BSR/ASHRAE Standard 207-2021RA

Public Review Draft

Laboratory Method of Test of Fault Detection and Diagnosis for Air Economizers

First Public Review (October 2024)

This draft has been recommended for public review by the responsible project committee. To submit a comment on this proposed standard, go to the ASHRAE website at www.ashrae.org/standards-research--technology/public-review-drafts and access the online comment database. The draft is subject to modification until it is approved for publication by the Board of Directors and ANSI. Until this time, the current edition of the standard (as modified by any published addenda on the ASHRAE website) remains in effect. The current edition of any standard may be purchased from the ASHRAE Online Store at www.ashrae.org/bookstore or by calling 404-636-8400 or 1-800-727-4723 (for orders in the U.S. or Canada).

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ASHRAE, 180 Technology Pkwy NW, Peachtree Corners, GA 30092

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ASHRAE obtains consensus through participation of its national and international members, associated societies, and public review.

ASHRAE Standards are prepared by a Project Committee appointed specifically for the purpose of writing the Standard. The Project Committee Chair and Vice-Chair must be members of ASHRAE; while other committee members may or may not be ASHRAE members, all must be technically qualified in the subject area of the Standard. Every effort is made to balance the concerned interests on all Project Committees.

The Senior Manager of Standards of ASHRAE should be contacted for

a. interpretation of the contents of this Standard,
b. participation in the next review of the Standard,
c. offering constructive criticism for improving the Standard, or
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Laboratory Method of Test of Fault Detection and Diagnosis for Air Economizers

NOTE

Approved addenda, errata, or interpretations for this standard can be downloaded free of charge from the ASHRAE website at www.ashrae.org/technology.

(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

FOREWORD

ASHRAE Standard 207 provides users and specifiers of HVAC air economizers with fault detection and diagnosis (FDD) systems with verification that the capabilities of the systems meet their specifications.

It is intended that future standards or future editions of this standard will include tests of FDD systems for additional faults and/or system types (particularly for airflow and refrigeration faults).

This standard is a physical laboratory test method to verify a specification that an FDD system will annunciate true faults and will not annunciate false faults for the air economizer system to which it is applied.

The intended users of this standard include both specifiers of HVAC FDD system performance and HVAC test laboratories on behalf of the end users of HVAC equipment. The standard takes no position on who is qualified or responsible to specify or conduct the specified testing.

It is critical to understand that this standard does not prescribe what faults should be detected by an FDD system, the performance an FDD system should have, or how an FDD system should accomplish its detections. It is the responsibility of other parties (for example, a third-party evaluating compliance with building codes, an engineer creating a design specification, an efficiency program manager, an authoring body for equipment standards, or a manufacturer) to use the language of this standard to specify the performance of the FDD system. The format and contents required for these specifications are, however, defined in this standard, and the standard specifies a method of test for determining the actual performance of the FDD system to enable comparison with and verification of the performance specification for the FDD system or requirements on it.

Note that any communications implying that an FDD system has passed tests that comply with Standard 207 shall specify which particular tests were passed. No communications shall imply that an FDD system is in compliance with Standard 207 in its entirety.

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1. PURPOSE

The purpose of this standard is to provide methods for laboratory testing of fault detection and diagnosis (FDD) systems to determine whether they perform as specified.

2. SCOPE

This standard applies to FDD systems that are intended to detect or diagnose faults that affect the performance of air economizers of air-conditioning equipment.

This standard defines laboratory tests for faults in four categories of economizer function: sensor communication, actuator communication, damper and actuator responsiveness, and damper position.

This standard only applies to those FDD systems designed to detect or diagnose faults by evaluating instantaneous or short-term conditions and parameters.

3. DEFINITIONS

actuator: device, either electrically, pneumatically, or hydraulically operated, that acts as a motor to change the position of movable devices such as valves or dampers.

air economizer: duct-and-dampers arrangement with an automatic control system that together allow a cooling system to supply outdoor air to reduce or eliminate the need for mechanical cooling during mild or cold weather.

air-handling unit: assembly consisting of sections containing a fan or fans and other necessary equipment to perform one or more of the following functions: circulating, filtration, heating, cooling, heat recovery, humidifying, dehumidifying, and mixing of air. It is usually connected to an air distribution system.

