Tech Report 1: ASHRAE Standard 62.1 Ventilation and Standard 90.1 Energy Design Evaluations

PHARM CORP.

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EXECUTIVE SUMMARY

Technical Report 1 documents the compliance of Pharm Corp. with respect to ASHRAE 62.1-2010 Ventilation for Acceptable Indoor Air Quality and ASHRAE 90.1-2010 Energy Standard for Buildings Expect Low-Rise Residential Buildings. The primary use of this building is serving as the headquarters for Pharm Corp, providing office and conference space for employees.

The first part of this report discusses ASHRAE 62.1 Section 5 and Section 6. Section 5 discusses systems and equipment that are used within the building, how the systems are controlled, varying HVAC equipment as a function of internal loads, and removal of contaminants within the building. It also comments on restrictions of thermal envelope U-values that may be used.

Section 6 discusses ventilation breathing zone procedures, ensuring that each zone is receiving at least the minimal required outdoor air. Appendix B, found at the end of this report, visually shows the breathing zone air flows that were calculated per zone. Pharm Corp. is in compliance with Section 6, maintaining the minimal outdoor air intake to be greater than the maximum exhaust air.

Most cases per ASHRAE were exceeded by more than the minimal amount, due to the required installation of state-of-the-art energy efficient equipment and lighting. These are seen in ASHRAE 90.1. Although this building is not LEED certified, much of the equipment installed and design energy use succeeds to comply to LEED.

BUILDING OVERVIEW

Pharm corporation is a new 4-story, 150,000 square foot office building with an attached multi-level parking garage. The building includes a 4-story atrium that contains a grand staircase connecting all levels. An atrium is open to the third floor dining area but is separated from the remainder of the building by sprinkler protected glass walls or by ceiling recessed smoke shutters.

The 1st level will house the main lobby space with associated security desk, conference and interview rooms, showers, facilities areas including loading dock, storage, back-of-house services, MEP equipment space and an auditorium. Approximately one-half of the 1st level will be office space.

The 2nd and 4th floors will consist largely of closed offices, with some open office space, conference rooms, collaborative spaces and support spaces such as mail/copy rooms, pantries and storage areas. There will be a conference area on the 4th floor.

The third floor will house a kitchen and dining / servery area to serve 300 people. During Town Hall events, generally four times a year, an estimated 700 people will gather in this area. Approximately one half of the floor will be dedicated to additional office space.

Roof Terraces will be created around the new building for occupant use and events. The building will be connected to a 475-car open parking structure that will be topped with a green roof. The green roof will be utilized as an event space.

MECHANICAL OVERVIEW

There are two mechanical rooms per floor located in the core connecting the East and West wing. The airside mechanical system shall be a water-cooled, indoor, vertical self-contained, VAV air conditioning unit. The units serving general office space are designed to have capacities of 54-tons. Cooling allowances for this building are 350 square feet per ton of cooling capacity. The dining and kitchen units have increased capacity of 76-tons each. All air-handling units have remote return fans affiliated with them.

With the mechanical room being placed on the perimeter, air-side economizer and enthalpy-based temperature reset is utilized when ambient temperatures permit. The chosen air-side economizer for the 54-ton units can withstand 22,000 CFM with a minimum outdoor air damper setting of 4,400 CFM. Larger air-conditioning units for the kitchen and dining have larger economizers, designed for 25,000 CFM and minimum 5,000 CFM of outdoor air.

Cooling tower on site are two, 270-ton closed circuit towers that have 10" condenser water lines routed to three 810 GPM condenser pumps. The condenser water shall contain 40% propylene glycol for freeze protection.

Four smoke control exhaust fans are placed on the roof for the worst-case scenario of a fire within the atrium. To make up for the exhausted air in the case of a fire, emergency powered make-up fans provide the required air to the atrium via the ceiling within the first floor elevator lobby.

ASHRAE STANDARD 62.1

SECTION 5: SYSTEMS AND EQUIPMENT

5.1 Ventilation Air Distribution

Shown in Section 6: Procedures, the minimum ventilation requirements are explained with their respected equations and processes. Appendix B shows all of the spaces within the building and their outdoor air intake requirements. All of the spaces satisfy the ventilation air required for each zone.

All spaces are ceiling supply and ceiling return, for both heating and cooling seasons. System effectiveness is 0.8, so that requires more air to be supplied to the space due to its air distribution configuration. To supplement the heating for perimeter zones with curtain wall glazing systems, perimeter electric baseboard heaters are installed to offset the heating load that the VAV box would have to satisfy.

A ceiling plenum is used to return all of the designed air back to the unit to either run through the economizer or to be expelled from the building. Transfer ducts with fire dampers are used to move the air through the full-height, 2-hour fire rated walls.

Figure 1 below shows the architectural linear diffusers placed in the atrium space. A continuous slot was designed to make the ventilation system integrate into the space.

Figure 1. Continuous linear diffusers placed along ceiling line in atrium.

5.2 Exhaust Duct Location

In order to remove contaminated air from occupied spaces, all of the ducts are kept at a negative pressure so contaminants are not recirculated back into the space. Due to the full-height interior walls in the bathrooms, there are individual exhaust grilles in each water closet stall. Transfer ducts allow conditioned air to enter the bathroom to keep it thermally comfortable, which can occur from the negative pressure within the bathroom cores.

5.3 Ventilation System Controls

The base building HVAC equipment is to be controlled and monitored by a direct digital control (DDC) system. Controls can be adjusted by the internet and send out remote notifications and alarms via text message, email and phone calls. Variable Frequency Drives (VFD) have full DDC controls with BMS interface for the water-cooled DX units.

As per the heating system, the building automation system (BAS) will control the overhead heating system served by VAV terminals in spaces that also have electric heat. The transfer air system is tied into the BAS in the IDF closers, main MDF room, main switchgear room and at electrical closets to maintain spaces below design temperature. The exhaust transfer air is transported into the ceiling plenum.

Pressurization control in the building is done by having the return fan and relief damper track the supply fan and outside air damper. The dampers shall also operate to allow for demand control ventilation. Carbon dioxide sensorsmodulate the outside air dampers.

With the mechanical rooms being located on the perimeter of the building, air-side economizers and enthalpy-based temperature reset shall be used when ambient temperatures allow for it.

5.4 Airstream Surfaces

The airstream surfaces are coated with an antimicrobial compound, and tested by the NRTL and registered by the EPA for use in HVAC systems. The coating must have a minimum hardness of 2H, in accordance to ASTM C 1338. To have resistance to erosion, all ducts are also in accordance to UL-181 class 1. The ducts for this building are not

required to have antimicrobial coating if the duct contains lining treated with antimicrobial coating.

5.5 Outdoor Air Intakes

The outdoor air intakes shall be located at the distance specified within Figure 2, which illustrates Table 5-1 from ASHRAE 62.1-2007.

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[3] and ANSI/AIHA Z9.5-1992.[4]
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 [5] and in the *ASHRAE Handbook—HVAC Applications*.[6]
Note 4: Shorter separation distances are permitted when determined in accordance with (a) Chapter 7 of ANSI Z223.1/NFPA 54-2002[7] for fuel gas burning appliances and equipment, (b) Chapter 6 of NFPA 31-2001[8] for oil burning appliances and equipment, or (c) Chapter 7 of NFPA 211-2003[9] 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 2. Table 5-1 from ASHRAE 62.1-2007 indicating minimum distance for air intakes.

Equipment	Object	Minimum Distance (ft)	Actual Distance (ft)	Compliance
AHU-1-1	Cooling Tower Exhaust	15	27	YES
AHU-1-1	Parking	5	56	YES
AHU-1-2	Cooling Tower Exhaust	15	39	YES
AHU-1-2	Parking	5	35	YES
RTU-5-1	Hood Exhaust	15	13.6	NO
RTU-5-2	Hood Exhaust	15	17.8	YES
RTU-5-3	Hood Exhaust	15	26	YES
RTU-5-4	Hood Exhaust	15	34	YES
RTU-5-5	Hood Exhaust	15	15.7	YES
RTU-5-6	Hood Exhaust	15	24.6	YES

Table 1. Air intake compliance for Pharm Corp.

As shown in Table 1 above, all equipment is compliant with their intake louvers from respected objects with the exception of RTU-5-1. There is a differential of 1.4 feet from the intake to the centrifugal upblast fan that serves the kitchen. There are 24" discharge extensions attached to the end of the fan, and with the discharge fan being in the opposite direction than the outdoor intake for RTU-5-1, the compliance with ASHRAE 62.1-2007 Table 5-1 is furthermore satisfied.

5.6 Load Capture of Contaminants

All mechanical rooms have exhaust fans within them to capture and remove any contaminants. Exhaust fans are ducted to the return air plenum that is also connected to the air handling units, and expelled out of the building.

5.7 Combustion Air

This requirement is not used within this building. Any air that has to be removed due to contaminants is satisfied by Section 5.6 above, for non-combustion equipment.

5.8 Particulate Matter Removal

All filters within the mechanical system are MERV 8, which is greater than the minimum MERV 6 that has to be satisfied. Filters are specified to be upstream of the coils.

5.9 Dehumidification Systems

Interior spaces, as shown in Table 2 indicate the Basis of Design all of the spaces provide space a relative humidity of 50% in the summer, and unindicated for the winter.

The mechanical systems meet the requirement to have a greater amount of minimal outdoor air versus the maximum amount of exhaust that the system provides. These compliances can be visually seen on the next page, in Table 3.

