV-2-34	CONFERENCE ROOM	217B	Conference/meeting	182	6	5	0.06	0.8	51	51	300	150	0.34	0.66	1	1	1
VAV-2-35	OPEN LAB-2	220-2	Computer lab	911	23	10	0.12	0.8	424	494	1925	1225	0.40	0.60	1	1	1
VAV-2-35	CLASS LAB SUPPORT	220A	Computer lab	130	4	10	0.12	0.8	70								
VAV-2-36	OPEN LAB-1	220-1	Computer lab	685	18	10	0.12	0.8	328	328	825	825	0.40	0.60	1	1	1
VAV-2-37	CLASS LAB-2	222-2	Computer lab	412	16	10	0.12	0.8	262	262	1200	650	0.40	0.60	1	1	1
VAV-2-38	CLASS LAB-1	222-1	Computer lab	574	12	10	0.12	0.8	236	236	600	600	0.39	0.61	1	1	1
VAV-2-39	ELEC	221	Electrical equipment rooms	54	0	0	0.06	0.8	4	4	100	100	0.04	0.96	1	1	1
VAV-2-40	CORRIDOR	291	Corridors	466	0	0	0.06	0.8	35	66	775	325	0.20	0.80	1	1	1
VAV-2-40	WORKRM / STORAGE	201A	Office Space	139	1	5	0.06	0.8	17								
VAV-2-40	SCHOLARSHIP ASSISTANT	201B	Office Space	103	1	5	0.06	0.8	14								
VAV-2-41	RECEPTION	201	Reception areas	323	6	5	0.06	0.8	62	62	225	175	0.35	0.65	1	1	1
VAV-2-42	SCHOLARSHIP DIR OFFICE	201C	Office Space	185	1	5	0.06	0.8	20	51	675	225	0.23	0.77	1	1	1
VAV-2-42	SCHOLARSHIP SPECIALIST	201D	Office Space	123	1	5	0.06	0.8	15								
VAV-2-42	SCHOLARSHIP SPECIALIST	201E	Office Space	119	1	5	0.06	0.8	15								
VAV-2-43	LOUNGE-1	202-1	Corridors	667	0	0	0.06	0.8	50	50	450	450	0.11	0.89	1	1	1
VAV-2-44	LOBBY-5	101-5	Main entry lobbies	675	7	5	0.06	0.8	94	115	1050	1050	0.11	0.89	1	1	1
VAV-2-44	LOUNGE-2	202-2	Corridors	269	0	0	0.06	0.8	20								
VAV-2-45	LOBBY-1	101-1	Main entry lobbies	604	7	5	0.06	0.8	89	89	1340	1340	0.07	0.93	1	1	1
VAV-2-46	LOBBY-2	101-2	Main entry lobbies	604	7	5	0.06	0.8	89	89	1340	1340	0.07	0.93	1	1	1
VAV-2-47	LOBBY-3	101-3	Main entry lobbies	604	7	5	0.06	0.8	89	89	1340	1340	0.07	0.93	1	1	1
REMOVED																	
VAV-2-48	HELP DESK	206A	Main entry lobbies	236	4	5	0.06	0.8	43	154	750	400	0.39	0.61	1	1	1
VAV-2-48	RECEPTION / INTAKE	206	Reception areas	488	12	5	0.06	0.8	112								
VAV-3-01	INTL STUDENT COORD.	307C	Office Space	119	1	5	0.06	0.8	15	30	350	125	0.24	0.76	1	1	1
VAV-3-01	INTL STUDENT COORD.	307B	Office Space	116	1	5	0.06	0.8	15								
VAV-3-02	LOUNGE	307A	Corridors	339	0	0	0.06	0.8	25	114	850	350	0.33	0.67	1	1	1
VAV-3-02	CORRIDOR	307D	Corridors	257	0	0	0.06	0.8	19								
VAV-3-02	RECEPTION	307	Reception areas	263	8	5	0.06	0.8	70								
VAV-3-03	MCSO PROG COUNSELOR	307E	Office Space	119	1	5	0.06	0.8	15	15	275	175	0.09	0.91	1	1	1
