



Technical Report One

Examination of Existing Design
Compliance with ASHRAE
Standard 62.1 & Standard 90.1

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Executive Summary

Oklahoma University Children's Medical Office Building is a 12-story above grade structure that is part of the Oklahoma University Health Services Division. The building under analysis is located in downtown Oklahoma City, Oklahoma and is situated on the university hospital grounds. The building is primarily comprised of office spaces and patient care services similar to a general medical office building. The medical services provided here are only diagnostic doctor care and outpatient care related to routine check-ups. It is important to note that the construction for the building is based on a tenant fit-out plan and not all of the floors are currently occupied.

The general mechanical layout for the building makes use of an air handling unit on each of the 11 above-grade floors and 1 basement floor. Each air handling unit is capable of providing approximately 28 tons of cooling and distributes air to approximately 40 terminal boxes per floor. Air delivery to the zones is primarily by variable air volume (VAV) boxes. The return system is through the plenum spaces above each room and the return air circulates around each floor via transfer ducts. Chilled and heating water is distributed through the building after transfer in the main mechanical room which is served by a central steam heating plant and a chiller plant both located offsite, but on the hospital campus.

The purpose of this report is to examine the existing design of the building and determine whether it is compliant with ASHRAE Standard 62.1, Ventilation for Acceptable Indoor Air Quality, and Standard 90.1, Energy Standard for Buildings. Standard 62.1 covers chapters 5, which lays out the requirements for the existing building mechanical equipment and the building envelope and makes sure each is capable of performing their required functions, while not causing any adverse effects such as microbial growth, which will be described in great detail in the following study. The standard also covers chapter 6, which is the ventilation rate procedure for each space contained on the ventilation systems for the building. An in depth analysis will be done based on the provided outdoor air rates and that which has been calculated as the required rates.

ASHRAE Standard 90.1 sets the minimum requirements for essentially each device that makes up the mechanical systems in the building. The requirements are based on the operating ratings of the equipment (specifically for energy use and savings) during occupied and unoccupied settings in which the specifications and manufacturer data is extensively examined. It also sets standards for the building envelope and mechanical system insulation so as to maintain the efficiency and ultimately keep loads to a minimum. The entire standard will be used and pertinent sections will be noted and detail to show compliance.



ASHRAE Standard 62.1 Ventilation for Acceptable Indoor Air Quality

Chapter 5 Systems & Equipment

Section 5.1 Ventilation Air Distribution

Every zone on the system is supplied by at least one terminal box. The system is only part plenum, where the primary air is delivered from the air handling units directly by duct, while the air is returned to the plenum spaces above the zones. Here some of this air will be mixed with the primary air in the terminal units for recirculation. Otherwise the return air in the plenum is pulled through the spaces via plenums and transfer ducts back to floor air handling unit to be re-circulated or exhausted.

The terminal units used by every space are variable air volume. Majority of the variable air volume boxes deliver only supply air from the air handling unit and do not directly re-circulate return air from the plenum. These terminal units vary the volume of primary air through the use of a damper. The remaining variable air volume boxes make use of a fan and mix return and primary air. In order to maintain minimum ventilation air the fans are variable speed. In addition, every supply branch downstream of all the terminal units is equipped with a manual air damper.

Section 5.2 Exhaust Duct Location

All necessary rooms such as toilet rooms, janitor closets, equipment rooms, as well as all required medical rooms and laboratories are provided with exhaust ductwork that is negatively pressurized by roof top fans (located outside the system). All exhaust ducts are additionally sealed per SMACNA Seal Class A. Most of the return air is also exhausted due to the buildings medical implications. However, the return air is exhausted through exterior walls with a fan provided just within the exterior wall.

Section 5.3 Ventilation System Controls

The supply fans for the AHUs run only on an occupied/unoccupied basis; there is no consideration of part load occupancy. In the occupied mode the control panel will enable the fan and modulate speed to maintain duct pressure. When the spaces are unoccupied the fan will be off unless any space temperature falls below the night setback temperature set-point of 62°F or rises above a set-point of 85°F.

An airflow measuring station serves the air handling units on each floor where the outdoor air intake is. The system also includes outdoor air economizers, in which case minimum outdoor air dampers have been included at the inlet to provide accurate airflow measurements in economizer mode.



Section 5.4 Airstream Surfaces

According to the specifications for obvious equipment, surfaces that are in contact with the airstream will have to comply with the 2004 requirements of ASHRAE 62.1. Therefore, it can be assumed to meet the standards under such tests as UL 181 or ASTM C 1338 for resistance to mold growth and erosion. Further investigation into the construction of certain mechanical devices will yield the use galvanized metals as well as specific cleaning and installation for the prevention of debris and particulates.

Section 5.5 Outdoor Air Intakes

Each floor features two mechanical rooms: one that houses the floor's air handling unit and the other who's main airside function is for exhausting the return and exhaust air therefore separating the outdoor air intake from the return/exhaust relief by the entire length of the building. Lab air as well as the basement floor air is ducted up to the roof and exhausted by rooftop fans where there is no intake equipment.

All outdoor air intakes are equipped with louvers in which air-performance, water-penetration, and wind-driven rain ratings are compliant with the equivalent tested manufacturer equipment per AMCA 500-L. Louvers are also manufactured with a gutter in the frame as well as on each blade and the sill is steeply sloped preventing water accumulation. For extra protection access doors and slopes to drainage are included in all outdoor air intake equipment that adjoins to these louvers. All outdoor air intakes are equipped with $\frac{1}{2}$ "x $\frac{1}{2}$ " bird screens to prevent nesting.

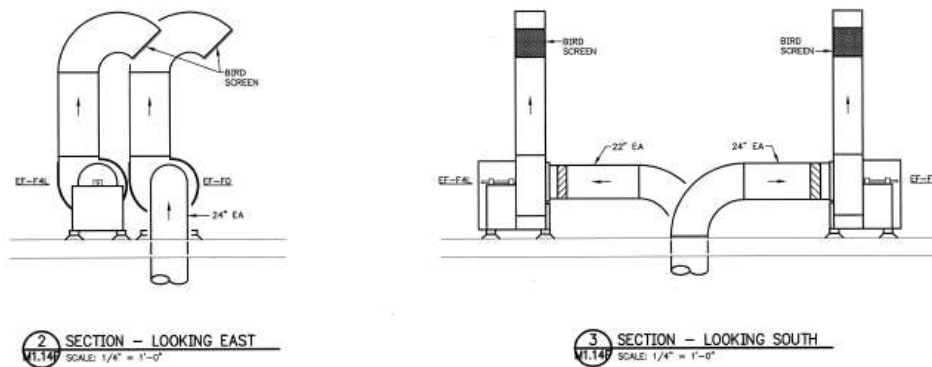


Figure 1. Bird Screens and Goosenecks

Section 5.6 Local Capture of Contaminants

This section is not applicable. See Section 5.8 *Particulate Matter Removal* for related material.



Section 5.7 Combustion Air

There is no combustion or fuel burning equipment within the building. The power system requires a natural gas generator. However, the generator and equipment are located outside the building and thus are exhausted outside the confines of the building.

Section 5.8 Particulate Matter Removal

The main air handling units contain 4" thick filters that have a MERV rating of 11. These are the pre-filters within the system. All other air distribution devices such as the terminal units are supplied with 2" filters, which are downstream from the cooling coils, which have the potential to harbor microbial growth. These filters have a MERV rating of 7 and achieve an arrestance of 90%. The downstream filter rating meets the minimums established in ASHRAE standard 52.1 and 52.2

Section 5.9 Dehumidification Systems

The standard requires that upper limit of relative humidity (RH) be set at 65% for the space air. The air handling units in this building have a heating coil preceding the cooling coil in-order for the cooling coil to extract the moisture out of the air as it conditions the air to the correct supply temperature. The temperature drop through the cooling coils effectively accommodates a relative humidity that is less than 65%.

