

## HVAC Characteristics

Information on the characteristics of the heating, ventilation, and air conditioning (HVAC) system(s) in the entire BASE building including types of ventilation, equipment configurations, and operation and maintenance issues was acquired by examining the building plans, conducting a building walk-through, and speaking with the building owner, manager, and/or operator. This information was collected using standard forms available in the appendices of the protocol during the building preliminary visit, and verified by the field team during the study week.

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**BASE Buildings HVAC Characteristics:** Type of Ventilation

Type of Ventilation	Number of Buildings Reporting <sup>1</sup>
Mechanical	98
Natural	3
Total Number of Buildings Reporting	100

<sup>1</sup>Column total adds up to greater than the total number of buildings reporting as one building used a combination of mechanical ventilation and natural ventilation (the building's study space employed natural ventilation, while mechanical ventilation was used in another portion of the building).

Variable Descriptions:

**Type of Ventilation** defines the primary means of providing outdoor air to the building.

The following categories apply:

**Mechanical ventilation** employs a powered system to bring outdoor air into the building.

**Natural ventilation** operates without external power, employing pressure differences caused by wind and temperature to induce airflow through the building, and includes any un-powered ventilation approach such as operable windows, ventilation shafts, intentional ventilation openings in walls, and envelope leakage. A building with a natural ventilation system may still have powered exhaust systems serving certain areas in the building.

**BASE Buildings HVAC Characteristics:** Cooling System Equipment - Primary and Secondary

Cooling System Equipment	Number of Buildings Reporting	
	Primary Cooling System <sup>1</sup>	Secondary Cooling System <sup>1</sup>
Chillers	72	0
Packaged AC Units	9	23
Heat Pump	2	10
Ducted Air Distribution	94	2
Fan Coil Units	6	20
Individual Room AC	4	68
Central System With Cooling Coils	80	1
Split AC System	9	21
Makeup Air Units	16	13
Total Number of Buildings Reporting	99	99
<p><u>Notes:</u>  <sup>1</sup>Based on those buildings in the dataset that had cooling systems (n=99). Values within each column add up to greater than 99 as some buildings had more than one primary or secondary cooling system equipment entered into the database.</p>		

Variable Descriptions:

**Primary Cooling System** is the equipment that provides cooling to the majority of the building.

**Secondary Cooling System** is the equipment that provides cooling to the remaining areas of the building or serves as back up to the primary system.

The following cooling system categories apply:

**Chillers** are evaporators that chill water or other liquids and provide a chilled liquid to a central air handling system.

**Packaged AC Units** are factory assembled air conditioning units equipped with the ability to heat or cool. Cooling is provided using a direct expansion refrigeration cycle.

**Heat Pumps** are factory assembled units with the capacity to heat and cool. A single system can be used to condition an entire building or individual zones. Heat pump types include air-to-air, water-to-air, air-to-water, and water-to-water. Ventilation air may be supplied by a central system to the individual units through a system of ductwork or the individual units may provide ventilation.

**Ducted Air Distribution** a network of ducts to carry the air to the rooms to be heated or cooled.

**Fan-Coil Units** consist of a finned-tube coil supplied with hot or chilled water from a central source and a fan that circulates room air over the coil. These units are sometimes provided with an outdoor air connection through the exterior wall.

**Individual Room AC** is a unit that is located in and provides cooling for an individual room.

**Central System with Cooling Coils** are air conditioning systems that are centrally located in the building, or on the building roof. These units may provide cooling using a chilled water cooling coil.

**Split AC System** is a system used for cooling where the condenser and compressor are in one package located outdoors, and the fan and evaporator coil are located inside the building.