VAV-3-03	FILE	307F	Storage rooms (inactive)	102	0	0	0	0.8	0								
VAV-3-03	STORAGE	307G	Storage rooms (inactive)	100	0	0	0	0.8	0								
VAV-3-04	WOMEN	311	Exhaust	181	0	0	0	0.8	0	21	400	400	0.05	0.95	1	1	1
VAV-3-04	MEN	313	Exhaust	176	0	0	0	0.8	0								
VAV-3-04	CORRIDOR	395	Corridors	282	0	0	0.06	0.8	21								
VAV-3-05	CONFERENCE	314	Conference/meeting	356	10	5	0.06	0.8	89	89	700	400	0.22	0.78	1	1	1
VAV-3-06	HELP DESK	305A	Reception areas	172	2	5	0.06	0.8	25	128	675	325	0.39	0.61	1	1	1
VAV-3-06	INTAKE	305	Reception areas	312	7	5	0.06	0.8	67								
VAV-3-06	CORRIDOR-1	305U-1	Corridors	128	0	0	0.06	0.8	10								
VAV-3-06	WORK ROOM	305C	Office Space	176	2	5	0.06	0.8	26								
VAV-3-07	TUTORING	305E	Office Space	83	1	5	0.06	0.8	12	25	200	100	0.25	0.75	1	1	1
VAV-3-07	TUTORING	305F	Office Space	86	1	5	0.06	0.8	13								
VAV-3-08	CORRIDOR	393	Corridors	1472	0	0	0.06	0.8	110	110	300	300	0.37	0.63	1	1	1
VAV-3-09	PROGRAM ASSISTANT	305B	Office Space	118	1	5	0.06	0.8	15	45	500	150	0.30	0.70	1	1	1
VAV-3-09	DSS DIR OFFICE	305EE	Office Space	122	1	5	0.06	0.8	15								
VAV-3-09	DSS COUNSELOR	305DD	Office Space	108	1	5	0.06	0.8	14								
VAV-3-10	TUTORING	305J	Office Space	84	1	5	0.06	0.8	13	50	300	175	0.28	0.72	1	1	1
VAV-3-10	TUTORING	305H	Office Space	84	1	5	0.06	0.8	13								
VAV-3-10	TUTORING	305G	Office Space	84	1	5	0.06	0.8	13								
VAV-3-10	CORRIDOR-3	305U-3	Corridors	160	0	0	0.06	0.8	12								
VAV-3-11	DSS LEARNING CENTER	305D	Media center	1166	30	10	0.12	0.8	550	584	1575	1450	0.40	0.60	1	1	1
VAV-3-11	CORRIDOR	305I	Corridors	455	0	0	0.06	0.8	34								
VAV-3-12	DSS COUNSELOR	305CC	Office Space	113	1	5	0.06	0.8	15	60	600	300	0.20	0.80	1	1	1
VAV-3-12	DSS COUNSELOR	305AA	Office Space	117	1	5	0.06	0.8	15								
VAV-3-12	DSS COUNSELOR	305Z	Office Space	117	1	5	0.06	0.8	15								
VAV-3-12	DSS COUNSELOR	305BB	Office Space	113	1	5	0.06	0.8	15								
VAV-3-13	TUTORING	305M	Office Space	84	1	5	0.06	0.8	13	49	400	225	0.22	0.78	1	1	1
VAV-3-13	TUTORING	305L	Office Space	84	1	5	0.06	0.8	13								

VAV Box	Name	Zone	Space Occupancy Category	Space Area A <sub>z</sub> (sf)	Space Occupancy P <sub>z</sub> (ppl)	People OA Rate R <sub>p</sub> (cfm/per)	Area OA Rate R <sub>A</sub> (cfm/sf)	Zone Ventilation Efficiency E <sub>z</sub>	Zone OA Flow Rate V <sub>oz</sub> (cfm)	Total Zone OA Flow (cfm)	Supply Air Provided (cfm)	Total Zone Min (cfm)	Zone OA Fraction Z <sub>o</sub>	Zone Vent Efficiency E <sub>vz</sub>	F <sub>A</sub>	F <sub>B</sub>	F <sub>C</sub>