Section 5.10 Drain Pans

The requirements laid out in this section apply only to the building air handling units and fan coil units which contain cooling coils; terminal units contain only heating coils. The air handling and fan coil units that contain cooling and/or dehumidification coils are compliant with the specific requirements for drain pan slope and size as well as drain outlet size. In addition, the selected air handling units contain the drain pans within a double-wall construction with foam insulation in-between to seal the moisture tight, further preventing the spread of microbial contaminants in the event there is standing water or a blockage in the drain.

Section 5.11 Finned-Tube Coils and Heat Exchangers

In addition to the above mentioned equipment for dehumidification coil drain pans; all condensate producing heat exchangers are equipped with drainage for consequent water within the shell of the exchanger. The drainage is compliant with the requirements in this section and is connected with by a hose for removal.

No finned-tube coils are used in the heat exchangers; heat exchangers are shell and tube construction with seamless copper tubes.



Section 5.12 Humidifiers and Water-Spray Systems

There are no humidifiers and/or water-spray systems present in either of the two types of air handling units used, nor is there any system that makes use of these components anywhere else in the building.

Section 5.13 Access for Inspection, Cleaning, and Maintenance

Access to all equipment is provided by the appropriate clearances for service and maintenance. It is implied in each device's installation section of their specification to be compliant with manufacturer clearances. The equipment which includes all air handling units, fan coil units, and terminal units are manufactured with access doors or removable panels for access to parts requiring service, adjustment, cleaning, or maintenance. It is additionally important to note that all equipment requiring drain pans have access to these areas.

As demonstrated in the air handling unit below there is an access door for the following: air intake/mixing plenum section, filter access, downstream section of heating coil, fan section, and one for the discharge plenum which is downstream of the cooling coil. This is compliant with the standard and also denoted by the manufacturer in the specifications for periodic maintenance and inspections.

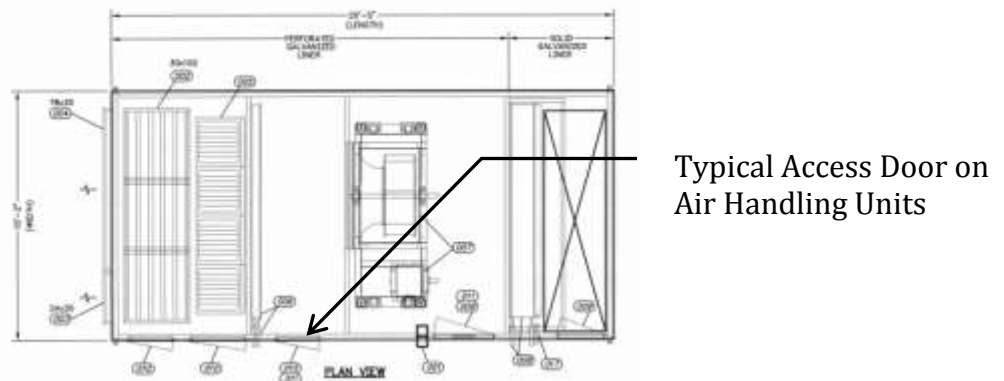


Figure 2. Plan View of Air Handling Unit with Access Doors

Section 5.14 Building Envelope and Interior Surfaces

Air and vapor barrier systems within the building envelope establish a continuous barrier to air infiltration/exfiltration and water vapor transmission while also acting as a liquid water drainage plane flashed to discharge any incidental condensation or water penetration. Since a large part of the exterior façade is brick veneer, weeps are included in the exterior wall construction to allow water to pass through into the air space via wicks. Joint sealants and caulking provide continuous weather tight construction along with flashing, transition tape, drainage mats and the membrane roofing, which is aided by roof drains.

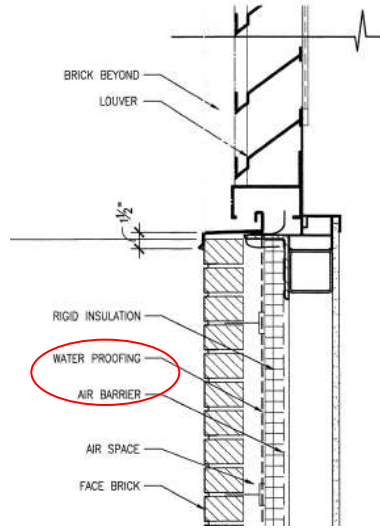


Figure 3. Exterior Wall Section indicating Weather-Proofing

Interior equipment that has the potential to generate condensation such as supply ducts, various piping, and other mechanical equipment are fitted with thermal insulation and vapor retarders as necessary. Similar to barrier/water prevention connections being made for all walls, foundation, windows, doors, roof, etc. with retarders and sealants, all joints, seams, and penetrations in ducts and piping are ensured to be sealed.

No measures are taken for radon infiltration from the ground or other soil gas contaminants. There is also no indication of the authority having jurisdiction requiring extra measures be taken.

Section 5.15 Buildings with Attached Parking Garages

The building has a parking garage on the ground floor that is accessed by several stairwells and elevators. Entry to the elevators and one stairwell is provided through a lobby, which is positively pressurized while a vestibule serves the other stairwell. Each of these egress spaces is designed to limit the entry of vehicular exhaust.

Section 5.16 Air Classification and Recirculation

All floors are served only by the air handling unit on that floor. Toilet rooms, janitor closets, and equipment rooms are the only rooms, which are exhausted. The remainder of spaces on each floor is designated as either Class 1 or Class 2 and each air class is only re-circulated with its own class. Lab fume hoods are also exhausted from the spaces containing them.

Section 5.17 Requirements for ETS Areas and ETS-Free Areas

Not applicable. Smoking is prohibited throughout the building.



Chapter 6 Ventilation Rate Calculations Procedure

The section provides the ventilation rate procedure used to design each ventilation system within the building. The approach is based on the minimum outdoor air that will be required based on the space area, occupancy, and room design. The section also includes the minimum ventilation rates in the breathing zone which will be utilized for the analysis. However, OU Children's Medical Office Building has been considered to be a healthcare facility, so ASHRAE Standard 170, Ventilation of Health Care Facilities, is also used.

Oklahoma University Children's Medical Office Building is a tenant fit out construction. Therefore, as floors and spaces are leased the floor plans are developed and designed base on the ventilation needed for those particular spaces. Currently, floors two, eleven, and twelve have yet to be occupied by tenants. However, each of the three floors is sized with an air handling unit that will provide 4000 CFM of outside air for the entire floor area. Once occupied, the air handling units with be adjusted to provide the correct amount of outdoor air required based on the ventilation calculations in this section.

Below is a summary of the floor by floor outdoor air currently being supplied, the amount of outdoor air that will be required, and whether or not these rates are compliant with the corresponding ASHRAE standard. Further analysis of room by room outdoor air ventilation rates can be found in Appendix B.

Table 1. Summary of Ventilation Rates by Floor Air Handling Units

	OA Supplied (CFM)	OA Required (CFM)	ASHRAE Compliant
AHU-F0	5680	1115	YES
AHU-F2	4000	-	NA
AHU-F3	4625	2537	YES
AHU-F4	3650	1692	YES
AHU-F5	4405	2287	YES
AHU-F6	4550	3150	YES
AHU-F7	4710	2773	YES
AHU-F8	5015	3240	YES
AHU-F9	4310	2455	YES
AHU-F10	3800	2575	YES
AHU-F11	4000	-	NA
AHU-F12	4000	-	NA



ASHRAE Standard 90.1 Energy Standard for Buildings

Chapter 5 Building Envelope

Section 5.1 General

5.1.4 Climate Zones

The climate zones for the continental United States increase from zone one to zone seven (eight is only present in Alaska) as temperature decreases and elevation increases from south to north generally. Additionally each county is defined by its relative humidity progressing from "A" on the east coast and much of the eastern half of the country where climates are considered moist or humid to "C" on the very edge of the west coast where areas are distinguished as cool and marine.

