

# **Simplified Mechanical Approach**

# **QUICK-GUIDE**

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for *ASHRAE 90.1-2013*

## How to Use the Guide

This guide is intended to help explain the commercial portion of the energy code and does not necessarily include all aspects and details. This guide is organized by building component and attempts to compile all relevant information and key practices related to each component. Each entry emphasizes the requirements of ASHRAE 90.1-2013.

## Need Help?

Additional Online Resources:

[www.southface.org/education/our-courses/georgia-energy-code-support-documents](http://www.southface.org/education/our-courses/georgia-energy-code-support-documents)

Southface Institute Energy Code Helpline:

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## Scope of Simplified Approach

### Approach

The simplified approach is an optional path for compliance within ASHRAE 90.1. This approach involves 18 requirements, which are detailed on the following pages.

Buildings comply with this mechanical section of ASHRAE 90.1 when the following conditions are met:

- a. Building is two stories or fewer in height.
- b. Gross floor area is less than 25,000 sq. ft.
- c. Each HVAC system in the building must comply with the 18 requirements.

**Code reference**

ASHRAE 90.1-2013—Section 6.3



This small commercial office building is an excellent candidate for the simplified compliance approach.

## 1. Single Zone

### Inspection Requirements

Verify that each system serves a single HVAC zone.

### Details

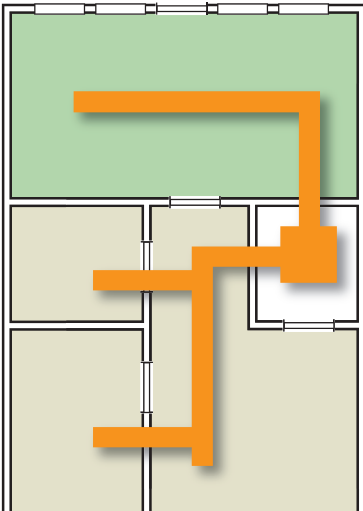
An HVAC zone is a space or group of spaces within a building with heating and cooling requirements that are sufficiently similar so that desired conditions (e.g., temperature) can be maintained throughout using a single sensor (e.g., thermostat or temperature sensor).

Each system should have only one thermostat. Multi-zone mechanical systems would not meet this requirement (and would thus not be able to show compliance using the Simplified Approach), but separate mechanical systems serving each zone would.

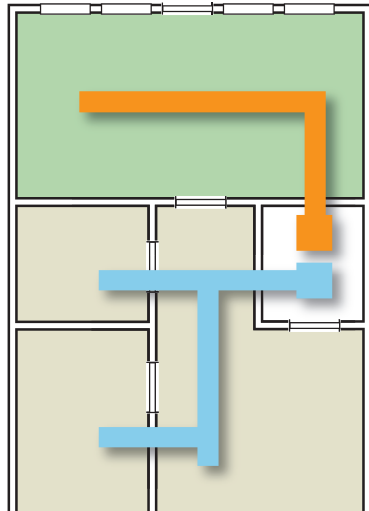
### Code reference

ASHRAE 90.1-2013—Section 6.3.2

Improperly zoned spaces



Properly zoned spaces



## 2. Variable Flow Equipment

### Inspection Requirements

Verify that variable fan speed equipment meets control requirements of Section 6.5.3.2.1.

### Details

DX and chilled-water cooling units that control the capacity of the mechanical cooling directly based on space temperature shall have a minimum of two stages of fan control. The following rules apply:

- Low or minimum speed shall not exceed 66% of full speed.
- At low or minimum speed, the fan system shall draw no more than 40% of the fan power at full fan speed.
- Low or minimum speed shall be used during periods of low cooling load and ventilation-only operation.

All other units—including DX cooling units and chilled-water units that control the space temperature by modulating airflow—shall have modulating fan control. The following rules apply:

- Minimum speed shall not exceed 50% of full speed.
- At minimum speed, the fan system shall draw no more than 30% of the power at full fan speed.
- Low or minimum speed shall be used during periods of low cooling load and ventilation-only operation.