Indoor Design Conditions			
All Areas Except Noted Below			
Constraints	Season		Notes
	Summer	Winter	
DB (ºF)	74 +/- 2	72 +/- 2	No humidity control
RH (%)	50	-	No humidity control
Kitchen and Food Prep Areas			
Constraints	Season		Notes
	Summer	Winter	
DB (ºF)	80 +/- 2	72 +/- 2	No humidity control
RH (%)	50	-	No humidity control
IDF Rooms			
Constraints	Season		Notes
	Summer	Winter	
DB (ºF)	72 +/- 2	72 +/- 2	No humidity control
RH (%)	50	-	No humidity control

Table 2. Indoor design conditions chosen.

System	Maximum Exhaust [CFM]	Minimum Outdoor Air [CFM]	Compliance
AHU-1-1	2100	2560	YES
AHU-1-2	0	1856	YES
AHU-2-1	800	898	YES
AHU-2-2	0	2031	YES
AHU-3-1	3880.7	4043	YES
AHU-3-2	0	1677	YES
AHU-4-1	800	1630	YES
AHU-4-2	103	1544	YES

Table 3. Compliance with maintaining positive pressure.

5.10 Drain Pans

Drain pans are to be installed and routed to the nearest floor drain. They are to be constructed with stainless steel. Outlets for the drains are sufficient enough to avoid overflow under all normal conditions. Drain pan sizes are not specified within the drawings, but are to be specified by manufacturer.

5.11 Finned-Tube Coils and Heat Exchangers

For a cooling coil, a drain pan is to be placed beneath it with a condensate drain pump for the removal of condensate. They are to be placed on a house-keeping pad. The pitch for the piping is to be ¼" per foot of piping, with a minimum slope of 1/8" in tight spaces. They are to be installed just as drain pans in section 5.10.

5.12 Humidifiers and Water Spray Systems

There are no humidifiers within this building due to the design criteria of not controlling humidity. Humidity will be from the design conditions for the space. The air side economizer can assist with humidity conditions in the space.

5.13 Access for Inspection, Cleaning and Maintenance

Equipment was placed to give adequate working clearance space, specified from the manufacturer. Working clearances were identified on the equipment cut sheets. All equipment must be installed with the maximum possible headroom unless specific mounting heights are not indicated. Working clearances may overlap as long as there are no obstructions. Within the mechanical room, all pipes and ducts mounted in the air must be above 6'-0" for headroom clearance.

Terminal boxes are to be installed so they are clear of lights for easy access to the box as well as the bottom access door for coil cleaning. For easy maintenance, the manufacturer must provide either a left or right side control as per field requirements. There must also be an access door installed downstream of each terminal unit.

5.14 Building Envelope and Interior Surfaces

All building envelope elements, including the roof, walls, foundations and others, are specified to have waterproofing, like an air barrier in Figure 3 to the right. Any points where a connection takes place, either curtain wall panels, stone cladding or metal panels, there must be a sealant and backer rod to prevent water from entering.

In areas that contain a green roof, there must be root barriers to separate the vegetation from the roofing structure, along with hot fluid applied waterproofing on top of the terrace slab. A detail of the green roof terrace can be visualized in Figure 4.

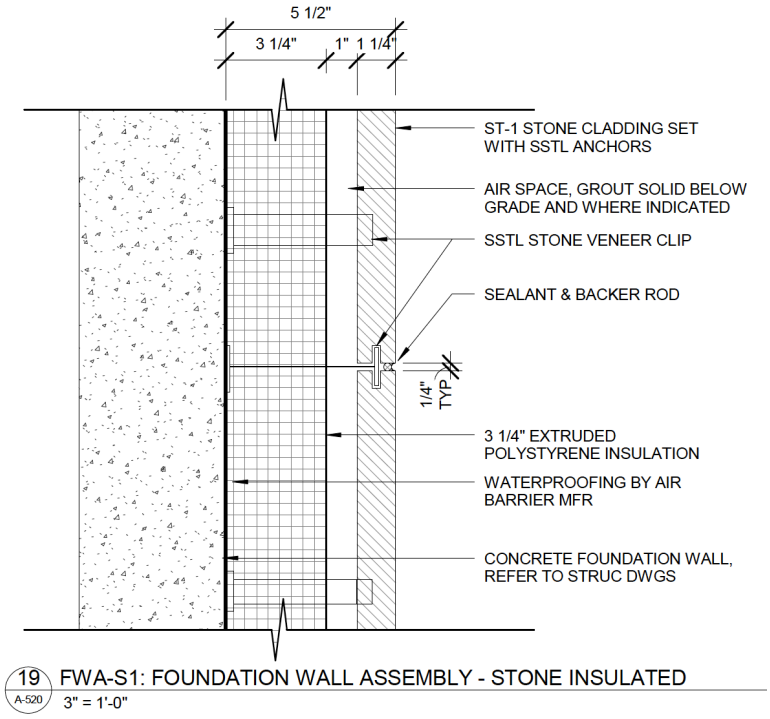

Figure 3. Foundation wall assembly showing proper barriers and sealants.

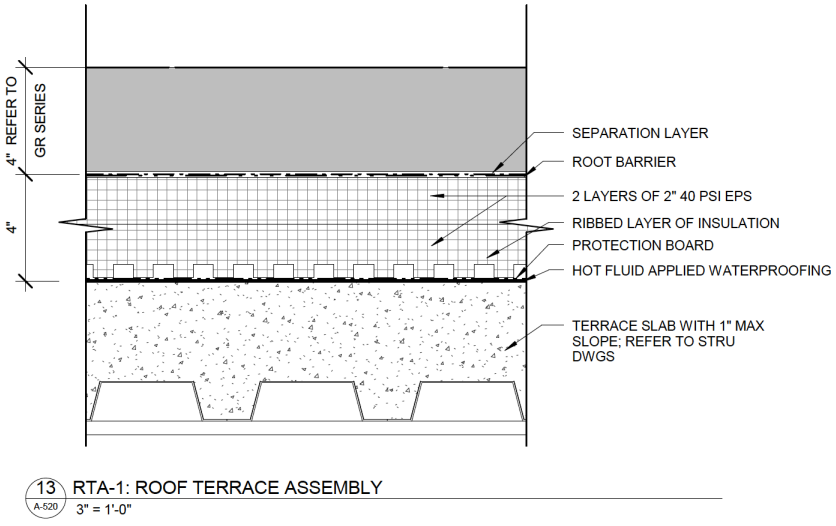

Figure 4. Hot fluid applied waterproofing for roof terrace assemblies.

5.15 Buildings with Attached Parking Garages

With an attached parking garage present, a vestibule was designed connecting the garage to the building to provide an airlock between the two buildings. Figure 5 below shows the vestibule. An air curtain system is installed to prevent contaminated air from the garage to enter the building.

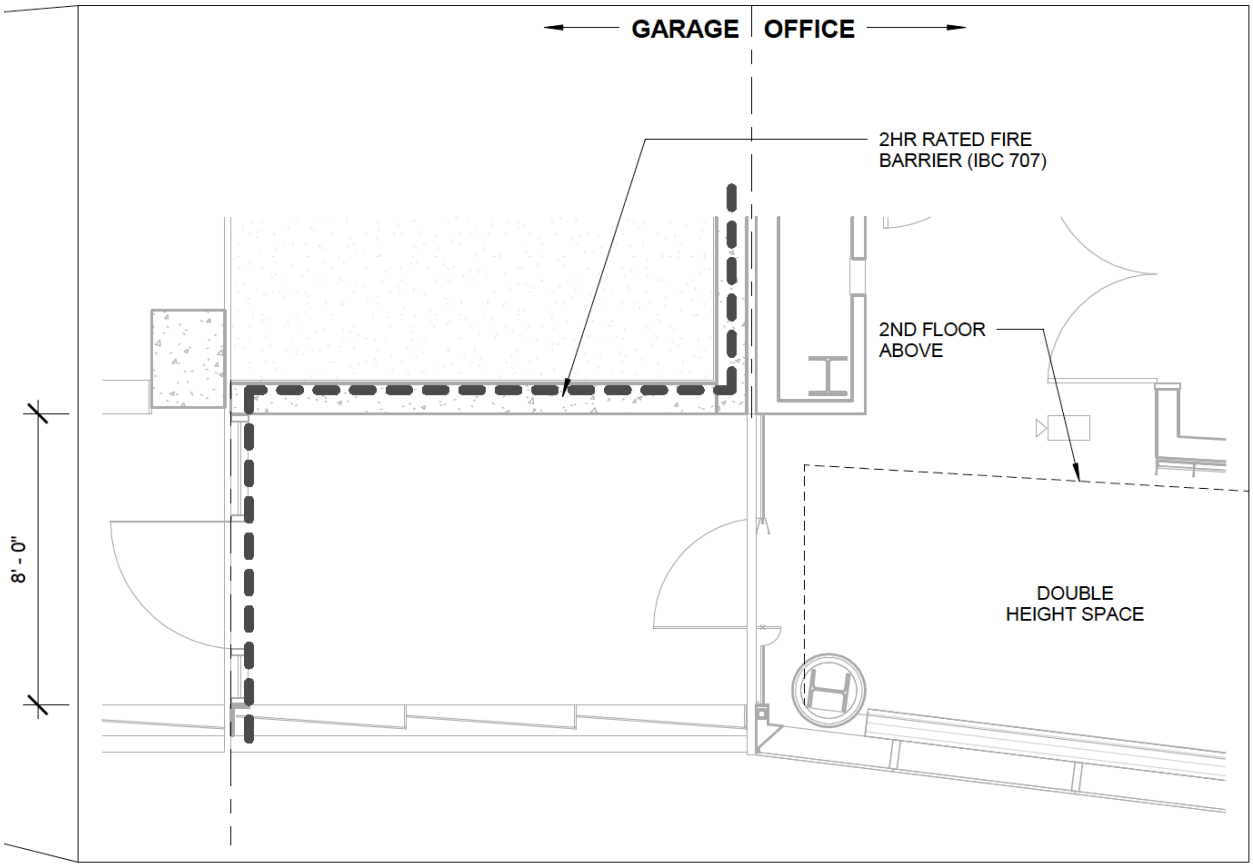

Figure 5. Floor plans identifying the CUH that is placed in the vestibule between the parking garage and the main building.