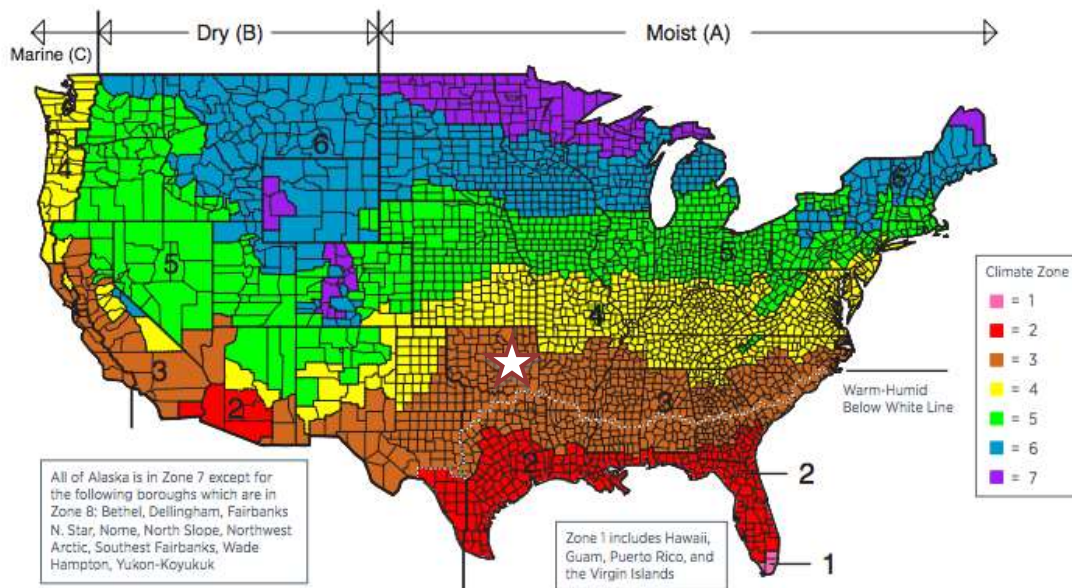


Figure 4. Climate Zones for United States Locations

Oklahoma borders zone four to the north and the dry region (B) to the west. All counties in Oklahoma fall in climate zone 3A except Beaver, Cimarron, and Texas counties, which lie in zone 4A. Therefore, Oklahoma University Children's Medical Office Building in Oklahoma City (Oklahoma County) resides in zone 3A, which is described as being warm-humid.

Section 5.2 Compliance Paths

5.2.1 Compliance

The compliance path of the construction follows Section 5.5, the Prescriptive Building Envelope Option. Refer to Section 5.5 for the full requirements. To comply,



the vertical fenestration area of the floors must not exceed 40% of the gross wall area and the skylight fenestration area cannot exceed 5% of the gross roof area. The OU Children's Medical Office Building meets both of these categories in that the ratio of vertical wall fenestration to gross wall area is lower than 40%, and there is no skylight fenestration to factor in. Therefore, the Prescriptive Building Envelope Option can be used.

Section 5.4 Mandatory Provisions

5.4.3 Air Leakage

The entire building envelope is designed to maintain a continuous air barrier.

Section 5.5 Prescriptive Building Envelope Option

5.5.1 Building Envelope Requirements

OU Children's Medical Office Building is a nonresidential conditioned space; therefore it must comply with the requirements outlined in the table beside for the appropriate climate zone, 3A.

Table 2. Building Envelope Requirements for Climate Zone 3 (A, B, C) [Skylight Fenestration Excluded from Table]

Opaque Elements	Nonresidential	
	Assembly Maximum	Insulation Min. R-Value
<i>Roofs</i>		
Insulation Entirely above Deck	U-0.048	R-20.0 c.i.
Metal Building ^a	U-0.055	R-13.0 + R13.0
Attic and Other	U-0.027	R-38.0
<i>Walls, Above-Grade</i>		
Mass	U-0.123	R-7.6 c.i.
Metal Building	U-0.084	R-19.0
Steel-Framed	U-0.084	R-13.0 + R-3.8 c.i.
Wood-Framed and Other	U-0.089	R-13.0
<i>Walls, Below-Grade</i>		
Below-Grade Wall	C-1.140	NR
<i>Floors</i>		
Mass	U-0.107	R-6.3 c.i.
Steel-Joist	U-0.052	R-19.0
Wood-Framed and Other	U-0.051	R-19.0
<i>Slab-On-Grade Floors</i>		
Unheated	F-0.730	NR
Heated	F-0.900	R-10 for 24 in.
<i>Opaque Doors</i>		
Swinging	U-0.700	
Nonswinging	U-1.450	
Fenestration	Assembly Max. U	Assembly Max. SHGC
<i>Vertical Glazing, 0%–40% of Wall</i>		
Nonmetal framing (all) ^c	U-0.65	
Metal framing (curtainwall/storefront) ^d	U-0.60	SHGC-0.25 all
Metal framing (entrance door) ^d	U-0.90	
Metal framing (all other) ^d	U-0.65	



Chapter 6 Heating, Ventilation, and Air Conditioning

Section 6.2 Compliance Paths

6.2.1 Compliance

Compliance will be achieved by meeting all the requirements for Section 6.4, Mandatory Provisions, and Section 6.5, Prescriptive Path. A discussion follows.

Section 6.4 Mandatory Provisions

6.4.1 Equipment Efficiencies, Verification, and Labeling Requirements

All equipment in the building that is shown on the tables in Appendix A must have a minimum performance that it will meet at the specified rating condition. Only the tables containing pertinent equipment have been included.

Section 6.5 Prescriptive Path

6.5.1 Economizers

Each cooling system that has a fan within the building must include an economizer since all systems are over 54,000 BTU/h. All air handling units in the building utilize an air economizer. Computer cooling does not require an economizer as the building resides in climate zone 3A.

Chapter 7 Service Water Heating

The steam and heating water used for the building comes from an offsite location, a steam/heating water plant that is elsewhere on the Oklahoma University Hospital campus. This is also true about the chilled water.

Once on site the water is then distributed to various heat exchangers and pumps to heat domestic and heating water for the Medical Office Building.

Chapter 8 Power

The Children's Medical Office Building uses low-voltage dry-type transformers rated at 600 V and less, with capacities up to 1000 kVA. Under the mandatory provisions section, the feeder conductors cannot impose a voltage drop greater than 2% at design load. Additionally, the branch circuit conductors must not exceed a voltage drop of 3% at design load.

Chapter 9 Lighting

Only areas such as restrooms, corridors, stairwells, and lobbies will be full automatic-on. The rest of the spaces will be either manual or not more than 50% power when automatically controlled. Based on the occupancy schedule, the lighting will be automatically controlled to shut off when the building is considered



unoccupied. In addition to on and off, the space lighting is indicated to have a medium power setting between 30% and 70% of full lighting power.



Appendix A

**TABLE 6.8.1A Electronically Operated Unitary Air Conditioners and Condensing Units—
Minimum Efficiency Requirements (continued)**