Units that include an air-side economizer to meet the requirements of Section 6.5.1 shall have a minimum of two speeds of fan control during economizer operation.

Some exceptions are made when ASHRAE 62.2 requirements necessitate larger volumes of outside air or for low-power fans. See Section 6.5.3.2.1 for full exception details.

**Code reference**

ASHRAE 90.1-2013—Section 6.3.2

3. Cooling Equipment

Inspection Requirements

Verify that construction documents indicate air-cooled or evaporatively cooled equipment meet minimum efficiencies. For example, a five-ton or smaller heat pump or air conditioner must be a 13.0 SEER or higher. Verify that field installation matches construction documents.

Note: Evaporatively cooled equipment is rarely used in the Southeast.

Details

Cooling shall be provided by a unitary packaged or split-system air conditioner that is either air-cooled or evaporatively cooled, with efficiency meeting the requirements shown in ASHRAE 90.1-2013, Table 6.8.1A (air conditioners), Table 6.8.1B (heat pumps), or Table 6.8.1D (packaged terminal and room air conditioners and heat pumps) for the applicable category.

Code reference                      ASHRAE 90.1-2013—Section 6.3.2,  
Table 6.8.1A, Table 6.8.1B or Table 6.8.1D

TABLE 6.8.1A    Electronically Operated Unitary Air Conditioners and Condensing Units—  
Minimum Efficiency Requirements

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency <sup>a</sup>	Test Procedure <sup>b</sup>
Air conditioners, air cooled	<65,000 Btu/h <sup>c</sup>	All	Split system	13.0 SEER (as of 1/23/2006)	ARI 210/240
			Single package	13.0 SEER (as of 1/23/2006)	
Through-the-wall, air cooled	≤30,000 Btu/h <sup>c</sup>	All	Split system	10.9 SEER (as of 1/23/2006) 12 SEER (as of 1/23/2010)	
			Single package	10.6 SEER (as of 1/23/2006) 12.0 SEER (as of 1/23/2010)	
Small-duct high-velocity, air cooled	<65,000 Btu/h <sup>c</sup>	All	Split system	10 SEER	



## 4. Economizers

### Inspection Requirements

Verify that economizer functions are installed and properly functioning as required by Section 6.5.1. Note: Economizers are now required for most commercial buildings in CZs 2-4.

### Details

ASHRAE 90.1-2013 now requires economizers for systems > 5 tons in CZs 2-4. (This is a significant change from the previous Georgia commercial energy code. Many more commercial buildings now require economizers.)

The HVAC system shall have an air economizer where indicated in Table 6.5.1, with controls as indicated in Tables 6.5.1.1.3A and 6.5.1.1.3B and with either barometric or powered relief sized to prevent over-pressurization of the building. Outdoor air dampers for economizer use shall be provided with blade and jamb seals.

There are 10 exceptions, including for systems in certain types of computer rooms, healthcare facilities, and supermarkets. See Section 6.5.1 for details.

Computer room economizers are never required in CZs 2-4. (See Table 6.5.1-2.)

The use of an economizer may be traded off with more efficient equipment. In CZ2, economizer controls can be eliminated by using equipment that is 17% more efficient than the minimum; in CZ3, the threshold is 27%, and in CZ4 it is 42%. (See Table 6.5.1-3.)

### Code reference

ASHRAE 90.1-2013—Section 6.3.2 & 6.5.1





## 5. Heating Equipment

### Inspection Requirements

Verify that construction documents indicate heating equipment meets minimum efficiencies.

Verify that field installation matches construction documents.

### Details

Heating must be provided by one of the following:

- Unitary packaged or split-system heat pump that meets applicable efficiency requirements shown in Table 6.8.1-2 (heat pumps) or Table 6.8.1-4 (packaged terminal and room air conditioners and heat pumps)
- Fuel-fired furnace that meets applicable efficiency requirements shown in Table 6.8.1-5 (furnaces, duct furnaces, and unit heaters)
- Electric resistance heater
- Baseboard system connected to a boiler that meets applicable efficiency requirements shown in Table 6.8.1-6 (boilers)

### Code reference

ASHRAE 90.1-2013—Section 6.3.2,  
Table 6.8.1A, Table 6.8.1B or Table 6.8.1D;  
Table 6.8.1-2 (heat pump requirements)

## 6. Exhaust Air Energy Recovery

### Inspection Requirements

Verify that energy recovery is installed for exhaust air systems as required.