5.16 Air Classification and Recirculation

Within Pharm Corp., most spaces are classified as Class 1 air, with several spaces such as the restrooms being classified as Class 2 air. Zones that are classified as Class 2 are kept as a slightly less pressure than the Class 1 areas to transfer the air into those spaces. Class 2 zones are then exhausted to maintain their lesser pressure.

The bathrooms exhaust more air than what is being supplied to maintain this pressurization and to draw Class 1 air into the space. Section 5.2 Exhaust Duct Locations specifies the negative pressure needed for Class 2 zones.

The commercial kitchen that is located on Level 3 is classified as Class 4 air. Class 4 air is defined by ASHRAE 62.1-2007 as "Air with highly objectionable fumes or with potential dangerous particles…". To exhaust this air, three centrifugal upblast exhaust fans for the kitchen are located on the roof. There are 24" duct extensions on the end of each fan to discharge the exhaust high enough into the atmosphere to ensure no short-cycling with outdoor air intakes.

5.17 Requirements for Buildings Containing ETS Areas and ETS-Free Areas

This building is smoke-free, with no spaces being ETS-areas. Therefore, all spaces are classified as ETS-free areas and maintain a positive pressure to ensure no entrainment of smoke.

SECTION 6: PROCEDURES

6.1 General

The outdoor air requirements for Pharm Corp. are deemed acceptable based on proper ventilation rate procedures and exhaust ventilation. No natural ventilation strategies were used within Pharm Corp.

6.2 Ventilation Rate Procedure

The outdoor air treatment for the spaces are met except for a few classifications of spaces. These spaces fall under the exception of 6.2.1 Outdoor Air Treatment, and these spaces are janitor's closets and storage rooms.

The breathing zone air flow required for each space is from Table 6-1, shown in the Appendix B. The equation for this is shown below:

$$V_{BZ} = R_p \cdot P_z + R_a \cdot A_z \quad (1)$$

where:

V_{BZ}: amount of outdoor air needed *[CFM]*
R_p: outdoor air rate per person required *[CFM/person]*
R_a: outdoor air rate per unit area *[CFM/ft^2]*
A_z : net area of the zone *[ft^2]*

The values for R_p and R_a can be found on Table 6-1, in the Appendix A, which are dependent on zone classification. The primary use of equation (1) above is to account for the people-related and area-related sources in the zone. The zone air distribution effectiveness (E_z) affects the amount of total design zone outdoor air that must be supplied to the zone. Table 6-2 from ASHRAE 62.1-2007, which can be found in the Appendix A, gives the values for distribution effectiveness for different configurations.

The new design zone outdoor air would be:

$$V_{OZ} = V_{BZ}/E_Z \quad (2)$$

where:

V_{OZ}: new design total outdoor air based on effectiveness *[CFM]*
V_{BZ}: original design outdoor air to the space *[CFM]*
E_z: air distribution effectiveness *[-]*

For Pharm Corp., the distribution configuration is ceiling supply, ceiling return, with E_Z=0.8, with a few spaces being 1.0, which are only ceiling supply.

System Ventilation Efficiency (E_v) determines the efficiency of ventilation to the zone. A primary outdoor air fraction (Z_p) is needed to determine the efficiency, which can be seen below:

$$Z_p = V_{OZ}/V_{PZ} \quad (3)$$

where:

Z_p: outdoor air fraction *[%]*
V_{oz}: design outdoor air based on effectiveness *[CFM]*
V_{pz}: zone primary air flow *[CFM]*

Table 6-3, from ASHRAE 62.1-2007, which can also be found in Appendix A, shows the different system efficiencies from the outdoor air fraction. All of the AHUs in the building have a system ventilation efficiency (E_v) of 0.9, with the maximum outdoor air fraction being $\leq$ 0.25.

6.3 Indoor Air Quality (IAQ) Procedures

The Ventilation Rate Procedure requires either an outdoor air design or an IAQ design performance for indoor air contaminants. Pharm Corp. selected the outdoor air design procedure, so IAQ was not the design guidelines.

6.4 Design Documentation Procedures

All design documentation is recorded within the basis of design submitted by the MEP Engineer. These design criteria are room conditions, lighting densities, light and equipment heat rejection, building envelope performance U-values, and occupancy density.

Acoustically, the design documentation is that the tenant office areas are to not exceed NC-40 everywhere in the building expect rooms located adjacent to the mechanical rooms. Those designated rooms are to be NC-45.

6.5 Exhaust Ventilation

Exhaust airflow is in accordance with Table 6-4, shown in Appendix A. For the public water closets, the lower ventilation rate, 50 CFM/unit, is used due to it being a continuously used toilet during normal office hours. Transfer ducts are to provide make-up air into the water closets.

ASHRAE STANDARD 90.1

SECTION 5: BUILDING ENVELOPE

5.1 General

Delaware falls in the 4A climate zone, indicating it is a warm, moist area. This location has an average annual high of 64.1°F, an annual low of 45.8°F, with up to 43 inches of rain and 19 inches of snow per year. These temperature ranges show the economizer will be used a high percentage of the time.

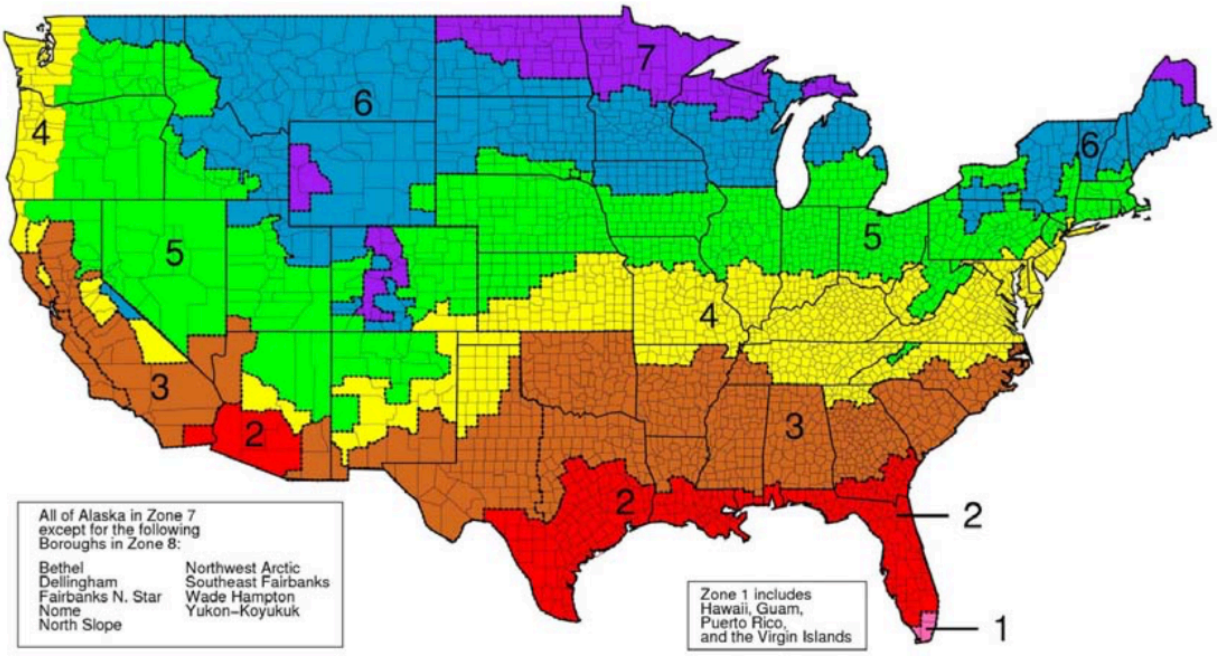

Figure 6. Climate zone division provided from ASHRAE 90.1-2007

5.2 Compliance Path

The vertical fenestration, according to ASHRAE 90.1, states that it will not exceed 40% of the gross wall area for each conditioned space. Shown in Table 4, on the next page, are the walls per each side of the building with their fenestrations. The North façade does not abide to the 40% rule, exceeding it by 24%. The heat gain due to the North façade is going

to be less than any other façade, making it feasible to have a larger window-to-wall ratio without many ramifications.

North		East		South		West	
Wall Area (SF)	13972	Wall Area (SF)	14960	Wall Area (SF)	62980	Wall Area (SF)	11315
Window Area (SF)	8896	Window Area (SF)	3973	Window Area (SF)	17971	Window Area (SF)	2865
Ratio	0.64	Ratio	0.27	Ratio	0.29	Ratio	0.25

Table 4. Wall fenestration ratio per façade.

5.4 Mandatory Provisions

All fenestrations that require insulation are compliant to section 5.4.1 insulation. The curtain wall glazing system is constructed with 90% argon fill for window thermal insulation. Spandrel ribbon windows are thermally broken head and sill tracks with 90% argon fill. Windows, doors and metal wall panels are all properly sealed in accordance to Air Leakage 5.4.3. A vestibule is used in the connection between the garage and office building to protect the conditioned space from the exterior conditions.

5.5 Prescriptive Building Envelope Option

Table 5 below identifies if each category meets the ASHRAE 90.1-2010 Section 5.5 maximum prescribed U-values. All construction categories are in compliance with section 5.5. The metal panels are significantly less than the prescribed U-value, resulting in higher thermal performance.