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency ^a	Test Procedure ^b
Air conditioners, water cooled	≥760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER (before 6/1/2011)	AHRI 340/360
				12.2 EER (as of 6/1/2011)	
		All other	Split System and Single Package	11.1 IEER (before 6/1/2011)	
				12.4 IEER (as of 6/1/2011)	
< 65,000 Btu/h	All	Split System and Single Package	10.8 EER (before 6/1/2011)	AHRI 210/240	
			12.0 EER (as of 6/1/2011)		
Air conditioners, evaporatively cooled	≥65,000 Btu/h and <135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	10.9 IEER (before 6/1/2011)	AHRI 340/360
				12.2 IEER (as of 6/1/2011)	
		All other	Split System and Single Package	11.5 EER (before 6/1/2011)	
				12.1 IEER (as of 6/1/2011)	
Air conditioners, evaporatively cooled	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER (before 6/1/2011)	AHRI 340/360
				12.0 EER (as of 6/1/2011)	
		All other	Split System and Single Package	11.2 IEER (before 6/1/2011)	
				12.2 IEER (as of 6/1/2011)	
Air conditioners, evaporatively cooled	≥240,000 Btu/h and < 760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	10.8 EER (before 6/1/2011)	AHRI 340/360
				11.8 EER (as of 6/1/2011)	
		All other	Split System and Single Package	11.0 IEER (before 6/1/2011)	
				12.0 IEER (as of 6/1/2011)	
Air conditioners, evaporatively cooled	≥760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER (before 6/1/2011)	AHRI 340/360
				11.7 EER (as of 6/1/2011)	
		All other	Split System and Single Package	11.1 IEER (before 6/1/2011)	
				11.9 IEER (as of 6/1/2011)	
Condensing units, air cooled	≥135,000 Btu/h	-	-	10.8 EER (before 6/1/2011) 12.2 EER (as of 6/1/2011) 10.9 IEER (before 6/1/2011) 11.9 IEER (as of 6/1/2011)	
Condensing units, water cooled	≥135,000 Btu/h	-	-	11.0 EER (before 6/1/2011) 11.9 EER (as of 6/1/2011) 11.1 IEER (before 6/1/2011) 12.1 IEER (as of 6/1/2011)	AHRI 365
Condensing units, evaporatively cooled	≥135,000 Btu/h	-	-	10.1 EER (before 6/1/2011) 10.5 EER (as of 6/1/2011) 11.4 IEER (before 6/1/2011) 11.8 IEER (as of 6/1/2011)	AHRI 365
Condensing units, evaporatively cooled	≥135,000 Btu/h	-	-	13.1 EER (before 6/1/2011) 13.5 EER (as of 6/1/2011) 13.6 IEER (before 6/1/2011) 14.0 IEER (as of 6/1/2011)	AHRI 365
Condensing units, evaporatively cooled	≥135,000 Btu/h	-	-	13.1 EER (before 6/1/2011) 13.5 EER (as of 6/1/2011) 13.6 IEER (before 6/1/2011) 14.0 IEER (as of 6/1/2011)	AHRI 365

^aPLVs and part-load rating conditions are only applicable to equipment with capacity modulation.
^bSection 12 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
^cSingle-phase, air-cooled air conditioners <65,000 Btu/h are regulated by NAECA. SEER values are those set by NAECA.



TABLE 6.8.1D Electrically Operated Packaged Terminal Air Conditioners, Packaged Terminal Heat Pumps, Single-Package Vertical Air Conditioners, Single-Package Vertical Heat Pumps, Room Air Conditioners, and Room Air-Conditioner Heat Pumps—Minimum Efficiency Requirements

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure ^a
PTAC (cooling mode) standard size	All capacities	95°F db outdoor air	12.5 – (0.213 × Cap/1000) ^c EER (before 10/08/2012) 13.8 – (0.300 × Cap/1000) ^c EER (as of 10/08/2012)	AHRI 310/ 380
PTAC (cooling mode) nonstandard size ^b	All capacities	95°F db outdoor air	10.9 – (0.213 × Cap/1000) ^c EER	
PTHP (cooling mode) standard size	All capacities	95°F db outdoor air	12.3 – (0.213 × Cap/1000) ^c EER (before 10/08/2012) 14.0 – (0.300 × Cap/1000) ^c EER (as of 10/08/2012)	AHRI 310/ 380
PTHP (cooling mode) nonstandard size ^b	All capacities	95°F db outdoor air	10.8 – (0.213 × Cap/1000) ^c EER	
PTHP (heating mode) standard size	All capacities	—	3.2 – (0.026 × Cap/1000) ^c COP _H (before 10/08/2012) 3.7 – (0.052 × Cap/1000) ^c COP _H (as of 10/08/2012)	AHRI 310/ 380
PTHP (heating mode) nonstandard size ^b	All capacities	—	2.9 – (0.026 × Cap/1000) ^c COP _H	
SPVAC (cooling mode)	<65,000 Btu/h	95°F db/75°F wb outdoor air	9.0 EER	AHRI 390
	≥65,000 Btu/h and <135,000 Btu/h	95°F db/75°F wb outdoor air	8.9 EER	
	≥135,000 Btu/h and <240,000 Btu/h	95°F db/75°F wb outdoor air	8.6 EER	
SPVHP (cooling mode)	<65,000 Btu/h	95°F db/75°F wb outdoor air	9.0 EER	AHRI 390
	≥65,000 Btu/h and <135,000 Btu/h	95°F db/75°F wb outdoor air	8.9 EER	
	≥135,000 Btu/h and <240,000 Btu/h	95°F db/75°F wb outdoor air	8.6 EER	
SPVHP (heating mode)	<65,000 Btu/h	47°F db/43°F wb outdoor air	3.0 COP	AHRI 390
	≥65,000 Btu/h and <135,000 Btu/h	47°F db/43°F wb outdoor air	3.0 COP	
	≥135,000 Btu/h and <240,000 Btu/h	47°F db/43°F wb outdoor air	2.9 COP	
Room air conditioners, with louvered sides	<6000 Btu/h	—	9.7 SEER	ANSI/AHAM RAC-1
	≥6000 Btu/h and <8000 Btu/h	—	9.7 SEER	
	≥8000 Btu/h and <14,000 Btu/h	—	9.8 EER	
	≥14,000 Btu/h and <20,000 Btu/h	—	9.7 SEER	
	≥20,000 Btu/h	—	8.5 EER	



TABLE 6.8.1E Warm-Air Furnaces and Combination Warm-Air Furnaces/Air-Conditioning Units, Warm-Air Duct Furnaces, and Unit Heaters

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure ^a
Warm-Air Furnace, Gas-Fired	<225,000 Btu/h	Maximum capacity ^c	78% AFUE or 80% E_t ^{b,d}	DOE 10 CFR Part 430 or Section 2.39, Thermal Efficiency, ANSI Z21.47
	≥225,000 Btu/h	Maximum capacity ^c	80% E_t ^d	Section 2.39, Thermal Efficiency, ANSI Z21.47
Warm-Air Furnace, Oil-Fired	<225,000 Btu/h	Maximum capacity ^c	78% AFUE or 80% E_t ^{b,d}	DOE 10 CFR Part 430 or Section 42, Combustion, UL 727
	≥225,000 Btu/h	Maximum capacity ^c	81% E_t ^d	Section 42, Combustion, UL 727
Warm-Air Duct Furnaces, Gas-Fired	All Capacities	Maximum capacity ^c	80% E_c ^e	Section 2.10, Efficiency, ANSI Z83.8
Warm-Air Unit Heaters, Gas-Fired	All capacities	Maximum capacity ^c	80% E_c ^{e,f}	Section 2.10, Efficiency, ANSI Z83.8
Warm-Air Unit Heaters, Oil-Fired	All capacities	Maximum capacity ^c	80% E_c ^{e,f}	Section 40, Combustion, UL 731

^a Section 12 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
^b Combination units not covered by NARCA (1-phase power or cooling capacity greater than or equal to 65,000 Btu/h) may comply with either rating.
^c Compliance of multiple firing rate units shall be at the maximum firing rate.
^d E_t = thermal efficiency. Units must also include an interrupted or intermittent ignition device (IID), have jacket losses not exceeding 0.75% of the input rating, and have either power venting or a flue damper. A test damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.
^e E_c = combustion efficiency (100% less flue losses). See test procedure for detailed discussion.
^f As of August 8, 2006, according to the Energy Policy Act of 2005, units must also include an interrupted or intermittent ignition device (IID) and have either power venting or an automatic flue damper.