### Details

The system shall meet the exhaust air energy recovery requirements of Section 6.5.6.1.

Each fan system shall have an energy recovery system when the system's supply airflow rate exceeds the value listed in Tables 6.5.6.1-1 and 6.5.6.1-2, based on the climate zone and percentage of outdoor airflow rate at design conditions. In general, this means very large systems, systems with a large volume of outdoor air, or systems which run more than 8,000 hours per year.

Table 6.5.6.1-1 is used for all ventilation systems that operate less than 8,000 hours per year. Table 6.5.6.1-2 is used for all ventilation systems that operate 8,000 or more hours per year.

Energy recovery systems must have at least 50% energy recovery effectiveness. Fifty percent energy recovery effectiveness means a change in the enthalpy of the outdoor air supply equal to 50% of the difference between the outdoor air and return air enthalpies at design conditions.

Provisions must be made to bypass or control the energy recovery system to permit air economizer operation as required by Section 6.5.1.1.

### Code reference

ASHRAE 90.1-2013—Section 6.3.2

**TABLE 6.5.6.1-1 Exhaust Air Energy Recovery Requirements for Ventilation Systems Operating Less Than 8,000 Hours per Year**

% Outdoor air at full design airflow rate	≥10% and <20%	≥20% and <30%	≥30% and <40%	≥40% and <50%	≥50% and <60%	≥60% and <70%	≥70% and <80%	≥80%
Design supply airflow rate (cfm) for CZs 2-4	≥26,000	≥16,000	≥5500	≥4500	≥3500	≥2000	≥1000	≥0

**TABLE 6.5.6.1-1 Exhaust Air Energy Recovery Requirements for Ventilation Systems Operating Less Than 8,000 Hours per Year**

% Outdoor air at full design airflow rate	≥10% and <20%	≥20% and <30%	≥30% and <40%	≥40% and <50%	≥50% and <60%	≥60% and <70%	≥70% and <80%	≥80%
Design supply airflow rate (cfm) for CZs 2-4	≥2500	≥2000	≥1000	≥500	>0	>0	>0	>0
CZ4	>0	>0	>0	>0	>0	>0	>0	>0

7. Thermostat Controls

**Inspection Requirements**

Verify that the system is controlled by a manual changeover or dual setpoint thermostat.

**Details**

A typical programmable thermostat will meet these requirements.

Code reference                      ASHRAE 90.1-2013—Section 6.3.2



## 8. Supplemental Heat

### Inspection Requirements

Verify that heat pump supplemental (auxiliary) heat functions have proper control system. This requirement is only applicable if heat pumps are installed. If so, projects must use some control device (such as an outdoor temperature lockout device) capable of restricting supplemental auxiliary resistance heat from operating when the heat pump compressor can meet the load.

### Details

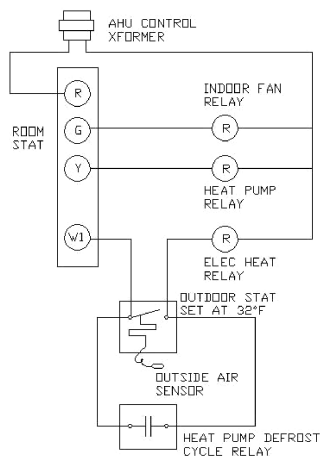
Heat pumps with auxiliary electric resistance heat must have controls that prevent supplemental heater operation when the heating load can be met by the heat pump alone. Supplemental heater operation is permitted during outdoor coil defrost cycles. The heat pump must be controlled by either:

1. A digital or electronic thermostat designed for heat-pump use that energizes auxiliary heat only when the heat pump has insufficient capacity to maintain setpoint or to warm up the space at a sufficient rate; OR,
2. A multistage space thermostat and an outdoor air thermostat wired to energize auxiliary heat only on the last stage of the space thermostat and when outdoor air temperature is less than 40°F.