Category	Description	Actual U-Value (BTU/hr*ft^2*F)	ASHRAE Prescribed U-Value (BTU/hr*ft^2*F)	Compliance
Roof	Insulation entirely above deck	0.026	0.048	YES
Roof	Occupied terrace areas	0.03	0.048	YES
Walls - above grade	Metal panel	0.045	0.113	YES
Walls - above grade	Stone clad	0.06	0.104	YES
Walls - above grade	Stone base	0.09	0.104	YES
Window	Curtain wall glass	0.46	0.5	YES

Table 5. Building envelope U-values.

SECTION 6: HEATING, VENTILATING AND AIR CONDITIONING

All equipment selected have efficiencies that meet ASHRAE 90.1-2010 Tables 6.8.1A through 6.8.1H. With being in climate zone 4A, there is no requirement for an economizer. However, Pharm Corp. utilizes an air side economizer when the ambient temperature permits. In accordance to Table 6.5.1.1.3A High-Limit Shutoff Control Options for Air Economizers in ASHRAE 90.1-2010, there is no differential dry bulb controls. There are enthalpy-based controls, which is permitted for this climate zone. If the outdoor air temperature is greater than the return air temperature, the economizer is to shut off.

Fan system selections meet the power limitation, which is met with the equation:

$$hp \leq CFM_s \cdot 0.0015 \quad (3)$$

where:

hp: maximum combined motor nameplate horsepower

CFM_s: maximum design supply air rate to conditioned space

Table 6 shows all the fans used in the building with their compliances to the HP limit.

Fan	Flow [CFM]	HP	HP Limitation	Compliance
EF-1-1	150	0.17	0.225	YES
EF-1-2	450	0.17	0.675	YES
EF-1-3	250	0.17	0.375	YES
EF-1-4	150	0.17	0.225	YES
EF-5-1	3700	2	5.55	YES
RF-1-1	20000	20	30	YES
RF-1-2	16000	15	24	YES
RF-2-1	20000	20	30	YES
RF-2-2	18000	15	27	YES
RF-3-1	23000	20	34.5	YES
RE-3-2	18000	15	27	YES
RF-4-1	16000	15	24	YES
RF-4-2	16000	15	24	YES
SEF-5-1	45000	30	67.5	YES
SEF-5-2	45000	30	67.5	YES
SEF-5-3	45000	30	67.5	YES
SEF-5-4	45000	30	67.5	YES
TEF-1-1	450	0.17	0.675	YES
TEF-1-2	250	0.17	0.375	YES
TEF-2-1	450	0.17	0.675	YES
TEF-2-2	250	0.17	0.375	YES
TEF-3-1	450	0.17	0.675	YES
TEF-3-2	250	0.17	0.375	YES
TEF-4-1	450	0.17	0.675	YES
REF-4-2	250	0.17	0.375	YES

Table 6. Fan horsepower compliance.

SECTION 7: SERVICE WATER HEATING

The commercial gas water heater exceeds the minimum performance required from Table 7.8 Performance Requirements for Water Heating Equipment. The gas water heater serves the kitchen on the third floor. Individual electric water heaters are placed on each floor in the mechanical rooms serving the conference rooms and pantry.

SECTION 8: POWER

The power basis of design follows ASHRAE 90.1 for voltage drop requirements being less than 2% and the branch circuits voltage drop of 3%. Specific values for the calculated voltage drops are not included in the drawings received.

SECTION 9: LIGHTING

State-of-the-art energy efficient lighting system shall be utilized in all cases. Vacancy or occupancy sensors are placed in closed offices, conference rooms, storage rooms and lavatories. All lighting are within ASHRAE 90.1 and LEED requirements, based on application within the building. Table 9.6.1 Lighting Power Densities Using the Space-by-Space Method are the required values for ASHRAE 90.1. Due to there being multiple different space types, this method was chosen to adjust lighting power densities throughout the building. This table can also be found in Appendix A. All wiring is sized in accordance to the National Electric Code.

SECTION 10: OTHER EQUIPMENT

All motors that are used follow the requirements given by Energy Policy Act of 1992, which can be seen in Table 10.8 from ASHRAE 90.1-2007. The air handling units contain the largest motors in the building, being 25 HP at 1544 RPM. The efficiency is premium, as selected by Daikin McQuay.

REFERENCES

ANSI/ASHRAE. (2007). Standard 62.1-2010, Ventilation for Acceptable Indoor Air Quality. Atlanta, GA: American Society of Heating Refrigeration and Air Conditioning Engineers, Inc.

ANSI/ASHRAE. (2010). Standard 62.1-2010, Ventilation for Acceptable Indoor Air Quality. Atlanta, GA: American Society of Heating Refrigeration and Air Conditioning Engineers, Inc.

ANSI/ASHRAE. (2010). Standard 90.1-2010, Energy Standard for Buildings Except Low Rise Residential Buildings. Atlanta, GA: American Society of Heating Refrigeration and Air Conditioning Engineers, Inc.

APPENDIX A

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
						Occupant Density (see Note 4)	Combined Outdoor Air Rate (see Note 5)		
	cfm/person	L/s·person	cfm/ft^2	L/s·m^2		#/1000 ft^2 or #/100 m^2	cfm/person	L/s·person	
Correctional Facilities									
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
Educational Facilities									
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
Food and Beverage Service									
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
General									
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
Hotels, Motels, Resorts, Dormitories									
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
						Occupant Density (see Note 4)	Combined Outdoor Air Rate (see Note 5)		
	cfm/person	L/s·person	cfm/ft^2	L/s·m^2		#/1000 ft^2 or #/100 m^2	cfm/person	L/s·person	
Office Buildings									
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
Miscellaneous Spaces									
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
Public Assembly Spaces									
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
Residential									
Dwelling unit	5	2.5	0.06	0.3	F,G	F			1
Common corridors	–	–	0.06	0.3					1
Retail									
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 R_p		Area Outdoor Air Rate R_a		Notes	Default Values			Air Class
						Occupant Density (see Note 4)	Combined Outdoor Air Rate (see Note 5)		
	cfm/person	L/s·person	cfm/ft^2	L/s·m^2		#/1000 ft^2 or #/100 m^2	cfm/person	L/s·person	
Sports and Entertainment									
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

1 **Related requirements:** The rates in this table are based on all other applicable requirements of this standard being met.
2 **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.
3 **Air density:** Volumetric airflow rates are based on an air density of 0.075 lb_{da}/ft^3 (1.2 kg_{da}/m^3), 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.
4 **Default occupant density:** The default occupant density shall be used when actual occupant density is not known.
5 **Default combined outdoor air rate (per person):** This rate is based on the default occupant density.
6 **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.
7 **Health-care facilities:** Rates shall be determined in accordance with Appendix E.

ITEM-SPECIFIC NOTES FOR TABLE 6-1

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

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 at least 8°C (15°F) above space temperature and ceiling return.	0.8
Ceiling supply of warm air less than 8°C (15°F) above space temperature and ceiling return provided that the 0.8 m/s (150 fpm) supply air jet reaches to within 1.4 m (4.5 ft) of floor level. **Note**: For lower velocity supply air, $E_z = 0.8$.	1.0
Floor supply of cool air and ceiling return provided that the 0.8 m/s (150 fpm) supply jet reaches at least 1.4 m (4.5 ft) above the floor. **Note**: 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

Notes for Table 6.2

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 ASHRAE Standard 129 for all air distribution configurations except unidirectional flow.

TABLE 6.3
System Ventilation Efficiency

Max (Z_p)	E_V
≤ 0.25	0.9
≤ 0.35	0.8
≤ 0.45	0.7
≤ 0.55	0.6
> 0.55	Use Appendix G

Notes for Table 6.3

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_{ou} 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 G may yield more practical results.

TABLE 6.4
Minimum Exhaust Rates

Occupancy Category	Exhaust Rate cfm/unit	Exhaust Rate cfm/ft²	Notes	Exhaust Rate L/s-unit	Exhaust Rate L/s-m²
Art classrooms	-	0.70		-	3.5
Auto repair rooms	-	1.50	A	-	7.5
Barber shop	-	0.50		-	2.5
Beauty and nail salons	-	0.60		-	3.0
Cell with toilet	-	1.00		-	5.0
Darkrooms	-	1.00		-	5.0
Arena	-	0.50	B	-	2.5
Kitchen - commercial	-	0.70		--	3.5
Kitchenettes	-	0.30		--	1.5
Locker rooms	-	0.50		-	2.5
Locker/dressing rooms	-	0.25		-	1.25
Parking garages	-	0.75	C	--	3.7
Janitor, trash, recycle	-	1.00		-	5.0
Pet shops (animal areas)	-	0.90		-	4.5
Copy, printing rooms	-	0.50		-	2.5
Science lab classrooms	-	1.00		-	5.0
Toilets - public	50/70	-	D	25/35	-
Toilet - private	25/50	-	E	12.5/25	-
Woodwork shop/classroom	-	0.50		-	2.5

Notes For Table 6.4

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 theaters, schools, and sports facilities. The lower rate may be used where use is intermittent.

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.