TABLE 6.8.1F Gas- and Oil-Fired Boilers, Minimum Efficiency Requirements

Equipment Type ^a	Subcategory or Rating Condition	Size Category (Input)	Minimum Efficiency ^{b,c}	Efficiency as of 3/2/2010 (Date 3 yrs after ASHRAE Board Approval)	Efficiency as of 3/2/2020 (Date 13 yrs after ASHRAE Board Approval)	Test Procedure
Boilers, hot water	Gas-fired	<300,000 Btu/h	80% AFUE	80% AFUE	80% AFUE	10 CFR Part 430
		≥300,000 Btu/h and ≤2,500,000 Btu/h ^d	75% E_t	80% E_t	80% E_t	10 CFR Part 431
		>2,500,000 Btu/h ^a	80% E_c	82% E_c	82% E_c	
	Oil-fired ^e	<300,000 Btu/h	80% AFUE	80% AFUE	80% AFUE	10 CFR Part 430
		≥300,000 Btu/h and ≤2,500,000 Btu/h ^d	78% E_t	82% E_t	82% E_t	10 CFR Part 431
		>2,500,000 Btu/h ^a	83% E_c	84% E_c	84% E_c	
Boilers, steam	Gas-fired— all, except natural draft	<300,000 Btu/h	75% AFUE	75% AFUE	75% AFUE	10 CFR Part 430
		≥300,000 Btu/h and ≤2,500,000 Btu/h ^d	75% E_t	79% E_t	79% E_t	10 CFR Part 431
		>2,500,000 Btu/h ^a	80% E_c	79% E_t	79% E_t	
	Gas-fired— natural draft	<300,000 Btu/h	80% AFUE	80% AFUE	80% AFUE	10 CFR Part 430
		≥300,000 Btu/h and ≤2,500,000 Btu/h ^d	75% E_t	77% E_t	79% E_t	10 CFR Part 431
		>2,500,000 Btu/h ^a	80% E_c	77% E_t	79% E_t	
Oil-fired ^e	<300,000 Btu/h	80% AFUE	80% AFUE	80% AFUE	10 CFR Part 430	
	≥300,000 Btu/h and ≤2,500,000 Btu/h ^d	78% E_t	81% E_t	81% E_t	10 CFR Part 431	
		>2,500,000 Btu/h ^a	83% E_c	81% E_t	81% E_t	

^a These requirements apply to boilers with rated input of 8,000,000 Btu/h or less that are not packaged boilers and to all packaged boilers. Minimum efficiency requirements for boilers cover all capacities of packaged boilers.
^b E_c = combustion efficiency (100% less flue losses). See reference document for detailed information.
^c E_t = thermal efficiency. See reference document for detailed information.
^d Maximum capacity – minimum and maximum ratings as provided for and allowed by the unit's controls.
^e Includes oil-fired (residual).



Appendix B

ROOM NAME	AHU	No. of People	ROOM DIMENSIONS			ASHRAE 170 Space Designation	ASHRAE 62.1 Space Designation	MINIMUM CFM REQUIRED		
			Area, SF	Height, FT	Volume, CF			SA		
								AIA	AIA	IMC
Mech	AHU F-3	0.0	942	8	7,535		Electrical Equipment Rooms			0
Corridor	AHU F-3	0.0	268	8	2,145	Corridor		71	0	
Conference	AHU F-3	15.0	546	8	4,365		Conference/meeting			95
Shared Conference	AHU F-3	6.0	253	8	2,023		Conference/meeting			50
Echo	AHU F-3	1.0	148	8	1,187	Patient Rooms		119	40	
Exam	AHU F-3	2.0	135	8	1,079	Patient Rooms		108	36	
Exam	AHU F-3	2.0	129	8	1,032	Patient Rooms		103	34	
Nurse Work	AHU F-3	2.0	122	8	980	Patient Rooms		98	33	
Vitals	AHU F-3	1.0	84	8	672	Patient Rooms		67	22	
Reception	AHU F-3	1.0	300	8	2,402		Booking/Waiting			8
Toilet	AHU F-3	0.0	72	8	577	Bathroom		96	0	
Exam	AHU F-3	2.0	122	8	977	Patient Rooms		98	33	
Exam	AHU F-3	2.0	122	8	975	Patient Rooms		98	33	
Exam	AHU F-3	2.0	118	8	945	Patient Rooms		95	32	
Echo	AHU F-3	2.0	148	8	1,183	Patient Rooms		118	39	
Phys. Work	AHU F-3	1.0	153	8	1,227	Patient Rooms		123	41	
Echo Work	AHU F-3	2.0	136	8	1,087	Patient Rooms		109	36	
Heart Storage	AHU F-3	0.0	132	8	1,054	Sterile Storage		70	35	
Office	AHU F-3	1.0	161	8	1,286		Office Spaces			5
Consultation	AHU F-3	3.0	252	8	2,015	Patient Rooms		202	67	
shared Break	AHU F-3	3.0	259	8	2,073		Break Rooms			35
Exam	AHU F-3	2.0	144	8	1,151	Patient Rooms		115	38	
Exam	AHU F-3	2.0	146	8	1,168	Patient Rooms		117	39	
Exam	AHU F-3	2.0	143	8	1,140	Patient Rooms		114	38	
Exam	AHU F-3	2.0	138	8	1,101	Patient Rooms		110	37	
Exam	AHU F-3	2.0	144	8	1,149	Patient Rooms		115	38	
Exam	AHU F-3	2.0	146	8	1,168	Patient Rooms		117	39	
Data	AHU F-3	0.0	90	8	721		Telephone/data entry			0
Storage	AHU F-3	0.0	166	8	1,326		Storage Rooms			1
Mechanical	AHU F-3	0.0	461	8	3,692		Electrical Equipment Rooms			0
JC	AHU F-3	0.0	92	8	738		Janitor Closets, Trash Rooms, Recycling			0
Xray/CT	AHU F-3	2.0	485	8	3,879	X-Ray (diagnostic and treatment)		388	129	
Control Room	AHU F-3	1.0	164	8	1,313	Radiology waiting rooms		263	44	
Toilet	AHU F-3	0.0	73	8	586	Bathroom		98	0	
Change	AHU F-3	0.0	40	8	322		Locker/dressing Rooms			0
Change	AHU F-3	0.0	38	8	305		Locker/dressing Rooms			0
Ultra	AHU F-3	2.0	195	8	1,564	Patient Rooms		156	52	
Ultra	AHU F-3	2.0	206	8	1,645	Patient Rooms		164	55	
Toilet	AHU F-3	0.0	91	8	727	Bathroom		121	0	
Toilet	AHU F-3	0.0	85	8	677	Bathroom		113	0	

ROOM NAME	AHU	No. of People	ROOM DIMENSIONS			ASHRAE 170 Space Designation	ASHRAE 62.1 Space Designation	MINIMUM CFM REQUIRED		
			Area, SF	Height, FT	Volume, CF			SA	OUTSIDE AIR	
								AIA	AIA	IMC
Start Up	AHU F-3	1.0	94	8	755	Patient Rooms		75	25	
Toilet	AHU F-3	0.0	89	8	708	Bathroom		118	0	
Radiology Storage	AHU F-3	0.0	135	8	1,084	Sterile Storage		72	36	
Office	AHU F-3	1.0	120	8	958		Office Spaces			5
Xray	AHU F-3	2.0	249	8	1,993	x-Ray (diagnostic and treatment)		199	66	
Cast 1	AHU F-3	2.0	151	8	1,211	Patient Rooms		121	40	
Cast 2	AHU F-3	2.0	163	8	1,305	Patient Rooms		130	43	
Procedure/Exam	AHU F-3	2.0	186	8	1,484	Patient Rooms		148	49	
Phys. Work	AHU F-3	2.0	173	8	1,387	Patient Rooms		139	46	
Nurse Work	AHU F-3	3.0	261	8	2,091	Patient Rooms		209	70	
Phys. Work	AHU F-3	2.0	134	8	1,076	Patient Rooms		108	36	
Exam	AHU F-3	2.0	146	8	1,169	Patient Rooms		117	39	
Exam	AHU F-3	2.0	142	8	1,133	Patient Rooms		113	38	
Exam	AHU F-3	2	153.9	8	1,231	Patient Rooms		123	41	
Vitals	AHU F-3	1.0	74	8	592	Patient Rooms		59	20	
Toilet	AHU F-3	0.0	63	8	506	Bathroom		84	0	
Toilet	AHU F-3	0.0	70	8	561	Bathroom		93	0	
Vitals	AHU F-3	1.0	73	8	586	Patient Rooms		59	20	
Check-in	AHU F-3	2.0	240	8	1,923		Booking/Waiting			15
Tech Work	AHU F-3	2.0	260	8	2,082	Pharmacy		139	69	
Reception	AHU F-3	1.0	94	8	755		Booking/Waiting			8
Private Reception	AHU F-3	1.0	88	8	705		Booking/Waiting			8
Xray	AHU F-3	2.0	248	8	1,985	X-Ray (diagnostic and treatment)		198	66	
Xray	AHU F-3	2.0	276	8	2,208	X-Ray (diagnostic and treatment)		221	74	
Cast 3	AHU F-3	2.0	193	8	1,541	Patient Rooms		154	51	
RN/CT	AHU F-3	1.0	135	8	1,078	Patient Rooms		108	36	
PA Office	AHU F-3	1.0	114	8	915		Office Spaces			5
Cast 4	AHU F-3	2.0	183	8	1,464	Patient Rooms		146	49	
Toilet	AHU F-3	0.0	69	8	550	Bathroom		92	0	
RN/CT	AHU F-3	1.0	150	8	1,200	Patient Rooms		120	40	
Exam	AHU F-3	2.0	131	8	1,045	Patient Rooms		105	35	
Exam	AHU F-3	2.0	151	8	1,205	Patient Rooms		121	40	
Exam	AHU F-3	2.0	153	8	1,222	Patient Rooms		122	41	
Exam	AHU F-3	2.0	141	8	1,128	Patient Rooms		113	38	
Exam	AHU F-3	2.0	146	8	1,167	Patient Rooms		117	39	
Women	AHU F-3	0.0	229	8	1,835	Bathroom		306	0	
Men	AHU F-3	0.0	202	8	1,619	Bathroom		270	0	
Waiting	AHU F-3	3.0	374	8	2,995		Lobbies/prefunction			23
Waiting	AHU F-3	3.0	391	8	3,128		Lobbies/prefunction			23
Waiting	AHU F-3	3.0	386	8	3,087		Lobbies/prefunction			23