There is an exception for some NAECA-certified equipment.

### Code reference

ASHRAE 90.1-2013—Section 6.3.2



Sample Wiring Schematic for Electric Heat Lockout on Heat Pumps

## 9. Reheat

### Inspection Requirements

Verify that the system controls do not permit reheat or any other form of simultaneous heating and cooling for humidity control.

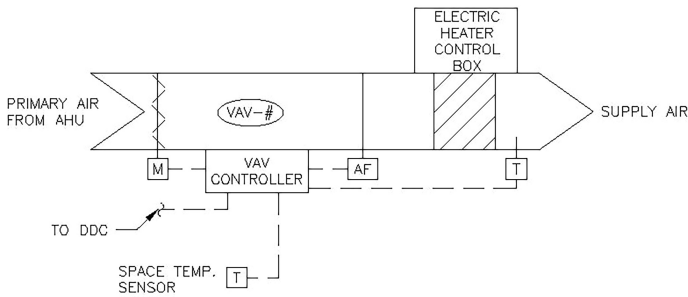
### Details

A system may not cool then reheat air to control humidity. An example of this is commonly seen in schools where a 100% outside air rooftop unit cools then reheats air.

In general, reheat is banned (with a few exceptions such as site-solar energy) as more efficient means of dehumidification are available. If reheat is desired for humidity control, the Prescriptive Path must be used to demonstrate compliance.

### Code reference

ASHRAE 90.1-2013—Section 6.3.2



1  
M502.0

TYPICAL VAV BOX WITH  
ELECTRIC REHEAT CONTROL DIAGRAM  
SCALE: NONE

Reheat is prohibited by the Simplified approach and has limited applications in the Prescriptive approach.

## 10. Timeclock Control

### Inspection Requirements

Verify that appropriate timeclock controls have been installed.

### Details

Systems with a cooling or heating capacity greater than 15,000 Btu/h and a supply fan motor power greater than 0.75hp must have a timeclock control that satisfies the following five requirements:

1. Can start and stop the system under different schedules for seven different day types per week
2. Is capable of retaining programming and time setting during a loss of power for a period of at least ten hours
3. Includes an accessible manual override that allows temporary operation of the system for up to two hours
4. Is capable of temperature setback down to 55°F during off-hours
5. Is capable of temperature setup to 90°F during off-hours

Hotel/motel guestrooms and spaces requiring continuous operation are exempted.

Code reference

ASHRAE 90.1-2013—Section 6.3.2



## 11. Pipe Insulation

### Inspection Requirements

Verify that insulation on piping is properly installed and protected.

Note: Refrigerant piping requires insulation, and insulation must be protected from the elements (e.g., wind, rain, solar UV).

### Details

HVAC piping must be insulated according to Tables 6.8.3-1 and 6.8.3-2. Insulation exposed to weather must be protected by aluminum, sheet metal, painted canvas, or plastic cover. Cellular foam insulation must be protected as above or painted with a coating that is water resistant and provides shielding from solar radiation.

Piping within manufacturer's units is exempt.