TABLE 9.6.1 Lighting Power Densities Using the Space-by-Space Method

Common Space Types[a]	*LPD*, W/ft^2	Building-Specific Space Types	*LPD*, W/ft^2
Office—Enclosed	1.1	Gymnasium/Exercise Center	
Office—Open Plan	1.1	Playing Area	1.4
Conference/Meeting/Multipurpose	1.3	Exercise Area	0.9
Classroom/Lecture/Training	1.4	Courthouse/Police Station/Penitentiary	
For Penitentiary	1.3	Courtroom	1.9
Lobby	1.3	Confinement Cells	0.9
For Hotel	1.1	Judges' Chambers	1.3
For Performing Arts Theater	3.3	Fire Stations	
For Motion Picture Theater	1.1	Engine Room	0.8
Audience/Seating Area	0.9	Sleeping Quarters	0.3
For Gymnasium	0.4	Post Office—Sorting Area	1.2
For Exercise Center	0.3	Convention Center—Exhibit Space	1.3
For Convention Center	0.7	Library	
For Penitentiary	0.7	Card File and Cataloging	1.1
For Religious Buildings	1.7	Stacks	1.7
For Sports Arena	0.4	Reading Area	1.2
For Performing Arts Theater	2.6	Hospital	
For Motion Picture Theater	1.2	Emergency	2.7
For Transportation	0.5	Recovery	0.8
Atrium—First Three Floors	0.6	Nurses' Station	1.0
Atrium—Each Additional Floor	0.2	Exam/Treatment	1.5
Lounge/Recreation	1.2	Pharmacy	1.2
For Hospital	0.8	Patient Room	0.7
Dining Area	0.9	Operating Room	2.2
For Penitentiary	1.3	Nursery	0.6
For Hotel	1.3	Medical Supply	1.4
For Motel	1.2	Physical Therapy	0.9
For Bar Lounge/Leisure Dining	1.4	Radiology	0.4
For Family Dining	2.1	Laundry—Washing	0.6
Food Preparation	1.2	Automotive—Service/Repair	0.7
Laboratory	1.4	Manufacturing	
Restrooms	0.9	Low Bay (<25 ft Floor to Ceiling Height)	1.2
Dressing/Locker/Fitting Room	0.6	High Bay (≥25 ft Floor to Ceiling Height)	1.7
Corridor/Transition	0.5	Detailed Manufacturing	2.1
For Hospital	1.0	Equipment Room	1.2
For Manufacturing Facility	0.5	Control Room	0.5
Stairs—Active	0.6	Hotel/Motel Guest Rooms	1.1
Active Storage	0.8	Dormitory—Living Quarters	1.1
For Hospital	0.9	Museum	
Inactive Storage	0.3	General Exhibition	1.0
For Museum	0.8	Restoration	1.7
Electrical/Mechanical	1.5	Bank/Office—Banking Activity Area	1.5

TABLE 9.6.1 Lighting Power Densities Using the Space-by-Space Method *(continued)*

Common Space Types[a]	*LPD*, W/ft^2	Building-Specific Space Types	*LPD*, W/ft^2
Workshop	1.9	Religious Buildings	
Sales Area [for accent lighting, see Section 9.6.2(b)]	1.7	Worship Pulpit, Choir	2.4
		Fellowship Hall	0.9
		Retail	
		Sales Area [for accent lighting, see Section 9.6.3(c)]	1.7
		Mall Concourse	1.7
		Sports Arena	
		Ring Sports Area	2.7
		Court Sports Area	2.3
		Indoor Playing Field Area	1.4
		Warehouse	
		Fine Material Storage	1.4
		Medium/Bulky Material Storage	0.9
		Parking Garage—Garage Area	0.2
		Transportation	
		Airport—Concourse	0.6
		Air/Train/Bus—Baggage Area	1.0
		Terminal—Ticket Counter	1.5

[a] In cases where both a common space type and a building-specific type are listed, the building specific space type shall apply.

APPENDIX B

Ventilation rate tables conducted for ASHRAE 62.1-2007 Section 6.

System Name	Zone Name	Occupancy Category	Area ft^2 (Az)	Zone Population (Pz)	ACH min.	People Outdoor Air Rate *cfm/person* (Rp)	Area Outdoor Air Rate *cfm/SF* (Ra)	Occupancy Density (#/1000 ft^2)	Breathing Zone Outdoor Air Ventilation (Vbz)	Zone Outdoor Airflow (Voz)	Primary Outdoor Air Fraction (Zp)	System Ventilation Efficiency (Ev)	Zone Design Supply *CFM*	% of total design airflow rate at conditioned analyzed (Ez)	Air Distribution	Diversity	Zone Air Effectiveness (Ez)	Heating *CFM*	Exhaust Rate *CFM/SF or CFM/unit*	Exhaust *CFM*
AHU-1-1	Atrium Café Area	Break rooms	1620	30	8	5	0.06	25	247	309	0.24	0.90	1300	30%	CSCRH	100%	0.8	390	-	-
	Elevator Vestibule/BOH Corridor	Corridors	1360	0	4	0	0.06	0	82	102	0.15	0.90	700	30%	CSCRH	100%	0.8	210	-	-
	Facilities Mail Room	Office space	360	2	4	5	0.06	5	32	40	0.13	0.90	300	30%	CSCRH	100%	0.8	90	-	-
	Facilites Office	Office space	200	1	4	5	0.06	5	17	21	0.07	0.90	320	30%	CSCRH	100%	0.8	96	-	-
	Facilities Pantry/Copy	Break rooms	330	3	4	5	0.06	25	35	44	0.07	0.90	600	30%	CSCRH	100%	0.8	180	-	-
	Garage Corridor	Corridors	2450	0	4	0	0.06	0	147	184	0.02	0.90	11020	30%	CSCRH	100%	0.8	3306	-	-
	LD Office	Office space	74	1	4	5	0.06	5	9	12	0.09	0.90	125	30%	CSCRH	100%	0.8	37.5	-	-
	Multipurpose	Conference/meeting	2090	200	4	5	0.06	50	1125	1125	0.38	0.70	3000	100%	CS	100%	1	900	-	-
	High Density Storage	Warehouses	400	0	6	0	0.06	0	24	30	0.13	0.90	240	30%	CSCRH	100%	0.8	72	-	-
	Facilites Storage 1	Warehouses	290	0	6	0	0.06	0	17	22	0.12	0.90	180	30%	CSCRH	100%	0.8	54	-	-
	Facilites Storage 2	Warehouses	220	0	6	0	0.06	0	13	17	0.12	0.90	140	30%	CSCRH	100%	0.8	42	-	-
	Facilites Storage 3	Warehouses	360	0	6	0	0.06	0	22	27	0.12	0.90	220	30%	CSCRH	100%	0.8	66	-	-
	Facilites Storage Corridor	Corridors	275	0	4	0	0.06	0	17	21	0.21	0.90	100	30%	CSCRH	100%	0.8	30	-	-
	Facilities Furniture Storage/Workshop	Warehouses	4960	0	6	0	0.06	0	298	372	0.10	0.90	3600	30%	CSCRH	100%	0.8	1080	-	-
	Shower Rm 1	Corridors	110	1	4	0	0.06	0	7	8	0.11	0.90	75	30%	CSCRH	100%	0.8	22.5	50/70	400
	Shower Rm 2	Corridors	110	1	4	0	0.06	0	7	7	0.09	0.90	75	100%	CS	100%	1	22.5	50/70	400
	Multipurpose/Restroom Corridor	Corridors	1180	0	4	0	0.06	0	71	89	0.12	0.90	725	30%	CSCRH	100%	0.8	217.5	-	-
	IT Storage	Warehouses	475	0	6	0	0.06	0	29	36	0.12	0.90	300	30%	CSCRH	100%	0.8	90	-	-
	Pantry	Break rooms	175	5	4	5	0.06	25	36	44	0.15	0.90	300	30%	CSCRH	100%	0.8	90	-	-
	Mens Room	Corridors	350	0	4	0	0.06	0	21	26	0.09	0.90	300	30%	CSCRH	100%	0.8	90	50/70	400
	Womens Room	Corridors	350	0	4	0	0.06	0	21	26	0.09	0.90	300	30%	CSCRH	100%	0.8	90	50/70	400