FOREWORD

The 2024 edition of Standard 207 updates normative references. This standard was prepared under the auspices of ASHRAE. It may be used, in whole or in part, by an association or government agency with due credit to ASHRAE. Adherence is strictly on a voluntary basis and merely in the interests of obtaining uniform guidelines throughout the industry.

alarm: signal, either audible or visual, or both, that alerts an operator to an off-normal condition that requires some form of corrective action.

analog sensor: a sensor with a continuously variable output used to represent another variable (e.g., in temperature or enthalpy measurement, an electric voltage or current output represents temperature input).

damper: element inserted into an air distribution system or element of an air distribution system permitting modification of the air resistance of the system and consequently changing the airflow rate or shutting off the airflow.

damper actuator: device that provides the necessary force to position a damper.

digital sensor: sensor where controlled and monitored analog or binary data (e.g., temperature, contact closures) are converted and sent to a controller in digital format for manipulation and calculations by the digital controller.

economizer: see *air economizer*.

excess outdoor air: airflow that exceeds the design minimum.

false alarm: a scenario in which a fault is detected no significant fault is actually present.

fault: a state of the system or equipment that causes a degradation in performance.

fault detection: the process of determining whether a system or component deviates from expected or desired operation.

fault detection and diagnosis (FDD): performance of both fault detection and fault diagnosis.

fault diagnosis: the process of isolating a fault from other possible faults, or identifying a fault's cause.

fault-free unit: air conditioning unit that has been verified to have no faults.

insufficient outdoor air: airflow below the design minimum.

laboratory: any facility or location where the unit under test can be installed and tested with instruments capable of performing measurements conforming to accuracy and other specified requirements.

minimum outdoor air: the minimum amount of outdoor air required for the purpose of controlling air contaminant levels in buildings.

outdoor air: (a) air outside a building or taken from the external atmosphere and therefore not previously circulated through the system; (b) the airstream entering an HVAC unit through the outdoor air dampers, simulating outdoor air conditions.

open, or no signal: condition in which any electrical circuit is not sending a signal due to physical disconnection or other causes.

packaged air conditioner: also known as a "self-contained unit," a complete air-conditioning unit, including refrigeration compressor, cooling coils, fans, filters, automatic controls, etc., assembled into one casing.

packaged heat pump: a packaged air conditioner capable of using the refrigerating system in a reverse cycle or heat pump mode to provide heat.

performance specification: a document that defines the capabilities of an FDD system. This forms the basis for a test plan and test report.

return air: (a) air removed from a space to be recirculated or exhausted; (b) air extracted from a space and totally or partially returned to an air conditioner, furnace, or other heating, cooling, or ventilating system; (c) the airstream entering an HVAC unit through the return air dampers, simulating return air conditions.

sensor: device or instrument designed to detect and measure a variable.

short, or high signal: condition in which any electrical circuit is sending a high signal due to short circuit or other causes.

short cycling: excessive frequency of starting and stopping in an operating system.

specifier: anyone who specifies the performance of an FDD system to be verified in lab tests.

test code: a unique identifier to define which specific Standard 207 test procedure (shown in Section 6) is to be or was carried out.

***test plan*:** a document that describes how FDD system testing is to be conducted. It embodies the technical requirements of this standard.

test report: a document that describes the results of testing per the requirements of this standard and documents whether or not the FDD system meets the performance specification.

test unit ("unit"): an HVAC unit (e.g., a packaged air conditioner, packaged heat pump, or air-handling unit) or other physical apparatus that performs the functions being tested on the system operating as intended by the equipment manufacturer.

tester: anyone who designs, plans, or implements the described tests.

4. METHODS OF TEST

4.1 Approach. The general approach is as follows:

a. Specifier defines select capabilities of an FDD system in the form of a performance specification.
b. Tester identifies which of the standardized tests are applicable to be performed.
c. Tester creates a test plan that defines each applicable test and the criteria for a successful test.
d. Tester performs laboratory tests.
e. Tester documents the outcome of each test in a test report.