ROOM NAME	AHU	No. of People	ROOM DIMENSIONS			ASHRAE 170 Space Designation	ASHRAE 62.1 Space Designation	MINIMUM CFM REQUIRED			
			Area, SF	Height, FT	Volume, CF			SA	OUTSIDE AIR		
								AIA	AIA	IMC	
Waiting	AHU F-3	3.0	390	8	3,120		Lobbies/prefunction			23	
Waiting	AHU F-3	3.0	412	8	3,293		Lobbies/prefunction			23	
Waiting	AHU F-3	3.0	1,158	8	9,264		Lobbies/prefunction			23	
Waiting	AHU F-3	3.0	1,065	8	8,520		Lobbies/prefunction			23	
Elevator Lobby	AHU F-3	0.0	289	8	2,315		Lobbies/prefunction			0	
Alcove	AHU F-3	0.0	216	8	1,727	Corridor		58	0		
Corridor	AHU F-3	0.0	441	8	3,530	Corridor		118	0		
Corridor	AHU F-3	0.0	286	8	2,285	Corridor		76	0		
Corridor	AHU F-3	0.0	367	8	2,933	Corridor		98	0		
Corridor	AHU F-3	0.0	316	8	2,530	Corridor		84	0		
Corridor	AHU F-3	0.0	478	8	3,825	Corridor		127	0		
Corridor	AHU F-3	0.0	317	8	2,538	Corridor		85	0		
Corridor	AHU F-3	0.0	733	8	5,862	Corridor		195	0		
Corridor	AHU F-3	0.0	621	8	4,966	Corridor		166	0		
							TOTAL	2137	400		
Central Supply	AHU F-0	0.0	700	8	5,603	Sterile Storage		374	187		
Medical Records	AHU F-0	0.0	810	8	6,479		Storage Rooms			1	
Receiving	AHU F-0	2.0	365	8	2,924		Booking/Waiting			15	
Mechanical	AHU F-0	0.0	2,359	8	18,870		Electrical Equipment Rooms			0	
Corridor	AHU F-0	0.0	1,760	8	14,080	Corridor		469	0		
Break Room	AHU F-0	2.0	183	8	1,464		Break Rooms			30	
Toilets	AHU F-0	0.0	93	8	740	Toilet room		123	0		
Conference	AHU F-0	6.0	197	8	1,573		Conference/meeting			50	
Medical Records Storage	AHU F-0	0.0	215	8	1,718		Storage Rooms			1	
Storage	AHU F-0	0.0	90	8	719		Storage Rooms			1	
Practitioner	AHU F-0	2.0	109	8	868	Patient Rooms		87	29		
Practitioner	AHU F-0	2.0	114	8	914	Patient Rooms		91	30		
Practitioner	AHU F-0	2.0	119	8	951	Patient Rooms		95	32		
Practitioner	AHU F-0	2.0	114	8	916	Patient Rooms		92	31		
Practitioner	AHU F-0	2.0	114	8	916	Patient Rooms		92	31		
Break Room	AHU F-0	2.0	114	8	916		Break Rooms			30	
J.C.	AHU F-0	0.0	63	8	504		Janitor Closets, Trash Rooms, Recycling			0	
Resident	AHU F-0	1.0	118	8	941	Patient Rooms		94	31		
Mechanical	AHU F-0	0.0	461	8	3,688		Electrical Equipment Rooms			0	
Data	AHU F-0	0.0	91	8	728		Electrical Equipment Rooms			0	
Available	AHU F-0	0.0	137	8	1,098		Office Spaces			0	
Special Exam	AHU F-0	2.0	126	8	1,009	Patient Rooms		101	34		
Exam	AHU F-0	2.0	126	8	1,009	Patient Rooms		101	34		
Exam	AHU F-0	2.0	132	8	1,056	Patient Rooms		106	35		

ROOM NAME	AHU	No. of People	ROOM DIMENSIONS			ASHRAE 170 Space Designation	ASHRAE 62.1 Space Designation	MINIMUM CFM REQUIRED		
			Area, SF	Height, FT	Volume, CF			SA	OUTSIDE AIR	
								AIA	AIA	IMC
Exam	AHU F-0	2.0	132	8	1,056	Patient Rooms				
Office	AHU F-0	1.0	119	8	955		106	35	5	
Office	AHU F-0	1.0	120	8	956				5	
Office	AHU F-0	1.0	120	8	956				5	
Office	AHU F-0	1.0	120	8	956				5	
Med. Rec. Office	AHU F-0	1.0	188	8	1,506				1	
Waiting	AHU F-0	3.0	167	8	1,336				23	
Office	AHU F-0	1.0	116	8	927				5	
Office	AHU F-0	1.0	116	8	929				5	
Office	AHU F-0	1.0	116	8	929				5	
Office	AHU F-0	1.0	116	8	929				5	
Copy Room	AHU F-0	0.0	127	8	1,019				0	
Admin Assist	AHU F-0	1.0	131	8	1,050				5	
Work	AHU F-0	3.0	2,921	8	23,371				15	
Storage	AHU F-0	0.0	198	8	1,582				1	
Sewing	AHU F-0	0.0	174	8	1,388				0	
Equipment	AHU F-0	0.0	608	8	4,866				0	
Conference	AHU F-0	6.0	225	8	1,801		Electrical Equipment Rooms			
Plaster	AHU F-0	2.0	225	8	1,801	Patient Rooms			50	
Gait	AHU F-0	0.0	273	8	2,182	Patient Rooms	180	60		
Casting	AHU F-0	2.0	273	8	2,182	Patient Rooms	218	73		
Oven	AHU F-0	0.0	170	8	1,359	Patient Rooms	218	73		
LAM	AHU F-0	0.0	170	8	1,359	Patient Rooms	136	45		
Women	AHU F-0	0.0	239	8	1,915	Toilet room	136	45		
Men	AHU F-0	0.0	194	8	1,552	Toilet room	319	0		
Staff Change	AHU F-0	0.0	75	8	602		259	0		
ADA Toilet	AHU F-0	0.0	75	8	602	Toilet room			0	
File	AHU F-0	0.0	59	8	472		Locker/dressing Rooms			
Waiting Area	AHU F-0	3.0	575	8	4,598		100	0		
Reception	AHU F-0	2.0	129	8	1,032				1	
Elevator Lobby	AHU F-0	0.0	565	8	4,520				23	
Corridor	AHU F-0	0.0	1,072	8	8,576	Corridor			15	
Corridor	AHU F-0	0.0	1,501	8	12,008	Corridor	286	0		
Corridor	AHU F-0	0.0	641	8	5,128	Corridor	400	0		
							TOTAL	804	311	
Mech	AHU F-4	0.0	877	8	7,016		Electrical Equipment Rooms		0	
Director's Office	AHU F-4	1.0	262	8	2,093		Office Spaces		5	
Admin Office	AHU F-4	1.0	117	8	939		Office Spaces		5	
Faculty Office	AHU F-4	1.0	115	8	920		Office Spaces		5	
Faculty Office	AHU F-4	1.0	141	8	1,129		Office Spaces		5	
Faculty Office	AHU F-4	1.0	159	8	1,274		Office Spaces		5	