**Makeup Air Units** are fan units that solely provide outdoor air to the building.

**BASE Buildings HVAC Characteristics:** Heating System Equipment - Primary and Secondary

	Number of Buildings Reporting	
	Primary Heating System <sup>1</sup>	Secondary Heating System <sup>1</sup>
Heating System Equipment		
Steam or Hot Water Boiler	60	1
Central System With Heating Coils	49	9
Reheat Coils in Air Distribution System	41	19
Packaged Units	4	11
Forced Air Furnace	2	2
Heat Pump	2	10
Ducted Air Distribution	81	6
Fan Coil Units	8	25
Individual Space Heating	1	7
Fin-Tube Radiators	26	17
Electric Baseboard	1	20
Makeup Air Units	9	8
Total Number of Buildings Reporting	100	100
<p><u>Notes:</u>  <sup>1</sup>Based on those buildings in the dataset that had heating systems (n=100). Values within each column add up to greater than 100 as some buildings had more than one primary or secondary heating system equipment entered into the database.</p>		

Variable Descriptions:

**Primary Heating System** is the equipment that provides heating to the majority of the building.

**Secondary Heating System** is the equipment that provides heating to the remaining areas of the building or serves as back up to the primary system.

The following heating system categories apply:

**Steam or Hot Water Boilers** produce hot water or steam which is delivered through pipes to space heating equipment. Key components to a boiler are the combustion chamber, burner, and the heat exchanger.

**Central System with Heating Coils** are air conditioning systems that are centrally located in the building, or on the building roof. These units may provide heating using a hot water or steam heating coils.

**Reheat Coils in Air Distribution System** are heating coils that are located in the ductwork near the distribution point to control the temperature in an individual zone.

**Packaged Units** are factory assembled air conditioning units equipped with the ability to heat or cool. Heating is generally provided using gas fired heat exchanger or electric resistance heating coils.

**Forced Air Furnace** heats by delivering warmed air to the spaces in a building. Components of the furnace are a heat exchanger, fuel burner, and air blower.

**Heat Pumps** are factory assembled units with the capacity to heat and cool. A single system can be used to condition an entire building or individual zones. Heat pump types include air-to-air, water-to-air, air-to-water, and water-to-water. Ventilation air may be supplied by a central system to the individual units through a system of ductwork or the individual units may provide ventilation.

**Ducted Air Distribution** a network of ducts to carry the air to the rooms to be heated or cooled.

**Fan Coil Units** consist of a finned-tube coil supplied with hot or chilled water from a central source and a fan that circulates room air over the coil. These units are sometimes provided with an outdoor air connection through the exterior wall. Temperature controllers in the unit meter the chilled or hot water to the coil.

**Individual Space Heating** is a unit that is located in and provides heat for the room where it is located.

**Fin-Tube Radiators** are hydronic terminal units equipped with metal fins that dissipate the heat from the hot water in the piping through natural convection.

**Electric Baseboard** are electric terminal units that heat by electrical resistance and natural convection.

**Makeup Air Units** are fan units that solely provide outdoor air to the building.

**BASE Buildings HVAC Characteristics:** Heating and Cooling Profiles - Number of Space Conditioning and Ventilation Days Per Week and Weekend

Days Per Week	Number of Buildings Reporting			
	Number of Space Conditioning Weekdays Per Week	Number of Space Conditioning Weekend Days Per Week <sup>1</sup>	Number of Space Ventilation Weekdays Per Week <sup>2</sup>	Number of Space Ventilation Weekend Days Per Week <sup>3</sup>
None	0	17	2	20
One	0	23	0	24
Two	0	59	0	54
Three	0	0	0	0
Four	0	0	0	0
Five	100	0	97	0
Total Number of Buildings Reporting	100	99	99	98
Notes:				
<sup>1</sup> Number of space conditioning days per weekend was not reported for one building.				
<sup>2</sup> Number of ventilation days weekdays per week was not reported for one building.				
<sup>3</sup> Number of ventilation days per weekend was not reported for two buildings.				

Variable Descriptions:

**Number of Space Conditioning Weekdays Per Week** refers to the number of weekdays per week that the building's space conditioning systems are reported to be operating.

**Number of Space Conditioning Weekend Days Per Week** refers to the number of days per weekend that the building's space conditioning systems are reported to be operating.

**Number of Space Ventilation Weekdays Per Week** refers to the number of weekdays per week that the building's ventilation systems are reported to be operating.

**Number of Space Ventilation Weekend Days Per Week** refers to the number of days per weekend that the building's ventilation systems are reported to be operating.