System Name	Zone Name	Occupancy Category	Area ft^2 (Az)	Zone Population (Pz)	ACH min.	People Outdoor Air Rate *cfm/person* (Rp)	Area Outdoor Air Rate *cfm/SF* (Ra)	Occupancy Density *(#/1000 ft^2)*	Breathing Zone Outdoor Air Ventilation (Vbz)	Zone Outdoor Airflow (Voz)	Primary Outdoor Air Fraction (Zp)	System Ventilation Efficiency (Ev)	Zone Design Supply *CFM*	% of total design airflow rate at conditioned analyzed (Ez)	Air Distribution	Diversity	Zone Air Effectiveness (Ez)	Heating *CFM*	Exhaust Rate *CFM/SF or CFM/unit*	Exhaust *CFM*
AHU-1-2	Atrium with Ceiling	Reception areas	1130	5	8	5	0.06	30	93	116	0.12	0.90	1000	30%	CSCRH	98%	0.8	300	-	-
	Open Atrium	Reception areas	1280		8	5	0.06	30	77	96	0.04	0.90	2250	30%	CSCRH	98%	0.8	675	-	-
	Conference SW	Conference/meeting	550	16	4	5	0.06	50	113	141	0.24	0.90	600	30%	CSCRH	98%	0.8	180	-	-
	Elevator Lobby	Corridors	442	0	4	0	0.06	0	27	33	0.08	0.90	400	30%	CSCRH	98%	0.8	120	-	-
	Lobby	Reception areas	2170	6	8	5	0.06	30	160	200	0.12	0.90	1700	30%	CSCRH	98%	0.8	510	-	-
	Office NE 1 Window	Office space	120	1	4	5	0.06	5	12	15	0.13	0.90	115	30%	CSCRH	98%	0.8	34.5	-	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.10	0.90	150	30%	CSCRH	98%	0.8	45	-	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.10	0.90	150	30%	CSCRH	98%	0.8	45	-	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.10	0.90	150	30%	CSCRH	98%	0.8	45	-	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.10	0.90	150	30%	CSCRH	98%	0.8	45	-	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.10	0.90	150	30%	CSCRH	98%	0.8	45	-	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.10	0.90	150	30%	CSCRH	98%	0.8	45	-	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.10	0.90	150	30%	CSCRH	98%	0.8	45	-	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.10	0.90	150	30%	CSCRH	98%	0.8	45	-	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.10	0.90	150	30%	CSCRH	98%	0.8	45	-	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.10	0.90	150	30%	CSCRH	98%	0.8	45	-	-
	Office NE Corner	Office space	120	1	4	5	0.06	5	12	15	0.04	0.90	360	30%	CSCRH	98%	0.8	108	-	-
	Office SE No Overhang	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	98%	0.8	84	-	-
	Office SE	Office space	120	1	4	5	0.06	5	12	15	0.10	0.90	160	30%	CSCRH	98%	0.8	48	-	-
	Office SE	Office space	120	1	4	5	0.06	5	12	15	0.10	0.90	160	30%	CSCRH	98%	0.8	48	-	-
	Office SE	Office space	120	1	4	5	0.06	5	12	15	0.10	0.90	160	30%	CSCRH	98%	0.8	48	-	-
	Office SE	Office space	120	1	4	5	0.06	5	12	15	0.10	0.90	160	30%	CSCRH	98%	0.8	48	-	-
	Office SE	Office space	120	1	4	5	0.06	5	12	15	0.10	0.90	160	30%	CSCRH	98%	0.8	48	-	-
	Pantry SE	Break rooms	120	3	4	5	0.06	25	22	28	0.11	0.90	260	30%	CSCRH	98%	0.8	78	-	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.13	0.90	115	30%	CSCRH	98%	0.8	34.5	-	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.13	0.90	115	30%	CSCRH	98%	0.8	34.5	-	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.13	0.90	115	30%	CSCRH	98%	0.8	34.5	-	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.13	0.90	115	30%	CSCRH	98%	0.8	34.5	-	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.13	0.90	115	30%	CSCRH	98%	0.8	34.5	-	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.13	0.90	115	30%	CSCRH	98%	0.8	34.5	-	-
	Interior Office	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	98%	0.8	30	-	-
	Interior Office	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	98%	0.8	30	-	-
	Interior Office	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	98%	0.8	30	-	-
	Interior Office	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	98%	0.8	30	-	-
	Interior Office	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	98%	0.8	30	-	-
	Interior Office	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	98%	0.8	30	-	-
	Interior Office	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	98%	0.8	30	-	-
	Interior Office	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	98%	0.8	30	-	-
	Interior Office	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	98%	0.8	30	-	-
	Interior Office	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	98%	0.8	30	-	-
	Interior Office	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	98%	0.8	30	-	-
	Interior Office	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	98%	0.8	30	-	-
	Interior Office	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	98%	0.8	30	-	-
	Interior Office	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	98%	0.8	30	-	-
	Pantry Interior	Break rooms	300	3	4	5	0.06	25	33	41	0.14	0.90	300	30%	CSCRH	98%	0.8	90	-	-
	Copy/Corridor	Corridors	925	0	4	0	0.06	0	56	69	0.17	0.90	400	30%	CSCRH	98%	0.8	120	-	-
	Conference Interior	Conference/meeting	560	14	4	5	0.06	50	104	130	0.22	0.90	600	30%	CSCRH	98%	0.8	180	-	-
	Interview	Conference/meeting	165	3	4	5	0.06	50	25	31	0.21	0.90	150	30%	CSCRH	98%	0.8	45	-	-
	Interview	Conference/meeting	165	3	4	5	0.06	50	25	31	0.21	0.90	150	30%	CSCRH	98%	0.8	45	-	-
	Security	Office space	150	2	4	5	0.06	5	19	24	0.20	0.90	120	30%	CSCRH	98%	0.8	36	-	-
	Open Office	Office space	3060	15	4	5	0.06	5	259	323	0.15	0.90	2190	30%	CSCRH	98%	0.8	657	-	-
	Focus	Office space	80	1	4	5	0.06	5	10	12	0.08	0.90	160	30%	CSCRH	98%	0.8	48	-	-

System Name	Zone Name	Occupancy Category	Area ft^2 (Az)	Zone Population (Pz)	ACH min.	People Outdoor Air Rate *cfm/person* (Rp)	Area Outdoor Air Rate *cfm/SF* (Ra)	Occupancy Density *(#/1000 ft^2)*	Breathing Zone Outdoor Air Ventilation (Vbz)	Zone Outdoor Airflow (Voz)	Primary Outdoor Air Fraction (Zp)	System Ventilation Efficiency (Ev)	Zone Design Supply *CFM*	% of total design airflow rate at conditioned analyzed (Ez)	Air Distribution	Diversity	Zone Air Effectiveness (Ez)	Heating *CFM*	Exhaust Rate *CFM/SF or CFM/unit*	Exhaust *CFM*
AHU-2-1	Conference	Conference/meeting	215	6	4	5	0.06	50	43	54	0.32	0.80	170	30%	CSCRH	93%	0.8	51	-	-
	Conference	Conference/meeting	255	8	4	5	0.06	50	55	69	0.33	0.80	210	30%	CSCRH	93%	0.8	63	-	-
	Copy Room	Corridors	120	0	4	0	0.06	0	7	9	0.05	0.90	190	30%	CSCRH	93%	0.8	57	-	-
	Copy Room	Corridors	180	0	4	0	0.06	0	11	14	0.04	0.90	360	30%	CSCRH	93%	0.8	108	-	-
	Elevator Lobby	Corridors	125	0	4	0	0.06	0	8	9	0.19	0.90	50	30%	CSCRH	93%	0.8	15	-	-
	Mens Room	Corridors	360	0	4	0	0.06	0	22	27	0.16	0.90	170	30%	CSCRH	93%	0.8	51	50/70	400
	Womens Room	Corridors	370	0	4	0	0.06	0	22	28	0.16	0.90	170	30%	CSCRH	93%	0.8	51	50/70	400
	Pantry	Corridors	230	3	4	0	0.06	0	14	17	0.07	0.90	250	30%	CSCRH	93%	0.8	75	-	-
	Office NW	Office space	920	3	4	5	0.06	5	70	88	0.08	0.90	1110	30%	CSCRH	93%	0.8	333	-	-
	Offic NW	Office space	130	1	4	5	0.06	5	13	16	0.03	0.90	505	30%	CSCRH	93%	0.8	151.5	-	-
	Office N	Office space	120	1	4	5	0.06	5	12	15	0.07	0.90	230	30%	CSCRH	93%	0.8	69	-	-
	Office N	Office space	120	1	4	5	0.06	5	12	15	0.07	0.90	230	30%	CSCRH	93%	0.8	69	-	-
	Office N	Office space	120	1	4	5	0.06	5	12	15	0.07	0.90	230	30%	CSCRH	93%	0.8	69	-	-
	Office N	Office space	120	1	4	5	0.06	5	12	15	0.07	0.90	230	30%	CSCRH	93%	0.8	69	-	-
	Office N	Office space	120	1	4	5	0.06	5	12	15	0.07	0.90	230	30%	CSCRH	93%	0.8	69	-	-
	Office N	Office space	120	1	4	5	0.06	5	12	15	0.07	0.90	230	30%	CSCRH	93%	0.8	69	-	-
	Office N	Office space	120	1	4	5	0.06	5	12	15	0.07	0.90	230	30%	CSCRH	93%	0.8	69	-	-
	Office N	Office space	120	1	4	5	0.06	5	12	15	0.07	0.90	230	30%	CSCRH	93%	0.8	69	-	-
	Office N	Office space	120	1	4	5	0.06	5	12	15	0.07	0.90	230	30%	CSCRH	93%	0.8	69	-	-
	Office N	Office space	120	1	4	5	0.06	5	12	15	0.07	0.90	230	30%	CSCRH	93%	0.8	69	-	-
	Office W	Office space	120	1	4	5	0.06	5	12	15	0.06	0.90	275	30%	CSCRH	93%	0.8	82.5	-	-
	Office W	Office space	120	1	4	5	0.06	5	12	15	0.06	0.90	275	30%	CSCRH	93%	0.8	82.5	-	-
	Office W	Office space	120	1	4	5	0.06	5	12	15	0.06	0.90	275	30%	CSCRH	93%	0.8	82.5	-	-
	Office W	Office space	120	1	4	5	0.06	5	12	15	0.06	0.90	275	30%	CSCRH	93%	0.8	82.5	-	-
	Office W	Office space	120	1	4	5	0.06	5	12	15	0.06	0.90	275	30%	CSCRH	93%	0.8	82.5	-	-
	Open Office	Office space	3060	15	4	5	0.06	5	259	323	0.15	0.90	2190	30%	CSCRH	98%	0.8	657	-	-
	Office W	Office space	120	1	4	5	0.06	5	12	15	0.06	0.90	275	30%	CSCRH	93%	0.8	82.5	-	-