4.2 Required Tests. Laboratory tests shall be performed to simulate a fault. The FDD system response to that fault will be documented accordingly. The results of the tests shall be provided on a test report that conforms to the requirements in Section 5.3.

For each fault identified in the performance specification, the following tests shall be conducted and documented:

a. **Fault-present test.** Test the system at the fault-present conditions and confirm that an alarm is generated, either indicating that a faulty condition has been detected or identifying a specific condition that is consistent with the fault test condition.
b. **Fault-not-present test.** Test the system at the fault-not-present conditions and confirm that either no alarm is generated or any alarms generated are different from or inconsistent with the fault test condition.

4.3 Apparatus and Measurement Accuracy. Tests shall be conducted in a laboratory with instrumentation that conforms to the tolerances stated in ASHRAE Standards 41.1 [1] and 41.6 [2]. All temperature measurements shall have a minimum accuracy of ±2°F (1°C). The FDD system shall be installed on an HVAC unit (e.g., a packaged air conditioner, packaged heat pump, or air-handling unit) or other physical apparatus that performs the functions being tested. Tests are to be performed on a fault-free unit for baseline.

5. APPLICATION OF TESTING

5.1 Specification of FDD System Performance. The specifier shall provide in a performance specification the information listed below to indicate what faults shall be detected and the parameters of the testing:

a. **Test code.** Test code for individual test to be performed, as indicated in Section 6.
b. **Specify units tested.** The specifier's rules for allowing results from testing of an individual model of HVAC system to represent the performance of a broader range of units.
c. **Components tested.** A list of components to be tested, such as individual sensors or actuators.
d. **Test specifics recorded.** Any test specifics required for the test, to be recorded during testing, such as any requirements for third-party testing; time, date, and location of testing; and names of individuals conducting tests, certifying results, or witnessing the testing.
e. **Test conditions.** Description of any conditions required for testing, such as allowable range in ambient temperature.
f. **Description of tests performed.** Any specifier requirements for how tests are to be performed (above and beyond the requirements of this standard).

g. **Measured operating conditions or parameters.** A list of the operating conditions or parameters to be measured.
h. **Coincident faults present during tests.** Any specifier requirements for other faults to be present during testing of the specified fault.

Some specifications may be provided in codes or regulations to which the FDD system must comply, or in owner specifications, rather than from manufacturer specifications.

5.2 Development of a Test Plan. A test plan document shall be developed to describe how FDD system testing is to be conducted. It is based on the items listed in the performance specification and embodies the detailed test procedures provided in Section 6.

5.3 Documentation of Results of Performance Testing. The tester shall document each test performed by recording in a test report all of the following information:

a. **Test code.** Test code for individual test that was performed.
b. **Specify units tested.** The make, model, size, and serial number of the actual unit tested, along with any features.
c. **Components tested.** A list of components that were tested, such as individual sensors or actuators.
d. **Test specifics recorded.** Actual test specifics, as noted in the performance specification, such as third-party testing; time, date, and location of testing; and names of individuals conducting tests, certifying results, or witnessing the testing.
e. **Test conditions.** The actual conditions under which the unit was tested, including measurements, as appropriate.
f. **Description of how tests were performed.** Description of how the tests were actually performed.
g. **Measured operating conditions or parameters.** Measurements of operating conditions or parameters during the testing.
h. **Coincident faults present during tests.** Description of any coincident faults present during testing of the specified fault. This may include fault levels as measured or observed for each individual coincident fault.
i. **Confirmation that an alarm was generated during fault-present test.** Note whether or not an alarm was generated, and state which alarm it was.
j. **Confirmation that no alarm was generated during fault-not-present test.** Note whether or not an alarm was generated.

Any communications implying that an FDD system has passed tests that complied with Standard 207 shall specify *which* particular tests were passed. No communications shall imply that an FDD system complies with Standard 207 in its entirety.

6. DETAILED TEST PROCEDURES

Methods for testing of particular faults are described in this section. Each subsection identifies an area of the economizer system or an operating mode that is to be tested. Each of these subsections consists of a number of individual tests, each with a unique test code. This code shall be used consistently in the performance specification, test plan, and test report. It shall also be used in communicating the particular tests that the FDD system has passed.