VAV-3-13	TUTORING	305K	Office Space	84	1	5	0.06	0.8	13								
VAV-3-13	CORRIDOR-4	305U-4	Corridors	148	0	0	0.06	0.8	11								
VAV-3-14	DSS COUNSELOR	305Y	Office Space	113	1	5	0.06	0.8	15	44	450	225	0.20	0.80	1	1	1
VAV-3-14	DSS COUNSELOR	305X	Office Space	113	1	5	0.06	0.8	15								
VAV-3-14	DSS ADJUNCT COUNSELOR	305W	Office Space	115	1	5	0.06	0.8	15								
VAV-3-15	CORRIDOR-2	305U-2	Corridors	147	0	0	0.06	0.8	11	73	500	300	0.24	0.76	1	1	1
VAV-3-15	CORRIDOR	305Q	Corridors	235	0	0	0.06	0.8	18								
VAV-3-15	DSS LEARNING CNTR COORD	305P	Office Space	126	1	5	0.06	0.8	16								
VAV-3-15	AT COORDINATOR	305T	Office Space	125	1	5	0.06	0.8	16								
VAV-3-15	TUTORING	305N	Office Space	84	1	5	0.06	0.8	13								
VAV-3-16	SIGN LANGUAGE	305V	Office Space	114	1	5	0.06	0.8	15	20	300	100	0.20	0.80	1	1	1
VAV-3-16	CORRIDOR-5	305U-5	Corridors	75	0	0	0.06	0.8	6								
VAV-3-17	AT INSTRUCTION LAB	305S	Office Space	167	1	5	0.06	0.8	19	47	475	150	0.31	0.69	1	1	1
VAV-3-17	DSS CAP OFFICES	305R	Office Space	204	2	5	0.06	0.8	28								
VAV-3-18	STORAGE	304E	Storage rooms (Inactive)	95	0	0	0	0.8	0	55	300	175	0.31	0.69	1	1	1
VAV-3-18	RECEPTION	304	Reception areas	206	5	5	0.06	0.8	47								
VAV-3-18	CORRIDOR	304D	Corridors	105	0	0	0.06	0.8	8								
VAV-3-19	BENEFITS COORDINATOR	304C	Office Space	118	1	5	0.06	0.8	15	46	600	275	0.17	0.83	1	1	1
VAV-3-19	CERTIFYING OFFICIAL	304B	Office Space	119	1	5	0.06	0.8	15								
VAV-3-19	CERTIFYING OFFICIAL	304A	Office Space	120	1	5	0.06	0.8	15								
VAV-3-20	ACES OFFICE	303E	Office Space	121	1	5	0.06	0.8	15	46	600	325	0.14	0.86	1	1	1
VAV-3-20	ACES OFFICE	303D	Office Space	121	1	5	0.06	0.8	15								
VAV-3-20	ACES OFFICE	303C	Office Space	115	1	5	0.06	0.8	15								
VAV-3-21	RECEPTION	303	Reception areas	206	5	5	0.06	0.8	47	56	300	175	0.32	0.68	1	1	1
VAV-3-21	CORRIDOR	303B	Corridors	119	0	0	0.06	0.8	9								
VAV-3-21	STORAGE	303A	Storage rooms (Inactive)	97	0	0	0	0.8	0								
VAV-3-22	IDF	315	Electrical equipment rooms	151	0	0	0.06	0.8	11	11	2500	750	0.02	0.98	1	1	1
VAV-3-23	RECEPTION	316	Reception areas	187	4	5	0.06	0.8	39	85	425	325	0.26	0.74	1	1	1
VAV-3-23	ADULT STUDENT RESOURCE	316A	Office Space	158	1	5	0.06	0.8	18								
VAV-3-23	CORRIDOR	316C	Corridors	107	0	0	0.06	0.8	8								
VAV-3-23	FILE ROOM	316E	Storage rooms (Inactive)	155	0	0	0	0.8	0								