### Code reference

ASHRAE 90.1-2013—Section 6.3.2



## 12. Duct Insulation

### Inspection Requirements

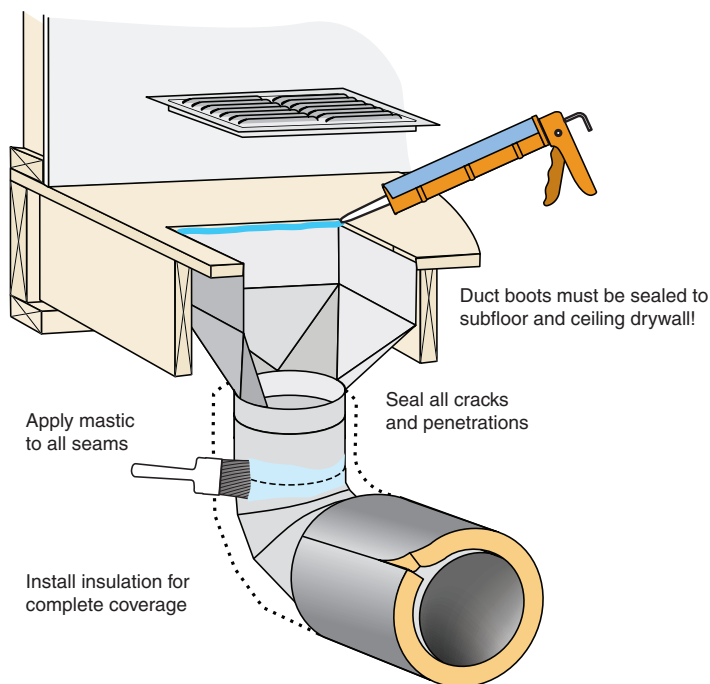
Verify that ductwork and plenums are insulated and sealed as required. R-6 will satisfy all conditions in CZs 2-4. Be sure the duct air barrier (liner, duct board, etc.) has been air sealed by performing a visual inspection of the duct system's collars, connectors, seams, and plenums.

### Details

Ductwork and plenums must be insulated according to Tables 6.8.2-1 and 6.8.2-2. Ductwork must be sealed according to Section 6.4.4.2.1.

### Code reference

ASHRAE 90.1-2013—Section 6.3.2





13. Air Balancing Report

Inspection Requirements

Verify that construction documents require an air-balance report to be provided to the building owner (or representative) for all HVAC systems. Request report at final mechanical inspection.

Details

Construction documents shall require a ducted system to be air balanced according to industry-accepted procedures. Typically, this measured air flow is within 10% of the design CFM.

Code reference                      ASHRAE 90.1-2013—Section 6.3.2

*Sample test and balance report*

AIRE-BAL

AIR MOVING EQUIPMENT TEST SHEET

Project: Chastain Tennis Center   Location: Fulton Co., GA   Date: 8/23/10

Unit No.	AHU-1		DH-1	
Location	Mechanical Room		Mechanical Room	
Manufacturer	Trane		Honeywell	
Model No.	4TEE3F65B1000		DH150	
Serial No.	100831331V		D1009764	
Operating Conditions	Specified	Actual	Specified	Actual
Total CFM	1820	1835	---	---
Return CFM	1420	1442	---	---
O.S.A. CFM	400	393	---	---
Ext. S.P.	.60"	.71"	---	.27"
Suction Press.	---	.49"	---	.43"
Disch. Press.	---	.22"	---	-.16"
Fan Sheave	---	D.D.	---	D.D.
Motor Sheave	---	D.D.	---	D.D.
Belts	---	D.D.	---	D.D.
Motor Manuf.	---	G.E.	---	G.E.
Motor Size	1.0	1.0	160W	160W
Voltage	208	207	120	120
Phase	1	1	1	1
Motor RPM	MED	MED/HI	HIGH	HIGH
Operating Conditions	Rated	Running	Rated	Running
Amperage	7.0	2.4	1.4	1.0
Fan RPM	MED	MED/HI	HIGH	HIGH

## 14. Automatic Dampers

### Inspection Requirements

Verify that ventilation and exhaust systems have a gravity or motorized damper as required.

### Details

Outdoor air intake and exhaust systems shall meet the requirements of Section 6.4.3.4.

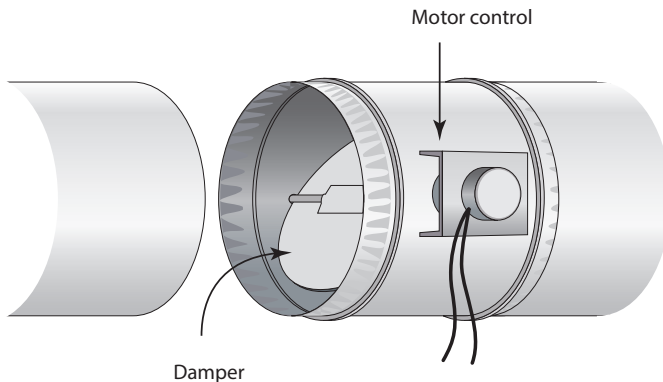
All outdoor air intake and exhaust systems shall be equipped with motorized dampers that will automatically shut when the systems or spaces served are not in use.