Each test procedure below describes both fault-present and fault-not-present conditions. In order to pass a specific test, an FDD system must be witnessed to meet both of the following criteria:

a. At fault-present conditions, an alarm is generated, either indicating that a faulty condition has been detected or identifying a specific fault condition that is consistent with the fault test condition.
b. At fault-not-present conditions, either no alarm is generated, or any alarms generated are different from or inconsistent with the fault-present test condition.

Note that in many cases, the fault-not-present conditions *do* represent a fault, but a different fault than the one that is currently being tested. This test only confirms that no alarm will be generated for the fault currently being tested. The fault that does exist under these conditions will be the subject of a different test.

Alarms, once generated, must persist for as long as the fault-present condition is present. Alarms shall be cleared between tests.

6.1 Baseline Setting Procedures. Before testing, verify that the alarms to be tested are included in the current firmware version of the FDD system you are testing. Ensure that the controller and the unit are properly commissioned and installed per the manufacturer's specifications. Confirm there are no alarms indicated by the economizer and that all sensor readings are within their specified tolerances. At the start of each test, the unit must be in the fault-not-present condition, and when the test is complete the unit must be returned to the fault-not-present condition prior to performing the next test.

6.2 No-Sensor-Communication Test Procedures. All sensors in an economizer system must be able to communicate with the controller. The tests in this section identify whether or not an FDD system accurately detects situations where there is no sensor communication.

Identify all sensors to be tested. Identify the sensor type and select the appropriate tests to perform.

NO SIGNAL FROM SENSOR TEST: DIGITAL COMMUNICATING SENSORS

- Test code: ECON-SENSCOM-DG
- Fault present: Disconnect communication wire(s) between sensor and controller.
- Fault not present: Reconnect communication wire(s) between sensor and controller.

NO SIGNAL FROM SENSOR TEST: WIRELESS SENSORS

- Test code: ECON-SENSCOM-WL
- Fault present: Remove power from sensor.
- Fault not present: Replace power to sensor.

NO SIGNAL FROM SENSOR TEST: ANALOG SENSORS

- Test code: ECON-SENSCOM-AN
- Fault present: Disconnect wire(s) between sensor and controller.
- Fault not present: Reconnect wire(s) between sensor and controller.

NO SIGNAL FROM SENSOR TEST: OPEN OR NO SIGNAL

- Test code: ECON-SENSCOM-OPNSG
- Fault present: Disconnect control signal wire between sensor and controller.
- Fault not present: Reconnect control signal wire between sensor and controller.

NO SIGNAL FROM SENSOR TEST: HIGH SIGNAL

- Test code: ECON-SENSCOM-HISIG
- Fault present: Disconnect control signal wire between sensor and controller. Connect a precision current or voltage source to the signal wire entering the controller. Close the circuit and ensure a common ground. Apply a current or voltage greater than the highest normal signal specified by sensor manufacturer.
- Fault not present: Disconnect the precision current or voltage source to the signal wire entering the controller and grounding. Reconnect the control signal wire between sensor and controller.

NO SIGNAL FROM SENSOR TEST: SHORT

- Test code: ECON-SENSCOM-SHORT
- Fault present: Connect a wire between the two sensor input terminals on the unit's controller.
- Fault not present: Disconnect the wire between the two sensor input terminals on the unit's controller.

6.3 No-Actuator-Communication Test Procedures. All actuators in an economizer system must be able to communicate with the controller. The tests in this section identify whether or not an FDD system accurately detects situations where there is no actuator communication.

Identify all actuators to be tested. Identify the communication type and select the appropriate tests to perform.

NO ACTUATOR COMMUNICATION TEST: DIGITAL COMMUNICATING

- Test code: ECON-ACTUCOM-DG
- Fault present: Disconnect communication wire(s) between actuator and controller.
- Fault not present: Reconnect communication wire(s) between actuator and controller.

NO ACTUATOR COMMUNICATION TEST: WIRELESS ACTUATORS

- Test code: ECON-ACTUCOM-WL
- Fault present: Remove power from actuator.
- Fault not present: Replace power to actuator.