VAV-3-23	WORK ROOM	316D	Office Space	183	1	5	0.06	0.8	20								
VAV-3-24	FAMILY CONFERENCE	316B	Conference/meeting	197	10	5	0.06	0.8	77	77	350	200	0.39	0.61	1	1	1
VAV-3-25	PASS OFFICE	316F	Office Space	119	1	5	0.06	0.8	15	31	300	200	0.16	0.84	1	1	1
VAV-3-25	FYE OFFICE	316G	Office Space	133	1	5	0.06	0.8	16								
VAV-3-26	CLASS LAB	320	Computer lab	930	24	10	0.12	0.8	440	440	1350	1100	0.40	0.60	1	1	1
VAV-3-27	CLASS LAB-2	321-2	Computer lab	390	18	10	0.12	0.8	284	284	1100	725	0.39	0.61	1	1	1
VAV-3-28	CLASS LAB-1	321-1	Computer lab	563	10	10	0.12	0.8	209	209	550	550	0.38	0.62	1	1	1
VAV-3-29	CLASS LAB-1	323-1	Computer lab	598	10	10	0.12	0.8	215	215	620	550	0.39	0.61	1	1	1
VAV-3-30	CLASS LAB-2	323-2	Computer lab	388	18	10	0.12	0.8	283	283	1240	750	0.38	0.62	1	1	1
VAV-3-31	ELEC	322	Electrical equipment rooms	54	0	0	0.06	0.8	4	4	225	100	0.04	0.96	1	1	1
VAV-3-32	CONFERENCE ROOM	301B	Conference/meeting	404	21	5	0.06	0.8	162	191	675	475	0.40	0.60	1	1	1
VAV-3-32	CORRIDOR-2	391-2	Corridors	393	0	0	0.06	0.8	29								
VAV-3-33	DEAN OFFICE	301D	Office Space	247	2	5	0.06	0.8	31	31	325	200	0.16	0.84	1	1	1
VAV-3-34	STUDENT CONDUCT COORD	301H	Office Space	121	1	5	0.06	0.8	15	50	600	200	0.25	0.75	1	1	1
VAV-3-34	SENIOR ADMIN AID OFFICE	301F	Office Space	168	1	5	0.06	0.8	19								
VAV-3-34	HOTELING OFFICE	301E	Office Space	127	1	5	0.06	0.8	16								
VAV-3-35	ASSOCIATE DEAN OFFICE	301J	Office Space	144	1	5	0.06	0.8	17	17	250	75	0.23	0.77	1	1	1
VAV-3-36	CONFERENCE ROOM	302	Conference/meeting	499	14	5	0.06	0.8	125	125	1125	350	0.36	0.64	1	1	1
VAV-3-37	LOUNGE	392	Corridors	393	0	0	0.06	0.8	29	96	475	475	0.20	0.80	1	1	1
VAV-3-37	ELEVATOR LOBBY	390	Corridors	305	0	0	0.06	0.8	23								
VAV-3-37	CORRIDOR-1	391-1	Corridors	583	0	0	0.06	0.8	44								
VAV-3-38	FILE / STORAGE	301K	Storage rooms (Inactive)	166	0	0	0	0.8	0	28	275	150	0.18	0.82	1	1	1
VAV-3-38	WORK ROOM	301L	Office Space	202	2	5	0.06	0.8	28								
VAV-3-39	CORRIDOR	301G	Corridors	179	0	0	0.06	0.8	13	58	250	175	0.33	0.67	1	1	1
VAV-3-39	RECEPTION	301	Reception areas	199	4	5	0.06	0.8	40								
VAV-3-39	CORRIDOR	301A	Corridors	57	0	0	0.06	0.8	4								
VAV-4-01	DIRECTOR OFFICE	406L	Office Space	129	1	5	0.06	0.8	16	16	250	100	0.16	0.84	1	1	1
VAV-4-02	CORRIDOR-1	406D-1	Corridors	112	0	0	0.06	0.8	8	24	250	100	0.24	0.76	1	1	1
VAV-4-02	CHAIR OFFICE	406M	Office Space	130	1	5	0.06	0.8	16								