**BASE Buildings HVAC Characteristics:** Heating and Cooling Profiles - Number of Space Conditioning and Ventilation Hours Per Day

	Number of Space Conditioning Hours Per Weekday	Number of Space Conditioning Hours Per Weekend Day <sup>1</sup>	Number of Ventilation Hours Per Weekday <sup>2</sup>	Number of Ventilation Hours Per Weekend Day <sup>3</sup>
Number of Buildings Reporting	100	98	99	97
Mean (Arithmetic)	17	13	17	12
Standard Deviation	5	9	6	9
Minimum	7	0	0	0
10th Percentile	11	0	11	0
25th Percentile	12	5	12	5
50th Percentile	16	12	16	9
75th Percentile	24	24	24	24
90th Percentile	24	24	24	24
Maximum	24	24	24	24

Notes:

<sup>1</sup>Two buildings did not report the number of space conditioning hours per weekend day.

<sup>2</sup>One building did not report the number of ventilation hours per weekday.

<sup>3</sup>Two buildings did not report the number of ventilation hours per weekend day.

Variable Descriptions:

**Number of Space Conditioning Hours Per Weekday** refers to the number of hours per weekday that the building's space conditioning systems are reported to be operating.

**Number of Space Conditioning Hours Per Weekend Day** refers to the number of hours per weekend day that the building's space conditioning systems are reported to be operating.

**Number of Ventilation Hours Per Weekday** refers to the number of hours per weekday that the building's ventilation systems are reported to be operating.

**Number of Ventilation Hours Per Weekend Day** refers to the number of hours per weekend day that the building's ventilation systems are reported to be operating.

**BASE Buildings HVAC Characteristics:** Primary HVAC Control Implementation

Primary HVAC Control Implementation	Number of Buildings Reporting <sup>1</sup>
Pneumatic	42
Low Voltage Analog Electric	8
Direct Digital	20
Pneumatic / Low Voltage Analog Electric Combination	2
Pneumatic / Direct Digital Combination	18
Low Voltage Analog Electric / Direct Digital Combination	3
Pneumatic / Low Voltage Analog Electric / Direct Digital Combination	4
Total Number of Buildings Reporting	97
<u>Notes:</u>	
<sup>1</sup> Based on those buildings reporting a primary HVAC control implementation method (n=97).	

Variable Descriptions:

**Primary HVAC Control Implementation** refers to the control system in place to control the operation of the heating, ventilating, and air conditioning system.

The following categories apply:

**Pneumatic** systems use compressed air as the source of energy to actuate the control devices of the heating, ventilating, and air conditioning system.

**Low Voltage Analog Electric** systems use electrical energy to actuate the control devices of the heating, ventilating, and air conditioning system.

**Direct Digital** systems use digital signals to control the devices of the heating, ventilating, and air conditioning system.

**BASE Buildings HVAC Characteristics:** Primary HVAC Control Response Strategy

Primary HVAC Control Response Strategy	Number of Buildings Reporting <sup>1</sup>
Two-Position	9
Proportional	79
Floating Point	3
Proportional-Integral	5
Proportional-Integral-Derivative	22
Total Number of Buildings Reporting	98
<u>Notes:</u> <sup>1</sup> Number of buildings based on those buildings reporting a primary HVAC control response strategy (n=98). Column total adds up to greater than the total number of buildings reporting as some buildings used a combination of these methods.	

Variable Descriptions:

**Primary HVAC Control Response Strategy** refers to the primary control response strategy for the building HVAC systems.

The following categories apply:

**Two-Position** refers to a control system in which the device being controlled is either full on or full off, with no intermediate operating positions available.

**Proportional** refers to a control algorithm or method in which the final control device (e.g. damper or valve) moves to a position proportional to the deviation from the setpoint value of the controlled variable such as a temperature setpoint.

**Floating Point** refers to a system where the controlled device is still operated by a two position controller, but the device moves gradually between full open and full closed. There is a neutral zone where no signal is transmitted and the controlled device "floats" in an intermediate position until a new signal is received.

**Proportional-Integral** also known as "proportional plus reset" refers to a proportional control system where the control point is changed automatically back toward the setpoint when an offset occurs.

**Proportional-Integral-Derivative** offers the same features as proportional-integral, but also controls the rate at which the control point is moved back to the setpoint.