ROOM NAME	AHU	No. of People	ROOM DIMENSIONS			ASHRAE 170 Space Designation	ASHRAE 62.1 Space Designation	MINIMUM CFM REQUIRED		
			Area, SF	Height, FT	Volume, CF			SA	OUTSIDE AIR	
								AIA	AIA	IMC
Faculty Office	AHU F-4	1.0	126	8	1,012				5	
Faculty Office	AHU F-4	1.0	126	8	1,008				5	
Faculty Office	AHU F-4	1.0	123	8	982				5	
Business Manager	AHU F-4	1.0	149	8	1,195				5	
Director's Office	AHU F-4	1.0	201	8	1,606				5	
Admin Office	AHU F-4	1.0	133	8	1,063				5	
Faculty Office	AHU F-4	1.0	154	8	1,230				5	
Nurse's Office	AHU F-4	1.0	152	8	1,212				5	
Faculty Office	AHU F-4	1.0	129	8	1,034				5	
Faculty Office	AHU F-4	1.0	119	8	955				5	
Faculty Office	AHU F-4	1.0	130	8	1,040				5	
Faculty Office	AHU F-4	1.0	130	8	1,039				5	
Faculty Office	AHU F-4	1.0	120	8	964				5	
Faculty Office	AHU F-4	1.0	135	8	1,080				5	
Equipment Room	AHU F-4	0.0	135	8	1,083		Electrical Equipment Rooms		0	
Data	AHU F-4	0.0	84	8	674		Electrical Equipment Rooms		0	
Lab	AHU F-4	1.0	144	8	1,152	Laboratory, general	115	38		
Mech	AHU F-4	0.0	494	8	3,948		Electrical Equipment Rooms		0	
J.C.	AHU F-4	0.0	89	8	715		Janitor Closets, Trash Rooms, Recycling		0	
Staff Office Secretary/s	AHU F-4	1.0	206	8	1,651		Office Spaces		5	
Work Files/Copier	AHU F-4	1.0	136	8	1,089		Copy/Printing Rooms		0	
Staff Office	AHU F-4	1.0	98	8	781		Office Spaces		5	
Staff Office	AHU F-4	1.0	101	8	809		Office Spaces		5	
Staff Office	AHU F-4	1.0	98	8	787		Office Spaces		5	
Staff Toilet	AHU F-4	0.0	102	8	813	Toilet room	135	0		
Staff Office	AHU F-4	1.0	85	8	677		Office Spaces		5	
Staff Office	AHU F-4	1.0	106	8	851		Office Spaces		5	
Staff Office	AHU F-4	1.0	99	8	791		Office Spaces		5	
Fellow's Office	AHU F-4	2.0	226	8	1,806		Office Spaces		10	
Kitchen	AHU F-4	0.0	117	8	936		Kitchenettes		0	
Staff Office	AHU F-4	1.0	137	8	1,093		Office Spaces		5	
Staff Office	AHU F-4	1.0	85	8	678		Office Spaces		5	
Staff Office	AHU F-4	1.0	90	8	722		Office Spaces		5	
Staff Office	AHU F-4	1.0	85	8	683		Office Spaces		5	
Small Conference	AHU F-4	2.0	209	8	1,669		Conference/meeting		30	
Storage	AHU F-4	0.0	116	8	929		Storage Rooms		1	
Physician Workroom	AHU F-4	1.0	137	8	1,094	Patient Rooms	109	36		
Exam Room	AHU F-4	2.0	142	8	1,133	Patient Rooms	113	38		
Exam Room	AHU F-4	2.0	147	8	1,175	Patient Rooms	117	39		

ROOM NAME	AHU	No. of People	ROOM DIMENSIONS			ASHRAE 170 Space Designation	ASHRAE 62.1 Space Designation	MINIMUM CFM REQUIRED			
			Area, SF	Height, FT	Volume, CF			SA	OUTSIDE AIR		
								AIA	AIA	IMC	
Vital Signs	AHU F-4	2.0	91	8	725	Patient Rooms		72	24		
Vital Signs	AHU F-4	2.0	94	8	753	Patient Rooms		75	25		
Exam Room	AHU F-4	2.0	117	8	935	Patient Rooms		94	31		
Exam Room	AHU F-4	2.0	123	8	986	Patient Rooms		99	33		
Exam Room	AHU F-4	2.0	121	8	971	Patient Rooms		97	32		
IV Infusion Area	AHU F-4	3.0	297	8	2,378	Laboratory, general		238	79		
History/Intake Room	AHU F-4	2.0	152	8	1,215	Patient Rooms		121	40		
Nurse Station/Reception/Check-in	AHU F-4	2.0	556	8	4,445	Patient Rooms		445	148		
Nurse's Office	AHU F-4	2.0	110	8	879		Office Spaces			10	
Small Conference	AHU F-4	3.0	193	8	1,543		Conference/meeting			35	
Medication Room	AHU F-4	2.0	85	8	683	Medication room		46	23		
Procedure Lab	AHU F-4	3.0	201	8	1,606	Laboratory, general		161	54		
Toilet	AHU F-4	0.0	78	8	627	Toilet room		104	0		
Open Office	AHU F-4	0.0	469	8	3,748		Office Spaces			0	
Nourishment	AHU F-4	2.0	180	8	1,442	Patient Rooms		144	48		
Women's Toilet	AHU F-4	0.0	222	8	1,774	Toilet room		296	0		
Men's toilet	AHU F-4	0.0	204	8	1,630	Toilet room		272	0		
Lab	AHU F-4	2.0	913	8	7,302	Laboratory, general		730	243		
Calorimetry Room	AHU F-4	1.0	422	8	3,376	Laboratory, general		338	113		
Treadmill Testing	AHU F-4	1.0	106	8	850	Laboratory, general		85	28		
Locker Room	AHU F-4	0.0	110	8	877		Locker/dressing Rooms			0	
Exercise Area	AHU F-4	2.0	635	8	5,077	Laboratory, general		508	169		
Metabolic Lab/Body Comp. Lab	AHU F-4	1.0	168	8	1,342	Laboratory, general		134	45		
Vascular Lab	AHU F-4	1.0	284	8	2,275	Laboratory, general		228	76		
Corridor	AHU F-4	0.0	227	8	1,812	Corridor		60	0		
Corridor	AHU F-4	0.0	691	8	5,528	Corridor		184	0		
Waiting	AHU F-4	3.0	1,261	8	10,089		Booking/Waiting			23	
Corridor	AHU F-4	0.0	676	8	5,411	Corridor		180	0		
Waiting	AHU F-4	2.0	605	8	4,839		Booking/Waiting			15	
Corridor	AHU F-4	0.0	431	8	3,449	Corridor		115	0		
Alcove	AHU F-4	0.0	243	8	1,945	Corridor		65	0		
Elevator Lobby	AHU F-4	0.0	501	8	4,010		Lobbies/prefunction			0	
Corridor	AHU F-4	0.0	615	8	4,921	Corridor		164	0		
Corridor	AHU F-4	0.0	456	8	3,645	Corridor		121	0		
Corridor	AHU F-4	0.0	313	8	2,508	Corridor		84	0		
Corridor	AHU F-4	0.0	475	8	3,802	Corridor		127	0		
Corridor	AHU F-4	0.0	528	8	4,228	Corridor		141	0		
Corridor	AHU F-4	0.0	1,006	8	8,051	Corridor		268	0		
Conference	AHU F-4	3.0	523	8	4,185		Conference/meeting			35	
							TOTAL		1364	328	
Mechanical	AHU F-5	0.0	985	8	7,883		Electrical Equipment Rooms			0	
Conference	AHU F-5	3.0	575	8	4,602		Conference/meeting			35	