VAV-4-03	FACULTY OFFICE	406J	Office Space	116	1	5	0.06	0.8	15	45	450	275	0.16	0.84	1	1	1
VAV-4-03	FACULTY OFFICE	406G	Office Space	118	1	5	0.06	0.8	15								
VAV-4-03	FACULTY OFFICE	406E	Office Space	116	1	5	0.06	0.8	15								
VAV-4-04	FACULTY OFFICE	406K	Office Space	117	1	5	0.06	0.8	15	50	350	175	0.29	0.71	1	1	1
VAV-4-04	ADJUNCT OFFICE	406H	Office Space	99	1	5	0.06	0.8	14								
VAV-4-04	PROGRAM ASSIST OFFICE	406F	Office Space	104	1	5	0.06	0.8	14								
VAV-4-04	CORRIDOR-2	406D-2	Corridors	100	0	0	0.06	0.8	8								
VAV-4-05	ADMIN AIDE OFFICE	406C	Office Space	115	1	5	0.06	0.8	15	30	300	175	0.17	0.83	1	1	1
VAV-4-05	FACULTY OFFICE	406B	Office Space	120	1	5	0.06	0.8	15								
VAV-4-06	STUDENT AID	406	Office Space	275	2	5	0.06	0.8	33	51	350	175	0.29	0.71	1	1	1

VAV Box	Name	Zone	Space Occupancy Category	Space Area A <sub>z</sub> (sf)	Space Occupancy P <sub>z</sub> (ppl)	People OA Rate R <sub>p</sub> (cfm/per)	Area OA Rate R <sub>A</sub> (cfm/sf)	Zone Ventilation Efficiency E <sub>z</sub>	Zone OA Flow Rate V <sub>oz</sub> (cfm)	Total Zone OA Flow (cfm)	Supply Air Provided (cfm)	Total Zone Min (cfm)	Zone OA Fraction Z <sub>D</sub>	Zone Vent Efficiency E <sub>Vz</sub>	F <sub>A</sub>	F <sub>B</sub>	F <sub>C</sub>
VAV-4-06	WORK ROOM	406A	Office Space	150	1	5	0.06	0.8	18								
VAV-4-07	CONFERENCE ROOM	414	Conference/meeting	356	10	5	0.06	0.8	89	110	850	300	0.37	0.63	1	1	1
VAV-4-07	CORRIDOR	495	Corridors	281	0	0	0.06	0.8	21								
VAV-4-08	REMOVED		Corridors	0	0	0	0.06	0.8	0	0	200	200	0.00	1.00	1	1	1
VAV-4-08	REMOVED		Corridors	0	0	0	0.06	0.8	0								
VAV-4-08	WOMEN	411	Exhaust	181	0	0	0	0.8	0								
VAV-4-08	MEN	413	Exhaust	176	0	0	0	0.8	0								
VAV-4-09	OFFICES / WORK RM	405R	Office Space	462	3	5	0.06	0.8	53	53	600	400	0.13	0.87	1	1	1
VAV-4-10	HELP DESK	405Q	Reception areas	226	4	5	0.06	0.8	42	158	925	600	0.26	0.74	1	1	1
VAV-4-10	RECEPTION	405A	Reception areas	244	4	5	0.06	0.8	43								
VAV-4-10	WAITING / LOCKERS	405	Corridors	972	0	0	0.06	0.8	73								
VAV-4-11	PLACEMENT TESTING-2	405D-2	Computer lab	1220	56	10	0.12	0.8	883	883	2250	2250	0.39	0.61	1	1	1
VAV-4-12	PLACEMENT TESTING-1	405D-1	Computer lab	1351	38	10	0.12	0.8	678	678	2250	1700	0.40	0.60	1	1	1
VAV-4-13	SOUND LOCK	405P	Corridors	56	0	0	0.06	0.8	4	37	350	125	0.29	0.71	1	1	1
VAV-4-13	TEST	405N	Office Space	61	1	5	0.06	0.8	11								
VAV-4-13	TEST	405M	Office Space	61	1	5	0.06	0.8	11								
VAV-4-13	TEST	405L	Office Space	61	1	5	0.06	0.8	11								