**BASE Buildings HVAC Characteristics:** Particle Filtration Systems - Frequency of Maintenance Actions for Different Configurations

Frequency of Actions	Number of Buildings Reporting		
	Frequency of Panel Filters Replacement <sup>1</sup>	Frequency of Manual Roll Filters Advancement <sup>2</sup>	Frequency of Automatic Roll Filters Inspection <sup>3</sup>
None	1	0	0
As Needed	4	4	0
Daily	0	0	0
Weekly	0	0	2
Bi-Weekly	0	0	0
Monthly	10	6	0
Semi-Quarterly	2	3	0
Quarterly	47	2	0
Semi-Annually	17	2	1
Annually	12	1	1
Total Number of Buildings Reporting	93	18	4

Notes:  
<sup>1</sup>Data represent panel filter replacement frequencies for 93 BASE buildings equipped with this filter type.  
<sup>2</sup>Data represent frequency of manual roll filter advancement for 18 BASE buildings equipped with this filter type.  
<sup>3</sup>Data represent frequency of automatic roll filter inspection for 4 BASE buildings equipped with this filter type.

Variable Descriptions:

**Frequency of Panel Filters Replacement** refers to the frequency that panel filters are changed out by building facilities personnel. Panel filters are manufactured in rectangular panels that are placed alongside each other in the filter bed. They are removed and either replaced or cleaned when dirty.

**Frequency of Manual Roll Filters Advancement** refers to the frequency that manual roll filters are advanced by building facilities personnel. Manual roll filters consist of a fabric roll mounted on a spool that moves across the airstream. The media is manually wound on a take up spool to expose new filter material when necessary.

**Frequency of Automatic Roll Filters Inspection** refers to the frequency that automatic roll filters are inspected by building facilities personnel. Automatic roll filters consist of a fabric roll mounted on a spool that moves across the airstream. The media is automatically wound on a take up spool to expose new filter. The movement of the media is often controlled by a pressure switch which senses the pressure drop across the media, or by an automatic timer.

The frequency categories are as follows:

**None** means that filters are not changed, advanced or inspected.

**As needed** means that filters are changed, advanced or inspected only when deemed necessary.

**Daily** means that filters are changed, advanced or inspected each day.

**Weekly** means that filters are changed, advanced or inspected once per week.

**Bi-weekly** means that filters are changed, advanced or inspected twice a month.

**Monthly** means that filters are changed, advanced or inspected once per month.

**Semi-Quarterly** means that filters are changed, advanced or inspected twice every three months.

**Quarterly** means that filters are changed, advanced or inspected every three months.

**Semi-annually** means that filters are changed, advanced or inspected once every six months.

**Annually** means that filters are changed, advanced or inspected once a year.

**BASE Buildings HVAC Characteristics:** Frequency of Inspection for HVAC Components

Frequency of Inspection	Number of Buildings Reporting							
	Air Handler Housing <sup>1</sup>	Heating and Cooling Coils <sup>2</sup>	Drain Pans <sup>3</sup>	Air Distribution Ductwork <sup>4</sup>	Humidifiers <sup>5</sup>	Evaporative Coolers <sup>6</sup>	Air Washers <sup>7</sup>	Cooling Towers <sup>8</sup>
None	25	6	8	59	4	1	1	0
As Needed	10	7	7	32	4	0	0	1
Daily	7	0	3	0	1	0	0	19
Weekly	2	1	4	0	0	0	0	11
Bi-Weekly	1	0	1	0	1	1	0	3
Monthly	14	14	15	1	9	1	0	17
Semi-Quarterly	1	2	3	0	0	0	0	1
Quarterly	23	29	27	2	9	0	0	10
Semi-Annually	5	13	6	1	4	0	0	3
Annually	10	26	22	4	6	4	0	2
<b>Total Number of Buildings Reporting</b>	<b>98</b>	<b>98</b>	<b>96</b>	<b>99</b>	<b>38</b>	<b>7</b>	<b>1</b>	<b>67</b>

**Notes:**

<sup>1</sup>Data represent 98 BASE buildings, which indicated an inspection frequency for air handling unit housing inspections.

<sup>2</sup>Data represent 98 BASE buildings, which indicated an inspection frequency for coil inspections.

<sup>3</sup>Data represent 96 BASE buildings, which indicated an inspection frequency for drain pans.