ROOM NAME	AHU	No. of People	ROOM DIMENSIONS			ASHRAE 170 Space Designation	ASHRAE 62.1 Space Designation	MINIMUM CFM REQUIRED		
			Area, SF	Height, FT	Volume, CF			SA	OUTSIDE AIR	
								AIA	AIA	IMC
Corridor	AHU F-5	0.0	254	8	2,030	Corridor				
Student Break	AHU F-5	2.0	295	8	2,362		68	0	30	
Shared Conference	AHU F-5	2.0	278	8	2,224				30	
Patient/Diab.	AHU F-5	2.0	141	8	1,130	Patient Rooms	113	38		
Patient/Diab.	AHU F-5	2.0	137	8	1,099	Patient Rooms	110	37		
Patient/Diab.	AHU F-5	2.0	154	8	1,235	Patient Rooms	123	41		
Res./Ed. Work	AHU F-5	1.0	270	8	2,161				5	
Office	AHU F-5	1.0	143	8	1,143				5	
Office	AHU F-5	1.0	145	8	1,160				5	
Phys. Work	AHU F-5	1.0	297	8	2,380				5	
Office	AHU F-5	1.0	163	8	1,301				5	
Storage	AHU F-5	0.0	137	8	1,099				1	
Storage	AHU F-5	0.0	132	8	1,056				1	
Data	AHU F-5	0.0	93	8	744				0	
Storage	AHU F-5	0.0	188	8	1,501				1	
Mechanical	AHU F-5	0.0	493	8	3,940				0	
J.C.	AHU F-5	0.0	106	8	846				0	
Exam	AHU F-5	2.0	149	8	1,189	Patient Rooms	119	40		
Exam	AHU F-5	2.0	145	8	1,160	Patient Rooms	116	39		
Exam	AHU F-5	2.0	160	8	1,283	Patient Rooms	128	43		
Toilet	AHU F-5	0.0	78	8	626	Toilet room	104	0		
Exam	AHU F-5	2.0	137	8	1,100	Patient Rooms	110	37		
Procedure	AHU F-5	2.0	138	8	1,107	Patient Rooms	111	37		
Exam	AHU F-5	2.0	161	8	1,288	Patient Rooms	129	43		
Exam	AHU F-5	2.0	154	8	1,232	Patient Rooms	123	41		
Nurse Work	AHU F-5	2.0	129	8	1,034	Patient Rooms	103	34		
Vitals	AHU F-5	2.0	78	8	622	Patient Rooms	62	21		
Reception	AHU F-5	1.0	129	8	1,031				5	
Exam	AHU F-5	2.0	131	8	1,050	Patient Rooms	105	35		
Exam	AHU F-5	2.0	124	8	990	Patient Rooms	99	33		
Exam	AHU F-5	2.0	134	8	1,072	Patient Rooms	107	36		
Patient Toilet	AHU F-5	0.0	89	8	712	Toilet room	119	0		
Vitals	AHU F-5	2.0	87	8	695	Patient Rooms	70	23		
Reception	AHU F-5	1.0	124	8	995				5	
Dictation	AHU F-5	1.0	103	8	823				5	
Exam	AHU F-5	2.0	134	8	1,071	Patient Rooms	107	36		
Exam	AHU F-5	2.0	126	8	1,007	Patient Rooms	101	34		
Procedure	AHU F-5	2.0	184	8	1,471	Patient Rooms	147	49		
Exam	AHU F-5	2.0	140	8	1,124	Patient Rooms	112	37		
Exam	AHU F-5	2.0	131	8	1,051	Patient Rooms	105	35		

ROOM NAME	AHU	No. of People	ROOM DIMENSIONS			ASHRAE 170 Space Designation	ASHRAE 62.1 Space Designation	MINIMUM CFM REQUIRED		
			Area, SF	Height, FT	Volume, CF			SA	OUTSIDE AIR	
								AIA	AIA	IMC
Nurse Work	AHU F-5	2.0	295	8	2,363	Patient Rooms		236	79	
Consult.	AHU F-5	2.0	295	8	2,360	Patient Rooms		236	79	
Exam	AHU F-5	2.0	135	8	1,080	Patient Rooms		108	36	
Exam	AHU F-5	2.0	134	8	1,071	Patient Rooms		107	36	
Exam	AHU F-5	2.0	132	8	1,054	Patient Rooms		105	35	
Exam	AHU F-5	2.0	146	8	1,170	Patient Rooms		117	39	
Exam	AHU F-5	2.0	143	8	1,142	Patient Rooms		114	38	
Exam	AHU F-5	2.0	142	8	1,138	Patient Rooms		114	38	
Nurse Work	AHU F-5	2.0	296	8	2,369	Patient Rooms		237	79	
Vitals	AHU F-5	2.0	78	8	623	Patient Rooms		62	21	
Vitals	AHU F-5	2.0	87	8	693	Patient Rooms		69	23	
Reception	AHU F-5	1.0	120	8	960		Office Spaces			5
Reception	AHU F-5	1.0	121	8	968		Office Spaces			5
Exam	AHU F-5	2.0	138	8	1,107	Patient Rooms		111	37	
Exam	AHU F-5	2.0	152	8	1,218	Patient Rooms		122	41	
Storage	AHU F-5	0.0	133	8	1,066		Storage Rooms			1
Exam	AHU F-5	2.0	142	8	1,136	Patient Rooms		114	38	
Group Conf./Work	AHU F-5	3.0	548	8	4,384		Conference/meeting			35
Staff Toilet	AHU F-5	0.0	78	8	624	Toilet room		104	0	
PVT. Infusion	AHU F-5	2.0	190	8	1,521	Laboratory, general		152	51	
Control	AHU F-5	2.0	611	8	4,888	Laboratory, general		489	163	
Infusion	AHU F-5	2.0	1,042	8	8,338	Laboratory, general		834	278	
Toilet	AHU F-5	0.0	74	8	589	Toilet room		98	0	
F.C./Consult	AHU F-5	2.0	158	8	1,262	Patient Rooms		126	42	
Lab	AHU F-5	2.0	280	8	2,243	Laboratory, general		224	75	
Meds	AHU F-5	2.0	159	8	1,270	Medication room		85	42	
Women's Toilet	AHU F-5	0.0	238	8	1,903	Toilet room		317	0	
Men's Toilet	AHU F-5	0.0	227	8	1,815	Toilet room		302	0	
Waiting	AHU F-5	3.0	1,170	8	9,357		Booking/Waiting			23
Waiting	AHU F-5	3.0	1,256	8	10,046		Booking/Waiting			23
Waiting	AHU F-5	2.0	246	8	1,968		Booking/Waiting			15
Corridor	AHU F-5	0.0	456	8	3,646	Corridor		122	0	
Elevator Lobby	AHU F-5	0.0	562	8	4,499		Lobbies/prefunction			0
Alcove	AHU F-5	0.0	241	8	1,925	Corridor		64	0	
Corridor	AHU F-5	0.0	638	8	5,104	Corridor		170	0	
Corridor	AHU F-5	0.0	458	8	3,661	Corridor		122	0	
Corridor	AHU F-5	0.0	456	8	3,647	Corridor		122	0	
Corridor	AHU F-5	0.0	553	8	4,422	Corridor		147	0	
Corridor	AHU F-5	0.0	475	8	3,797	Corridor		127	0	
Corridor	AHU F-5	0.0	340	8	2,722	Corridor		91	0	
Corridor	AHU F-5	0.0	474	8	3,791	Corridor		126	0	
Corridor	AHU F-5	0.0	407	8	3,259	Corridor		109	0	
Corridor	AHU F-5	0.0	395	8	3,159	Corridor		105	0	