

Ventilation Air for Buildings

The Florida Mechanical code requires the introduction of ventilation air for all buildings to maintain a healthy indoor environment for the occupants within the enclosed space. Ventilation air that is mechanically induced must be “fresh” outdoor air (non-contaminated) that is introduced into the conditioned space by the HVAC system. Outdoor air intake openings should be located a minimum of 10 feet from any noxious contaminant (plumbing vents, chimneys, streets, alleys, and parking lots to name a few). Section 403 of the Florida Mechanical Code prescribes the amount of ventilation air required and is based on the building’s space by space classification(s), conditioned area, the anticipated occupancy amounts, and occupancy duration per conditioned space. The ventilation air is first conditioned by the HVAC equipment prior to delivery into the breathing zone of each occupied space.

Almost year round the outdoor air in Florida is hot and moist - so a large amount of ventilation air is not desired – only the mechanical code prescribed rate is desired. Occupants who are sensitive to outdoor air contaminants may suffer if the ventilation air rates are too high, and occupants who are sensitive to indoor air contaminants may suffer if the ventilation air rate is too low. The HVAC system must be sized correctly to neutralize the extra heat and moisture associated with the introduction of Florida outdoor air, setting the correct amount of outdoor air is critical.

Residential ventilation air is required at a rate of 15 cfm of “fresh outdoor air” per person; residential people count is set at one person per bedroom plus one extra. Most every Florida home correctly constructed after year 2000 will require ventilation air because the homes building envelope will not naturally “leak” (aka infiltrate) the code required cfm amounts for occupant health. Homes constructed after 7/31/2017 requires building envelope construction tightness testing that are verified by performing a blower door test. Blower door testing results from the past few years show that smaller homes (less than 2k square feet) will almost always require ventilation air, while very large homes with few bedrooms may not require ventilation air at all. Proposed building infiltration (infiltration is natural building leakage) cfm calculations are performed prior to construction and use a construction practice “semi tight” for today’s modern homes. If the calculated infiltration cfm rate is lower than the code required 15 cfm per person, infiltration will not satisfy the health of the occupants. To satisfy the ventilation requirement, a ventilation air duct, damper, and motorized closure device is added to the hvac system. This ventilation air duct will induce the ventilation air directly to the hvac equipment where the ventilation air will be conditioned prior to delivery to the conditioned spaces. This ventilation air duct is controlled by the hvac equipment indoor fan to operate only during modes: “fan on”, “heating”, or “cooling”, the ventilation air duct remains sealed air tight while the hvac system indoor fan motor is not in operation. Below shows a chart with modern “semi tight” construction practices for various homes and a typical hvac equipment schedule showing both the mechanical ventilation rate and the calculated infiltration rate for a typical home.

SUMMER INFILTRATION CFM / AVERAGE ENVELOPE CONSTRUCTION PRACTICE			
CONDITIONED SQUARE FEET	1 STORY 3 - 4 EXP.	2 STORY 3 - 4 EXP.	CONDO 1-2 EXP.
UP TO 900	38	49	43
901 - 1500	46	60	54
1501-2000	53	69	61
2001 - 3000	64	84	76
MORE THAN 3000	72	91	82

1960 - 2000
average leak used

SUMMER INFILTRATION CFM / SEMI-TIGHT ENVELOPE CONSTRUCTION PRACTICE			
CONDITIONED SQUARE FEET	1 STORY 3 - 4 EXP.	2 STORY 3 - 4 EXP.	CONDO 1-2 EXP.
UP TO 900	26	34	30
901 - 1500	32	42	36
1501-2000	37	48	43
2001 - 3000	44	60	52
MORE THAN 3000	48	62	58

2001 -
semi tight used

HEAT PUMP SCHEDULE	
AIR HANDLER MARK:	AHU-1
UNIT MANUFACTURER:	AMERICAN STND
UNIT MODEL NUMBER:	TAM7A0C36H
UNIT DIMEN H/W/D:	56.9x23.5x21.8
UNIT WEIGHT:	146
SUPPLY PLENUM SIZE :	20.5x14.35
RETURN PLENUM SIZE :	20.5x17.15
MANUAL D DUCT CFM:	1200 / .510
SUPPLY FAN CFM / SP :	1230 / .1 to .9
SUPPLY FAN H/P :	1/2
VENTILATION AIR CFM:	60
AHU OFF / INFILTRATION:	48
UNIT PHASE / HERTZ:	1 / 60
UNIT VOLTAGE:	208 / 240
HEATER KW:	3.6 / 4.8
AHU + HEAT MOP:	25 / 30

Based on the chart shown above left for modern home construction, most every home will have a natural “infiltration” leakage rate too low to meet the ventilation rate required for a healthy indoor environment. Shown right, the hvac equipment schedule for this 3 bedroom home shows the natural “infiltration” leakage rate for this building envelope to be only 48 cfm (good for only 3 occupants) when the hvac system fan is off. The equipment schedule also shows a ventilation air duct that introduces 60 cfm during indoor air fan operation, this ventilation cfm rate is correct for the 4 occupants in this home. Another benefit of adding a ventilation air duct to a home is that during indoor air fan operation the building’s interior spaces will be slightly pressurized, interior building relief air will occur at the exit points like backdraft dampers (located in the range and bath fans) and the building envelope leakage points.