<sup>4</sup>Data represent 99 BASE buildings, which indicated an inspection frequency for ductwork.

<sup>5</sup>Data represent 38 BASE buildings, which indicated an inspection frequency for humidifiers.

<sup>6</sup>Data represent 7 BASE buildings, which indicated an inspection frequency for evaporative coolers.

<sup>7</sup>Data represent 1 BASE building, which indicated an inspection frequency for air washers.

<sup>8</sup>Data represent 67 BASE buildings, which indicated an inspection frequency for cooling towers.

Variable Descriptions:

**Air Handler Housing** refers to the inspection frequency of the air handling housing. The housing is a casing that is usually made up of galvanized sheet metal that contains the air handling unit components.

**Cooling Coils** refers to the inspection frequency of the air handling unit cooling coils.

**Heating Coils** refers to the inspection frequency of the air handling unit heating coils.

**Drain Pans** refers to the inspection frequency of the cooling coil condensate drain pans. The drain pan is generally located under the cooling coil to collect and drain away water vapor that condenses on the cooling coil.

**Air Distribution Ductwork** refers to the inspection frequency of the air handling unit air distribution ductwork.

**Humidifiers** refers to the inspection frequency of humidifiers.

**Evaporative Coolers** refers to the inspection frequency of evaporative coolers. Evaporative coolers are non-refrigerant systems that cool air by exchanging sensible heat for latent heat, reducing temperatures, but raising humidity.

**Air Washers** refers to the inspection frequency of air washers. In some applications, air washers serve as evaporative coolers or humidifiers as their operating principle is similar to that of evaporative coolers. These may also be used to filter wettable dust from the airstream by drawing air through a mist (caused by spray nozzles) and then through eliminators to remove dust and the water particles not evaporated in the air.

**Cooling Towers** refers to the inspection frequency of cooling towers. Cooling towers are used primarily to reject building heat to the atmosphere.

The frequency categories are as follows:

**None** refers to no inspections taking place in the building.

**As Needed** refers to an inspection schedule where inspection occurs only when deemed necessary.

**Daily** refers to an inspection schedule where inspection occurs each day.

**Weekly** refers to an inspection schedule where inspection occurs on a once per week.

**Bi-weekly** refers to an inspection schedule where inspection occurs twice a month.

**Monthly** refers to an inspection schedule where inspection occurs once per month.

**Semi-Quarterly** refers to an inspection schedule where inspection occurs twice every three months.

**Quarterly** refers to an inspection schedule where inspection occurs every three months.

**Semi-annually** refers to an inspection schedule where inspection occurs every six months.

**Annually** refers to an inspection schedule where inspection occurs once a year.

**BASE Buildings HVAC Characteristics:** Frequency of Cleaning for HVAC Components

Frequency of Cleaning	Air Handler Housing <sup>1</sup>	Heating and Cooling Coils <sup>2</sup>	Drain Pans <sup>3</sup>	Air Distribution Ductwork <sup>4</sup>	Humidifiers <sup>5</sup>	Evaporative Coolers <sup>6</sup>	Air Washers <sup>7</sup>	Cooling Towers <sup>8</sup> (surface cleaning)
None	36	13	14	77	7	0	0	1
As Needed	17	25	24	16	14	1	1	9
Daily	0	0	0	0	0	0	0	0
Weekly	0	0	0	0	0	0	0	0
Bi-Weekly	0	0	0	0	0	1	0	0
Monthly	2	0	1	0	0	0	0	2
Semi-Quarterly	0	0	0	0	1	0	0	1
Quarterly	14	5	7	1	3	0	0	7
Semi-Annually	4	8	10	0	3	0	0	10
Annually	24	47	40	2	8	5	0	36
<b>Total Number of Buildings Reporting</b>	<b>97</b>	<b>98</b>	<b>96</b>	<b>96</b>	<b>36</b>	<b>7</b>	<b>1</b>	<b>66</b>