VAV-4-14	TEST	405K	Office Space	61	1	5	0.06	0.8	11	75	650	200	0.38	0.62	1	1	1
VAV-4-14	TEST	405J	Office Space	61	1	5	0.06	0.8	11								
VAV-4-14	TEST	405H	Office Space	60	1	5	0.06	0.8	11								
VAV-4-14	TEST	405G	Office Space	60	1	5	0.06	0.8	11								
VAV-4-14	CORRIDOR	405C	Corridors	252	0	0	0.06	0.8	19								
VAV-4-14	ADA TESTING	405F	Office Space	92	1	5	0.06	0.8	13								
VAV-4-15	ADA TESTING	405E	Office Space	91	1	5	0.06	0.8	13	13	225	150	0.09	0.91	1	1	1
VAV-4-16	DIRECTOR	405B	Office Space	191	1	5	0.06	0.8	21	21	250	175	0.12	0.88	1	1	1
VAV-4-17	LEARNING CENTER	403D	Office Space	208	2	5	0.06	0.8	28	28	450	175	0.16	0.84	1	1	1
VAV-4-18	FILE / COPY	403B	Storage rooms (Inactive)	84	0	0	0	0.8	0	28	1450	450	0.06	0.94	1	1	1
VAV-4-18	STORAGE	403C	Storage rooms (Inactive)	99	0	0	0	1.8	0								
VAV-4-18	RECEPTION	403A	Storage rooms (Inactive)	169	0	0	0	2.8	0								
VAV-4-18	TRIO PC AREA	403	Storage rooms (Inactive)	926	0	0	0	3.8	0								
VAV-4-19	ADVISOR OFFICE	403E	Office Space	128	1	5	0.06	0.8	16	48	600	375	0.13	0.87	1	1	1
VAV-4-19	ADVISOR OFFICE	403F	Office Space	128	1	5	0.06	0.8	16								
VAV-4-19	PT SKILLS	403G	Office Space	128	1	5	0.06	0.8	16								
VAV-4-20	TRIO DIRECTOR	403H	Office Space	156	1	5	0.06	0.8	18	18	225	175	0.10	0.90	1	1	1
VAV-4-21	IDF	415	Electrical equipment rooms	151	0	0	0.06	0.8	11	11	1350	750	0.02	0.98	1	1	1
VAV-4-22	SECONDARY ELEM ED LAB	416	Classrooms (ages 5-8)	1055	27	10	0.12	0.8	496	496	1250	1250	0.40	0.60	1	1	1
VAV-4-23	AV / PREP	416B	Computer lab	611	8	10	0.12	0.8	192	192	500	500	0.38	0.62	1	1	1
VAV-4-24	TEACHING REVIEW RM	416A	Office Space	170	1	5	0.06	0.8	19	34	400	275	0.12	0.88	1	1	1
VAV-4-24	TEACHING REVIEW RM	417A	Office Space	114	1	5	0.06	0.8	15								
VAV-4-25	EARLY CHILDHOOD MODEL CLASS	417-2	Classrooms (ages 5-8)	545	12	10	0.12	0.8	232	232	600	600	0.39	0.61	1	1	1
VAV-4-26	EARLY CHILDHOOD MODEL CLASS	417-1	Classrooms (ages 5-8)	644	13	10	0.12	0.8	259	259	675	650	0.40	0.60	1	1	1
VAV-4-27	CLASS LAB-1	419-1	Computer lab	548	12	10	0.12	0.8	232	232	600	600	0.39	0.61	1	1	1
VAV-4-28	CLASS LAB-2	419-2	Computer lab	433	16	10	0.12	0.8	265	265	1200	675	0.39	0.61	1	1	1
VAV-4-29	ELEC	418	Electrical equipment rooms	54	0	0	0.06	0.8	4	4	100	100	0.04	0.96	1	1	1
VAV-4-30	VPP CONFERENCE	401J	Conference/meeting	403	14	5	0.06	0.8	118	140	675	500	0.28	0.72	1	1	1
VAV-4-30	CORRIDOR-2	491-2	Corridors	301	0	0	0.06	0.8	23								