Commercial ventilation air is required at a rate shown in table 403.3 of the Florida Mechanical code on a space by space basis. Commercial projects require mechanically induced ventilation air for every space that contains people. Occupant amounts, activity levels, duration, and space classification are all important factors when performing commercial building heat load and ventilation air calculations. The amount of ventilation air required for occupant health will vary depending on how the building is classified (office, church, retail, specialty), each space classification (conference, waiting, corridor, etc.), and the anticipated hourly occupancy per space. Ventilation must be designed to maintain a neutral or positive interior building pressure (Florida Mechanical Code 403.1), so the amount of exhaust air from the building interior must be approximately equal to the amount ventilation air being introduced into the building interior. The indoor air handler fan must operate continuously during occupied hours (Florida Mechanical Code 401.3) when used to introduce the ventilation air, and the ventilation air ducts must be closed when no occupants are present. Occupants with occupancy durations of less than one hour should be adjusted to 1/2 of the listed ventilation air cfm rate (waiting rooms, conference rooms, exam rooms, etc.) example: a conference room with infrequent meetings – the occupant amount used in the ventilation calculations for the conference room should be based on occupant duration of less than one hour. This adjustment will account for the fact that the occupants can’t simultaneously be in both the conference room and in their offices during the conference meeting. Shown below is a partial sample of the Florida ventilation air requirements for commercial and residential buildings, also shown is a ventilation calculation often seen on a typical HVAC design.

TABLE 403.3 REQUIRED OUTDOOR VENTILATION AIR			TABLE 403.3—continued REQUIRED OUTDOOR VENTILATION AIR		
OCCUPANCY CLASSIFICATION	ESTIMATED MAXIMUM OCCUPANT LOAD, PERSONS PER 1,000 SQUARE FEET ^a	OUTDOOR AIR [Cubic feet per minute (cfm) per person] UNLESS NOTED ^d	OCCUPANCY CLASSIFICATION	ESTIMATED MAXIMUM OCCUPANT LOAD, PERSONS PER 1,000 SQUARE FEET ^a	OUTDOOR AIR (Cubic feet per minute (cfm) per person) UNLESS NOTED ^d
Correctional facilities			Private dwellings, single and multiple		
Cells			Garages, common for multiple units ^b	—	1.5 cfm/ft ²
without plumbing fixtures	20	20	Garages, separate for each dwelling	—	100 cfm per car
with plumbing fixtures ^{a,b}	20	20	Kitchens ^e	—	100 cfm intermittent or 25 cfm continuous
Dining halls	100	15	Living areas ^f	Based upon number of bedrooms, first bedroom: 2; each additional bedroom: 1	0.35 air changes per hour ^g or 15 cfm per person, whichever is greater
Guard stations	40	15	Toilet rooms and bathrooms ^{e, h}	—	Mechanical exhaust capacity of 50 cfm intermittent or 20 cfm continuous
Dry cleaners, laundries					
Coin-operated dry cleaner	20	15			
Coin-operated laundries	20	15			
Commercial dry cleaner	30	30			
Commercial laundry	10	25			
Storage, pick up	30	35			
Education					
Auditoriums	150	15			
Classrooms	50	15			
Corridors	—	0.10 cfm/ft ²			
Laboratories	30	20			
Libraries	20	15			
Locker rooms ^b	—	0.50 cfm/ft ²			
Music rooms	50	15			
Smoking lounges ^{b,g}	70	60			
Training rooms	20	20			

BUILDING VENTILATION CALCULATION								
SQ FT	CLASSIFY	OCCUPANTS	OCCUPANT VA	AREA VA	MAX. VENT AIR	DURATION *	TOTAL AIR	CFM - PERSON
267	Office / Break	2	5	0.06	26.02	1	26.02	13.01
141	Reception / Wait	4	5	0.06	28.46	1	28.46	7.12
BUILDING VENT TOTALS		6				VARIES	54 minimum	70 provided
THIS BUILDING COMPLIES WITH THE 6th EDITION (12/31/2017) FLORIDA MECHANICAL CODE SECTION 403 AND TABLE 403.3.1.1								
THE OCCUPANTS SHOWN ARE ACTUAL EXPECTED OCCUPANTS AND MAY DIFFER FROM THE OCCUPANCY SHOWN FOR EGRESS / FIRE CODE								
VENTILATION AIR RATES ARE ADJUSTED FOR VARIABLE OCCUPANCY BASED ON THE ACTUAL TIME THE OCCUPANT OCCUPIES THE SPACE								