**Notes:**  
<sup>1</sup>Data represent 97 BASE buildings, which indicated a cleaning frequency for air handling unit-housing cleaning. For one building, the response was left blank.  
<sup>2</sup>Data represent 98 BASE buildings, which indicated a cleaning frequency for heating and cooling coils.  
<sup>3</sup>Data represent 96 BASE buildings, which indicated a cleaning frequency for drain pans.  
<sup>4</sup>Data represent 96 BASE buildings, which indicated a cleaning frequency air distribution duct work.  
<sup>5</sup>Data represent 36 BASE building, which indicated a cleaning frequency for humidifiers.  
<sup>6</sup>Data represent 7 BASE buildings, which indicated a cleaning frequency for evaporative coolers.  
<sup>7</sup>Data represent 1 BASE buildings, which indicated a cleaning frequency for air washers.  
<sup>8</sup>Data represent 66 BASE buildings, which indicated a cleaning frequency for cooling towers.

Variable Descriptions:

**Air Handler Housing** refers to the cleaning frequency of the air handling housing. The housing is a casing that is usually made up of galvanized sheet metal that contains the air handling unit components.

**Cooling Coils** refers to the cleaning frequency of the air handling unit cooling coils.

**Heating Coils** refers to the cleaning frequency of the air handling unit heating coils.

**Drain Pans** refers to the cleaning frequency of the cooling coil condensate drain pans. The drain pan is generally located under the cooling coil to collect and drain away water vapor that condenses on the cooling coil.

**Air Distribution Ductwork** refers to the cleaning frequency of the air handling unit air distribution ductwork.

**Humidifiers** refers to the cleaning frequency of humidifiers.

**Evaporative Coolers** refers to the cleaning frequency of evaporative coolers. Evaporative coolers are non-refrigerant systems that cool air by exchanging sensible heat for latent heat, reducing temperatures, but raising humidity.

**Air Washers** refers to the cleaning frequency of air washers. In some applications, air washers serve as evaporative coolers or humidifiers as their operating principle is similar to that of evaporative coolers. These may also be used to filter wettable dust from the airstream by drawing air through a mist (caused by spray nozzles) and then through eliminators to remove dust and the water particles not evaporated in the air.

**Cooling Towers** refers to the cleaning frequency of cooling towers. Cooling towers are used primarily to reject building heat to the atmosphere.

The frequency categories are as follows:

**None** refers to no cleaning implemented on these systems.

**As Needed** refers to a cleaning schedule where cleaning occurs only when deemed necessary.

**Daily** refers to a cleaning schedule where cleaning occurs each day.

**Weekly** refers to a cleaning schedule where cleaning occurs on a once per week.

**Bi-weekly** refers to a cleaning schedule where cleaning occurs twice a month.

**Monthly** refers to a cleaning schedule where cleaning occurs once per month.

**Semi-Quarterly** refers to a cleaning schedule where cleaning occurs twice every three months.

**Quarterly** refers to a cleaning schedule where cleaning occurs every three months.

**Semi-annually** refers to a cleaning schedule where cleaning occurs every six months.

**Annually** refers to a cleaning schedule where cleaning occurs once a year.

**BASE Buildings HVAC Characteristics:** Frequency of Maintenance Actions for Fan Coil Units and Terminal Units

Frequency of Actions	Number of Buildings Reporting		
	Fan Coil Units - Frequency of Inspection <sup>1</sup>	Fan Coil Units - Frequency of Filter Changing <sup>2</sup>	Terminal Units - Frequency of Inspection <sup>3</sup>
None	7	2	21
As Needed	2	5	41
Daily	1	0	0
Weekly	1	0	0
Bi-Weekly	0	1	0
Monthly	9	4	1
Semi-Quarterly	0	1	1
Quarterly	11	14	6
Semi-Annually	6	3	4
Annually	8	9	9
Total Number of Buildings Reporting	45	39	83

**Notes:**  
<sup>1</sup>Data represent 45 BASE buildings, which indicated an inspection frequency for fan coil units.  
<sup>2</sup>Data represent 39 BASE buildings, which indicated a filter changing frequency for fan coil units.  
<sup>3</sup>Data represent 83 BASE buildings, which indicated an inspection frequency for terminal units.

Variable Descriptions:

**Fan Coil Units - Frequency of Inspection** refers to the frequency of inspection for fan coil units.

**Fan Coil Units - Frequency of Filter Changing** refers to the frequency that fan coil unit filters are changed out by building facilities personnel.