VAV-4-31	RECEPTION	401	Office Space	271	2	5	0.06	0.8	33	73	425	275	0.26	0.74	1	1	1
VAV-4-31	HOTELING OFFICE	401L	Office Space	118	1	5	0.06	0.8	15								
VAV-4-31	WORK STATIONS	401A	Office Space	108	1	5	0.06	0.8	14								
VAV-4-31	CORRIDOR	401F	Corridors	137	0	0	0.06	0.8	10								
VAV-4-32	CORRIDOR-1	491-1	Corridors	656	0	0	0.06	0.8	49	49	250	250	0.20	0.80	1	1	1
VAV-4-33	VPP OFFICE	401K	Office Space	253	2	5	0.06	0.8	31	31	325	325	0.10	0.90	1	1	1
VAV-4-34	VPP STAFF OFFICE	401E	Office Space	133	1	5	0.06	0.8	16	51	750	450	0.11	0.89	1	1	1
VAV-4-34	ASSIST VPP OFFICE	401G	Office Space	170	1	5	0.06	0.8	19								
VAV-4-34	PROJECT COORD OFFICE	401H	Office Space	132	1	5	0.06	0.8	16								
VAV-4-35	CONFERENCE ROOM	402	Conference/meeting	499	25	5	0.06	0.8	194	194	900	500	0.39	0.61	1	1	1
VAV-4-36	LOUNGE	492	Corridors	393	0	0	0.06	1.8	13	20	350	300	0.07	0.93	1	1	1
VAV-4-36	ELEVATOR LOBBY	490	Corridors	305	0	0	0.06	2.8	7								
VAV-4-36	STORAGE	401C	Storage rooms (Inactive)	48	0	0	0	3.8	0								
VAV-4-37	WORKRM / FILE / STOR	401D	Office Space	283	2	5	0.06	4.8	6	6	350	150	0.04	0.96	1	1	1
VAV-4-38	CORRIDOR 493	493	Office Space	764	4	5	0.06	5.8	11	23	250	151	0.15	0.85	1	1	1

Table 10.8

TABLE 10.8 Minimum Nominal Efficiency for General Purpose Design A and Design B Motors<sup>a</sup>

Number of Poles ⇒	Minimum Nominal Full-Load Efficiency (%)					
	Open Motors			Enclosed Motors		
	2	4	6	2	4	6
Synchronous Speed (RPM) ⇒	3600	1800	1200	3600	1800	1200
Motor Horsepower						
1	—	82.5	80.0	75.5	82.5	80.0
1.5	82.5	84.0	84.0	82.5	84.0	85.5
2	84.0	84.0	85.5	84.0	84.0	86.5
3	84.0	86.5	86.5	85.5	87.5	87.5
5	85.5	87.5	87.5	87.5	87.5	87.5
7.5	87.5	88.5	88.5	88.5	89.5	89.5
10	88.5	89.5	90.2	89.5	89.5	89.5
15	89.5	91.0	90.2	90.2	91.0	90.2
20	90.2	91.0	91.0	90.2	91.0	90.2
25	91.0	91.7	91.7	91.0	92.4	91.7
30	91.0	92.4	92.4	91.0	92.4	91.7
40	91.7	93.0	93.0	91.7	93.0	93.0
50	92.4	93.0	93.0	92.4	93.0	93.0
60	93.0	93.6	93.6	93.0	93.6	93.6
75	93.0	94.1	93.6	93.0	94.1	93.6
100	93.0	94.1	94.1	93.6	94.5	94.1
125	93.6	94.5	94.1	94.5	94.5	94.1
150	93.6	95.0	94.5	94.5	95.0	95.0
200	94.5	95.0	94.5	95.0	95.0	95.0

<sup>a</sup>Nominal efficiencies shall be established in accordance with NEMA Standard MG1. Design A and Design B are National Electric Manufacturers Association (NEMA) design class designations for fixed-frequency small and medium AC squirrel-cage induction motors.