System Name	Zone Name	Occupancy Category	Area ft^2 (Az)	Zone Population (Pz)	ACH min.	People Outdoor Air Rate *cfm/person* (Rp)	Area Outdoor Air Rate *cfm/SF* (Ra)	Occupancy Density *(#/1000 ft²)*	Breathing Zone Outdoor Air Ventilation (Vbz)	Zone Outdoor Airflow (Voz)	Primary Outdoor Air Fraction (Zp)	System Ventilation Efficiency (Ev)	Zone Design Supply *CFM*	% of total design airflow rate at conditioned analyzed (Ez)	Air Distribution	Diversity	Zone Air Effectiveness (Ez)	Heating *CFM*	Exhaust Rate *CFM/SF or CFM/unit*
AHU-2-2	Atrium/Elevator Lobby	Corridors	3005	0	4	0	0.06	0	180	225	0.07	0.90	3440	30%	CSCRH	93%	0.8	1032	-
	Office NE Corner	Office space	150	1	4	5	0.06	5	14	18	0.05	0.90	370	30%	CSCRH	93%	0.8	111	-
	Office NE Upper Corner	Office space	160	1	4	5	0.06	5	15	18	0.10	0.90	180	30%	CSCRH	93%	0.8	54	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.12	0.90	130	30%	CSCRH	93%	0.8	39	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.12	0.90	130	30%	CSCRH	93%	0.8	39	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.12	0.90	130	30%	CSCRH	93%	0.8	39	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.12	0.90	130	30%	CSCRH	93%	0.8	39	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.12	0.90	130	30%	CSCRH	93%	0.8	39	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.12	0.90	130	30%	CSCRH	93%	0.8	39	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.12	0.90	130	30%	CSCRH	93%	0.8	39	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.12	0.90	130	30%	CSCRH	93%	0.8	39	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.12	0.90	130	30%	CSCRH	93%	0.8	39	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.12	0.90	130	30%	CSCRH	93%	0.8	39	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.12	0.90	130	30%	CSCRH	93%	0.8	39	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.12	0.90	130	30%	CSCRH	93%	0.8	39	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.12	0.90	130	30%	CSCRH	93%	0.8	39	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.12	0.90	130	30%	CSCRH	93%	0.8	39	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	93%	0.8	84	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	93%	0.8	84	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	93%	0.8	84	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	93%	0.8	84	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	93%	0.8	84	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	93%	0.8	84	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	93%	0.8	84	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	93%	0.8	84	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	93%	0.8	84	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	93%	0.8	84	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	93%	0.8	84	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	93%	0.8	84	-
	Office SE Corner	Office space	150	1	4	5	0.06	5	14	18	0.04	0.90	420	30%	CSCRH	93%	0.8	126	-
	Office SE	Office space	120	1	4	5	0.06	5	12	15	0.06	0.90	260	30%	CSCRH	93%	0.8	78	-
	Office SE	Office space	120	1	4	5	0.06	5	12	15	0.06	0.90	260	30%	CSCRH	93%	0.8	78	-
	Office SE	Office space	120	1	4	5	0.06	5	12	15	0.06	0.90	260	30%	CSCRH	93%	0.8	78	-
	Office SE	Office space	120	1	4	5	0.06	5	12	15	0.06	0.90	260	30%	CSCRH	93%	0.8	78	-
	Office SE	Office space	120	1	4	5	0.06	5	12	15	0.06	0.90	260	30%	CSCRH	93%	0.8	78	-
	Office SE	Office space	120	1	4	5	0.06	5	12	15	0.06	0.90	260	30%	CSCRH	93%	0.8	78	-
	Office NE Corner	Office space	160	1	4	5	0.06	5	15	18	0.03	0.90	600	30%	CSCRH	93%	0.8	180	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	93%	0.8	30	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	93%	0.8	30	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	93%	0.8	30	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	93%	0.8	30	-
	Pantry	Office space	300	3	4	5	0.06	5	33	41	0.14	0.90	300	30%	CSCRH	93%	0.8	90	-
	Open Office	Office space	10000	63	4	5	0.06	5	915	1144	0.15	0.90	7630	30%	CSCRH	93%	0.8	2289	-

System Name	Zone Name	Occupancy Category	Area ft^2 (Az)	Zone Population (Pz)	ACH min.	People Outdoor Air Rate *cfm/person* (Rp)	Area Outdoor Air Rate *cfm/SF* (Ra)	Occupancy Density *(#/1000 ft^2)*	Breathing Zone Outdoor Air Ventilation (Vbz)	Zone Outdoor Airflow (Voz)	Primary Outdoor Air Fraction (Zp)	System Ventilation Efficiency (Ev)	Zone Design Supply *CFM*	% of total design airflow rate at conditioned analyzed (Ez)	Air Distribution	Diversity	Zone Air Effectiveness (Ez)	Heating *CFM*	Exhaust Rate *CFM/SF or CFM/unit*	Exhaust *CFM*
AHU-3-1	Dining	Cafeteria/fast-food dining	7100	350	12	7.5	0.18	100	3903	4879	0.32	0.80	15340	30%	CSCRH	100%	0.8	4602	-	-
	Kitchen	Kitchen (cooking)	1421	6	15	0	0	20	0	0	0.00	0.90	3300	30%	CSCRH	100%	0.8	990	0.7	994.7
	Servery	Kitchen (cooking)	2980	34	15	0	0	20	0	0	0.00	0.90	6280	30%	CSCRH	100%	0.8	1884	0.7	2086
	Large Storage	Storage rooms	276	0	4	0	0.12	0	33	41	0.21	0.90	200	30%	CSCRH	100%	0.8	60	-	-
	Kitchen Office	Office space	100	0	4	5	0.06	5	6	8	0.08	0.90	100	30%	CSCRH	100%	0.8	30	-	-
	Storage	Storage rooms	60	0	4	0	0.12	0	7	9	0.18	0.90	50	30%	CSCRH	100%	0.8	15	-	-
	Elevator Vestibule	Corridors	125	0	4	0	0.06	0	8	9	0.09	0.90	100	30%	CSCRH	100%	0.8	30	-	-
	Rest Room Corridor	Corridors	730	0	4	0	0.06	0	44	55	0.11	0.90	500	30%	CSCRH	100%	0.8	150	-	-
	Mens Room	Corridors	350	0	4	0	0.06	0	21	26	0.09	0.90	300	30%	CSCRH	100%	0.8	90	50/70	400
	Womens Room	Corridors	350	0	4	0	0.06	0	21	26	0.09	0.90	300	30%	CSCRH	100%	0.8	90	50/70	400

System Name	Zone Name	Occupancy Category	Area ft^2 (Az)	Zone Population (Pz)	ACH min.	People Outdoor Air Rate *cfm/person* (Rp)	Area Outdoor Air Rate *cfm/SF* (Ra)	Occupancy Density *(#/1000 ft^2)*	Breathing Zone Outdoor Air Ventilation (Vbz)	Zone Outdoor Airflow (Voz)	Primary Outdoor Air Fraction (Zp)	System Ventilation Efficiency (Ev)	Zone Design Supply *CFM*	% of total design airflow rate at conditioned analyzed (Ez)	Air Distribution	Diversity	Zone Air Effectiveness (Ez)	Heating *CFM*	Exhaust Rate *CFM/SF or CFM/unit*	Exhaust *CFM*
AHU-3-2	Atrium/Elevator Lobby	Corridors	3047	0	4	0	0.06	0	183	229	0.08	0.90	2710	30%	CSCRH	92%	0.8	813	-	-
	Closet	Storage rooms	100	0	4	0	0.12	0	12	15	0.15	0.90	100	30%	CSCRH	92%	0.8	30	-	-
	Copy	Storage rooms	80	0	4	0	0.12	0	10	12	0.12	0.90	100	30%	CSCRH	92%	0.8	30	-	-
	Conference	Conference/meeting	370	10	4	5	0.06	50	72	90	0.15	0.90	600	30%	CSCRH	92%	0.8	180	-	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.12	0.90	130	30%	CSCRH	92%	0.8	39	-	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.12	0.90	130	30%	CSCRH	92%	0.8	39	-	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.12	0.90	130	30%	CSCRH	92%	0.8	39	-	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.12	0.90	130	30%	CSCRH	92%	0.8	39	-	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.12	0.90	130	30%	CSCRH	92%	0.8	39	-	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.12	0.90	130	30%	CSCRH	92%	0.8	39	-	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.12	0.90	130	30%	CSCRH	92%	0.8	39	-	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.12	0.90	130	30%	CSCRH	92%	0.8	39	-	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.12	0.90	130	30%	CSCRH	92%	0.8	39	-	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.12	0.90	130	30%	CSCRH	92%	0.8	39	-	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.12	0.90	130	30%	CSCRH	92%	0.8	39	-	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.12	0.90	130	30%	CSCRH	92%	0.8	39	-	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.12	0.90	130	30%	CSCRH	92%	0.8	39	-	-
	Conference NE Corner	Conference/meeting	220	6	4	5	0.06	50	43	54	0.09	0.90	600	30%	CSCRH	92%	0.8	180	-	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	92%	0.8	84	-	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	92%	0.8	84	-	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	92%	0.8	84	-	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	92%	0.8	84	-	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	92%	0.8	84	-	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	92%	0.8	84	-	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	92%	0.8	84	-	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	92%	0.8	84	-	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	92%	0.8	84	-	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	92%	0.8	84	-	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	92%	0.8	84	-	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	92%	0.8	84	-	-
	Office SE Corner	Office space	150	1	4	5	0.06	5	14	18	0.04	0.90	420	30%	CSCRH	92%	0.8	126	-	-