Non-motorized backdraft gravity dampers are acceptable for exhaust and relief in buildings fewer than three stories and for ventilation air intakes and exhaust/relief dampers in buildings of any height located in CZs 2-3 and in systems with a design outdoor air intake or exhaust capacity of 300 cfm or less.

Dampers are not required in ventilation or exhaust systems serving unconditioned spaces or in exhaust systems serving “Type 1” kitchen hoods.

### Code reference

ASHRAE 90.1-2013—Section 6.3.2



## 15. Interlocked Thermostats

### Inspection Requirements

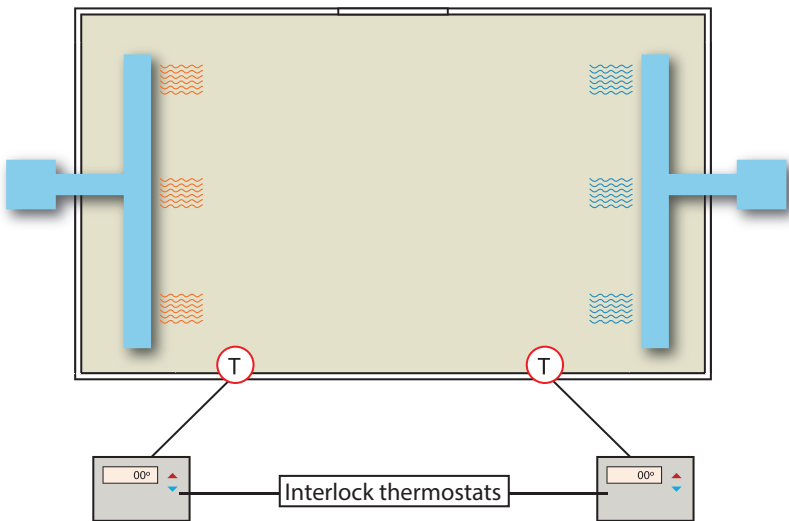
Verify that thermostat systems in the same zone have the ability to be interlocked. An example where this would be applicable is a conference room served by two systems. The system controls must be interlocked to prevent heating by one unit and cooling by another at the same time.

### Details

Where separate heating and cooling equipment serves the same space or zone, thermostats must be interlocked to prevent simultaneous heating and cooling.

Code reference

ASHRAE 90.1-2013—Section 6.3.2



Interlocked thermostats prevent simultaneous heating and cooling by separate systems

16. Optimum Start Controls

Inspection Requirements

Verify that systems with a design supply air capacity > 10,000 cfm have optimum start controls.

Details

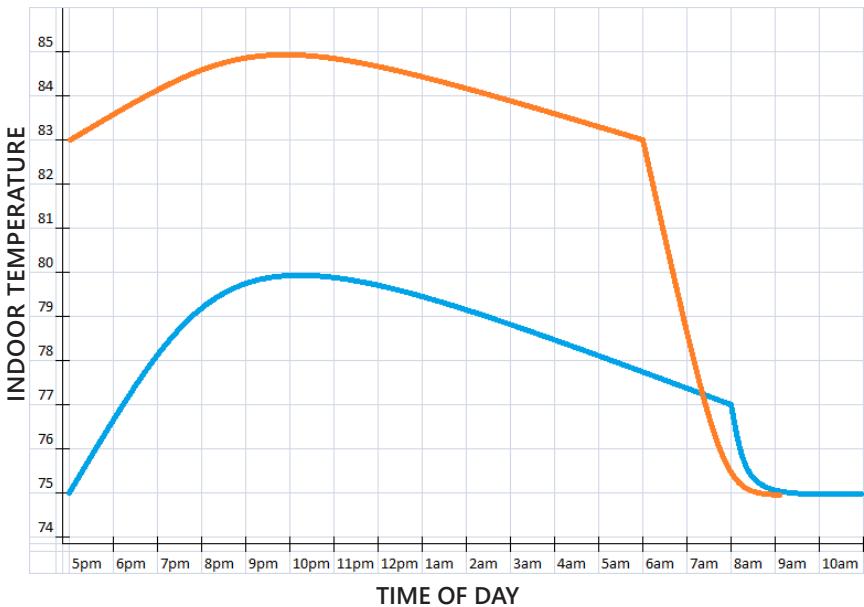
Systems with a design supply air capacity greater than 10,000 cfm shall have optimum start controls.