**Terminal Units - Frequency of Inspection** refers to the frequency of inspection for terminal units.

The frequency categories are as follows:

**None** means that no inspection or filter change out takes place.

**As Needed** refers to a maintenance schedule where maintenance occurs only when deemed necessary.

**Daily** refers to a schedule where inspection or filter change out occurs each day.

**Weekly** refers to a schedule where inspection or filter change out occurs once per week.

**Bi-weekly** refers to a schedule where inspection or filter change out occurs twice a month.

**Monthly** refers to a schedule where inspection or filter change out occurs once per month.

**Semi-Quarterly** refers to a schedule where inspection or filter change out occurs twice every three months.

**Quarterly** refers to a schedule where inspection or filter change out occurs every three months.

**Semi-annually** refers to a schedule where inspection or filter change out occurs every six months.

**Annually** refers to a schedule where inspection or filter change out occurs once a year.

**BASE Buildings HVAC Characteristics:** Control System - Frequency of Inspection and Sensor Calibration

Frequency of Actions	Number of Buildings Reporting	
	Frequency of Control System Inspection <sup>1</sup>	Frequency of Sensor Calibration <sup>2</sup>
None	12	15
As Needed	28	58
Daily	14	0
Weekly	2	0
Bi-Weekly	1	0
Monthly	4	4
Semi-Quarterly	0	0
Quarterly	12	3
Semi-Annually	11	7
Annually	14	10
Total Number of Buildings Reporting	98	97
<b>Notes:</b>		
<sup>1</sup> Data represent 98 BASE buildings, which indicated an inspection frequency.		
<sup>2</sup> Data represent 97 BASE buildings, which indicated a calibration frequency.		

Variable Descriptions:

**Frequency of Control System Inspection** refers to the frequency of inspection for the heating, ventilating, and air conditioning system control system.

**Frequency of Sensor Calibration** refers to the frequency of sensor calibration for the heating, ventilating, and air conditioning system control system.

The frequency categories are as follows:

**None** means that no inspections or calibrations take place.

**As Needed** refers to an inspection or calibration schedule that occurs only when deemed necessary.

**Daily** refers to an inspection or calibration schedule where inspection occurs each day.

**Weekly** refers to an inspection or calibration schedule where inspection occurs on a weekly cycle.

**Bi-weekly** refers to an inspection or calibration schedule where inspection occurs twice a month.

**Monthly** refers to an inspection or calibration schedule where inspection occurs on a monthly schedule.

**Semi-Quarterly** refers to an inspection or calibration schedule where inspection occurs twice every three months.

**Quarterly** refers to an inspection or calibration schedule where inspection occurs every three months.

**Semi-annually** refers to an inspection or calibration schedule where inspection occurs every six months.

**Annually** refers to an inspection or calibration schedule where inspection occurs once a year.

**BASE Buildings HVAC Characteristics:** Frequency of Testing and Balancing

Frequency of Testing and Balancing	Number of Buildings Reporting <sup>1</sup>
None	43
As Needed	52
Daily	0
Weekly	0
Bi-Weekly	0
Monthly	0
Semi-Quarterly	0
Quarterly	0
Semi-Annually	0
Annually	3
Total Number of Buildings Reporting	98
<u>Notes:</u> <sup>1</sup> Data represent 98 BASE buildings, which indicated a frequency for testing and balancing.	

Variable Descriptions:

**Frequency of Testing and Balancing** refers to the frequency that testing and balancing is implemented on the building's air distribution system.

The frequency categories are as follows:

**None** means that no testing and balancing takes place.

**As Needed** refers to a schedule where testing and balancing occurs only when deemed necessary.

**Daily** refers to a schedule where testing and balancing occurs each day.

**Weekly** refers to a schedule where testing and balancing occurs on a weekly cycle.

**Bi-weekly** refers to a schedule where testing and balancing occurs twice a month.

**Monthly** refers to a schedule where testing and balancing occurs on a monthly schedule.

**Semi-Quarterly** refers to a schedule where testing and balancing occurs twice every three months.

**Quarterly** refers to a schedule where testing and balancing occurs every three months.

**Semi-annually** refers to a schedule where testing and balancing occurs every six months.

**Annually** refers to a schedule where testing and balancing occurs once a year.