	Office SE Corner	Office space	150	1	4	5	0.06	5	14	18	0.04	0.90	420	30%	CSCRH	92%	0.8	126	-	-
	Office SE	Office space	120	1	4	5	0.06	5	12	15	0.06	0.90	260	30%	CSCRH	92%	0.8	78	-	-
	Office SE	Office space	120	1	4	5	0.06	5	12	15	0.06	0.90	260	30%	CSCRH	92%	0.8	78	-	-
	Office SE	Office space	120	1	4	5	0.06	5	12	15	0.06	0.90	260	30%	CSCRH	92%	0.8	78	-	-
	Office SE	Office space	120	1	4	5	0.06	5	12	15	0.06	0.90	260	30%	CSCRH	92%	0.8	78	-	-
	Office SE	Office space	120	1	4	5	0.06	5	12	15	0.06	0.90	260	30%	CSCRH	92%	0.8	78	-	-
	Office SE	Office space	120	1	4	5	0.06	5	12	15	0.06	0.90	260	30%	CSCRH	92%	0.8	78	-	-
	Office NE Corner	Office space	160	1	4	5	0.06	5	15	18	0.05	0.90	400	30%	CSCRH	92%	0.8	120	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	92%	0.8	30	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	92%	0.8	30	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	92%	0.8	30	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	92%	0.8	30	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	92%	0.8	30	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	92%	0.8	30	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	92%	0.8	30	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	92%	0.8	30	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	92%	0.8	30	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	92%	0.8	30	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	92%	0.8	30	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	92%	0.8	30	-	-
	Pantry	Office space	300	3	4	5	0.06	5	33	41	0.14	0.90	300	30%	CSCRH	92%	0.8	90	-	-
	Open Office	Office space	8600	51	4	5	0.06	5	771	964	0.15	0.90	6350	30%	CSCRH	92%	0.8	1905	-	-

System Name	Zone Name	Occupancy Category	Area ft^2 (Az)	Zone Population (Pz)	ACH min.	People Outdoor Air Rate *cfm/person* (Rp)	Area Outdoor Air Rate *cfm/SF* (Ra)	Occupancy Density *(#/1000 ft^2)*	Breathing Zone Outdoor Air Ventilation (Vbz)	Zone Outdoor Airflow (Voz)	Primary Outdoor Air Fraction (Zp)	System Ventilation Efficiency (Ev)	Zone Design Supply *CFM*	% of total design airflow rate at conditioned analyzed (Ez)	Air Distribution	Diversity	Zone Air Effectiveness (Ez)	Heating *CFM*	Exhaust Rate *CFM/SF or CFM/unit*	Exhaust *CFM*
AHU-4-1	Men's Room	Corridors	360	0	4	0	0.06	0	22	27	0.09	0.90	300	30%	CSCRH	100%	0.8	90	50/70	400
	Women's Room	Corridors	360	0	4	0	0.06	0	22	27	0.09	0.90	300	30%	CSCRH	100%	0.8	90	50/70	400
	Elevator Vestibule	Corridors	125	0	4	0	0.06	0	8	9	0.09	0.90	100	30%	CSCRH	100%	0.8	30	-	-
	Corridor	Corridors	1660	0	4	0	0.06	0	100	125	0.10	0.90	1200	30%	CSCRH	100%	0.8	360	-	-
	Dining	Cafeteria/fast-food dining	3850	0	12	7.5	0.18	100	693	866	0.14	0.90	6300	30%	CSCRH	100%	0.8	1890	-	-
	Office N	Office space	120	1	4	5	0.06	5	12	15	0.07	0.90	220	30%	CSCRH	100%	0.8	66	-	-
	Office N	Office space	120	1	4	5	0.06	5	12	15	0.07	0.90	220	30%	CSCRH	100%	0.8	66	-	-
	Office N	Office space	120	1	4	5	0.06	5	12	15	0.07	0.90	220	30%	CSCRH	100%	0.8	66	-	-
	Office N	Office space	184	1	4	5	0.06	5	16	20	0.05	0.90	430	30%	CSCRH	100%	0.8	129	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	100%	0.8	30	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	100%	0.8	30	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	100%	0.8	30	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	100%	0.8	30	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	100%	0.8	30	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	100%	0.8	30	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	100%	0.8	30	-	-
	Office Interior	Office space	125	1	4	5	0.06	5	13	16	0.16	0.90	100	30%	CSCRH	100%	0.8	30	-	-
	Office Interior	Office space	125	1	4	5	0.06	5	13	16	0.16	0.90	100	30%	CSCRH	100%	0.8	30	-	-
	Office Interior	Office space	125	1	4	5	0.06	5	13	16	0.16	0.90	100	30%	CSCRH	100%	0.8	30	-	-
	Office Interior	Office space	125	1	4	5	0.06	5	13	16	0.16	0.90	100	30%	CSCRH	100%	0.8	30	-	-
	Office Interior	Office space	125	1	4	5	0.06	5	13	16	0.16	0.90	100	30%	CSCRH	100%	0.8	30	-	-
	Office Interior	Office space	125	1	4	5	0.06	5	13	16	0.16	0.90	100	30%	CSCRH	100%	0.8	30	-	-
	Office Interior	Office space	125	1	4	5	0.06	5	13	16	0.16	0.90	100	30%	CSCRH	100%	0.8	30	-	-
	Office Interior	Office space	125	1	4	5	0.06	5	13	16	0.16	0.90	100	30%	CSCRH	100%	0.8	30	-	-
	Office Interior	Office space	125	1	4	5	0.06	5	13	16	0.16	0.90	100	30%	CSCRH	100%	0.8	30	-	-
	Office Interior	Office space	105	1	4	5	0.06	5	11	14	0.14	0.90	100	30%	CSCRH	100%	0.8	30	-	-
	Office Interior	Office space	105	1	4	5	0.06	5	11	14	0.14	0.90	100	30%	CSCRH	100%	0.8	30	-	-
	Office Interior	Office space	105	1	4	5	0.06	5	11	14	0.14	0.90	100	30%	CSCRH	100%	0.8	30	-	-
	Office Interior	Office space	105	1	4	5	0.06	5	11	14	0.14	0.90	100	30%	CSCRH	100%	0.8	30	-	-
	Open Office & Focus	Office space	1775	10	4	5	0.06	5	157	196	0.17	0.90	1160	30%	CSCRH	100%	0.8	348	-	-
	Pantry	Break rooms	145	0	4	5	0.06	25	9	11	0.03	0.90	400	30%	CSCRH	100%	0.8	120	-	-

System Name	Zone Name	Occupancy Category	Area ft^2 (Az)	Zone Population (Pz)	ACH min.	People Outdoor Air Rate *cfm/person* (Rp)	Area Outdoor Air Rate *cfm/SF* (Ra)	Occupancy Density *(#/1000 ft^2)*	Breathing Zone Outdoor Air Ventilation (Vbz)	Zone Outdoor Airflow (Voz)	Primary Outdoor Air Fraction (Zp)	System Ventilation Efficiency (Ev)	Zone Design Supply *CFM*	% of total design airflow rate at conditioned analyzed (Ez)	Air Distribution	Diversity	Zone Air Effectiveness (Ez)	Heating *CFM*	Exhaust Rate *CFM/SF or CFM/unit*	Exhaust *CFM*
AHU-4-2	Atrium/Elevator Lobby	Corridors	2492	0	4	0	0.06	0	150	187	0.07	0.90	2600	30%	CSCRH	92%	0.8	780	-	-
	Closet	Storage rooms	100	0	4	0	0.12	0	12	15	0.15	0.90	100	30%	CSCRH	92%	0.8	30	-	-
	Board Room	Conference/meeting	730	30	4	5	0.06	50	194	242	0.11	0.90	2250	30%	CSCRH	92%	0.8	675	-	-
	Copy	Break rooms	206	0	4	5	0.06	25	12	15	0.08	0.90	200	30%	CSCRH	92%	0.8	60	0.5	103
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	92%	0.8	84	-	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	92%	0.8	84	-	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	92%	0.8	84	-	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	92%	0.8	84	-	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	92%	0.8	84	-	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	92%	0.8	84	-	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	92%	0.8	84	-	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	92%	0.8	84	-	-
	Office SW	Office space	120	1	4	5	0.06	5	12	15	0.05	0.90	280	30%	CSCRH	92%	0.8	84	-	-
	Office SE Corner	Office space	160	1	4	5	0.06	5	15	18	0.03	0.90	540	30%	CSCRH	92%	0.8	162	-	-
	Office NE	Office space	165	1	4	5	0.06	5	15	19	0.10	0.90	195	30%	CSCRH	92%	0.8	58.5	-	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.11	0.90	140	30%	CSCRH	92%	0.8	42	-	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.11	0.90	140	30%	CSCRH	92%	0.8	42	-	-
	Office NE	Office space	120	1	4	5	0.06	5	12	15	0.11	0.90	140	30%	CSCRH	92%	0.8	42	-	-
	Exec Office	Office space	240	1	4	5	0.06	5	19	24	0.08	0.90	300	30%	CSCRH	92%	0.8	90	-	-
	Exec Office	Office space	240	1	4	5	0.06	5	19	24	0.08	0.90	300	30%	CSCRH	92%	0.8	90	-	-
	Exec Office	Office space	240	1	4	5	0.06	5	19	24	0.08	0.90	300	30%	CSCRH	92%	0.8	90	-	-
	Exec Office	Office space	240	1	4	5	0.06	5	19	24	0.08	0.90	300	30%	CSCRH	92%	0.8	90	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	92%	0.8	30	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	92%	0.8	30	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	92%	0.8	30	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	92%	0.8	30	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	92%	0.8	30	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	92%	0.8	30	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	92%	0.8	30	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	92%	0.8	30	-	-
	Office Interior	Office space	120	1	4	5	0.06	5	12	15	0.15	0.90	100	30%	CSCRH	92%	0.8	30	-	-
	Pantry Exterior	Break rooms	500	3	4	5	0.06	25	45	56	0.07	0.90	810	30%	CSCRH	92%	0.8	243	-	-
	Open Office	Office space	5490	26	4	5	0.06	5	459	574	0.13	0.90	4300	30%	CSCRH	92%	0.8	1290	-	-

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Conference Rooms RTU	Conference	Conference/meeting	665	20	4	5	0.06	50	140	175	0.19	0.90	900	100%	CSCRH	100%	0.8	270	-	-