A 10,000 cfm system will typically be 25 cooling tons or larger. These systems require a smart thermostat or control system to provide optimum start capability. Sometimes referred to as “adaptive learning,” these controls are designed to automatically adjust the start time of an HVAC system each day with the intention of bringing the space to the desired occupied temperature levels immediately before scheduled occupancy. For example, a building that is set back over the weekend will likely require a different (earlier) start time for the system to recover on Monday morning than on other weekdays.

Code reference

ASHRAE 90.1-2013—Section 6.3.2

Cooling Season Optimum Start Recovery



## 17. Demand-Controlled Ventilation

### Inspection Requirements

Verify that demand-controlled ventilation systems are installed as required.

### Details

Demand-control ventilation (DCV) is required for spaces that are larger than 500 sq. ft. and have a design occupancy for ventilation of greater than 25 people per 1000 sq. ft. of floor area. In addition, these spaces must be served by systems with one or more of the following:

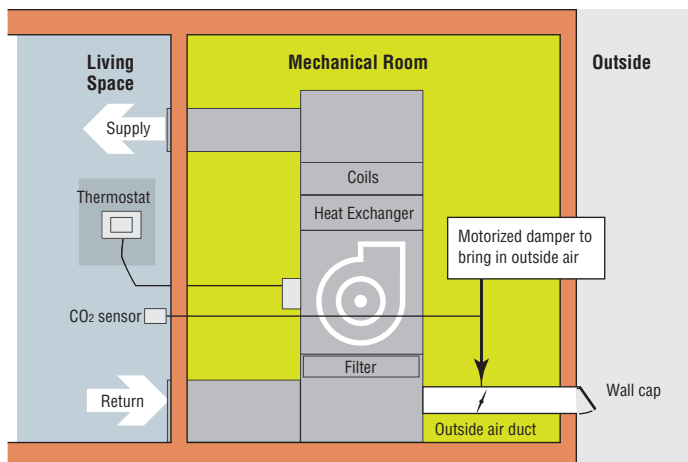
- Air-side economizer
- Automatic modulating control of outdoor air damper
- Design outdoor airflow greater than 3000 cfm

Exceptions are provided for:

- Systems with the exhaust air energy recovery complying with Section 6.5.6.1
- Multi-zone systems without direct digital control (DDC) of individual zones
- Systems with a design outdoor airflow less than 750 cfm
- Spaces where >75% of the design outdoor airflow is required for makeup air that is exhausted or transfer air (required for makeup air that is exhausted from other spaces)
- Correctional cells, daycare sickrooms, science labs, barbers, beauty and nail salons, and bowling alley seating.

Code reference

ASHRAE 90.1-2013—Section 6.3.2



## 18. Door Switches

### Inspection Requirements

Verify that the system complies with the door switch requirements.

### Details

Any conditioned space with a door that opens to the outdoors must be provided with the following controls that when the door is open:

- Disables mechanical heating or resets the heating setpoint to 55°F or lower within five minutes of the door being left open
- Disables mechanical cooling or resets the cooling setpoint to 90°F or greater within five minutes of the door being left open

Mechanical cooling may remain enabled if outdoor air temperature is below space temperature. This includes doors with more than one-half glass.

Exceptions are provided for:

- Building entries with automatic closing devices
- Any space without a thermostat
- Alterations to existing buildings
- Loading docks

**Code reference**

ASHRAE 90.1-2013—Section 6.3.2