NO ACTUATOR COMMUNICATION TEST: ANALOG

- Test code: ECON-ACTUCOM-AN
- Fault present: Disconnect wire(s) between actuator and controller.
- Fault not present: Reconnect wire(s) between actuator and controller.

NO ACTUATOR COMMUNICATION TEST: OPEN OR NO SIGNAL

- Test code: ECON-ACTUCOM-OPNSG
- Fault present: Disconnect control signal wire between actuator and controller.
- Fault not present: Reconnect control signal wire between actuator and controller.

NO ACTUATOR COMMUNICATION TEST: HIGH SIGNAL

- Test code: ECON-ACTUCOM-HISIG
- Fault present: Disconnect control signal wire between actuator and controller. Connect a precision current or voltage source to the signal wire entering the controller. Close the circuit and ensure a common ground. Apply a current or voltage greater than the highest normal signal specified by actuator manufacturer.
- Fault not present: Disconnect the precision current or voltage source to the signal wire entering the controller and grounding. Reconnect the control signal wire between actuator and controller.

NO ACTUATOR COMMUNICATION TEST: SHORT

- Test code: ECON-ACTUCOM-SHORT
- Fault present: Connect a wire between the two actuator input terminals on the unit's controller.
- Fault not present: Disconnect the wire between the two actuator input terminals on the unit's controller.

6.4 Unresponsive Damper/Actuator Test Procedures. All relevant dampers and actuators in an economizer system must be able to respond to signals from the controller. The tests in this section identify whether or not an FDD system accurately detects situations where dampers or actuators are unresponsive.

Identify all dampers and actuators to be tested.

UNRESPONSIVE DAMPER/ACTUATOR TEST: ACTUATOR UNRESPONSIVE

- Test code: ECON-UNRESP-ACTU
- Fault present: Fully close economizer outdoor air damper. Disconnect power from actuator (verify the actuator is positioned at the failsafe position or is fully closed). Configure economizer system to send control signal to the actuator to 50% of full control signal range.
- Fault not present: Reconnect power to actuator. Apply control signal to the actuator to 50% of full control signal range.

UNRESPONSIVE DAMPER/ACTUATOR TEST: ACTUATOR RESPONSIVE, DAMPER UNRESPONSIVE

- Test code: ECON-UNRESP-DMPR

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- Fault present: Fully close economizer outdoor air damper. Disconnect actuator from damper assembly. Configure economizer system to send control signal to the actuator to 50% of full control signal range.
- Fault not present: Reconnect the actuator to the damper assembly. Apply control signal to the actuator to 50% of full control signal range.

6.5 Inappropriate Damper Position Test Procedures. This category of tests is applicable only for FDD systems that annunciate specific faults rather than simply detect the presence of a general fault.

Economizer dampers are designed to bring in outdoor air when outdoor air temperatures are moderate, and only a minimal amount of outdoor air when outdoor air temperatures are high or low. The controls must result in damper positions that achieve this. The tests in this section identify whether or not an FDD system accurately detects situations where the damper positions are inappropriate to the conditions.

For each of the tests in this section, disable demand control ventilation. Adjust outdoor air temperature to a point in the specified range listed for each test. Either initiate a call for cooling or ensure that there is no call for cooling, as specified for each test. Adjust return air temperature to 75°F ± 5°F (23.9°C ± 2.8°C) and relative humidity to 40% rh ± 5% rh. Set the supply air temperature set point of the tested unit to 55°F ± 5°F (12.8°C ± 2.8°C). Define 10% outdoor air, by volume, to be the minimum outdoor air setting. Test at full-load speed.

For each fault-present or fault-not-present test, command or override the economizer outdoor air damper as specified:

- FULLY CLOSED: completely closed, allowing as little outdoor air as possible
- MINIMUM POSITION: open slightly, allowing nominal 10% outdoor air, by volume
- HALFWAY OPEN: open midway, allowing between 40% to 70% outdoor air, by volume
- FULLY OPEN: 100% open, allowing as much outdoor air as possible

HIGH TEMPERATURE TEST: DAMPER ALLOWING EXCESS OUTDOOR AIR

• Test code:	ECON-HI-EXSOA	
	Outdoor air temperature:	95°F ± 5°F (35.0C ± 2.8°C)
	Outdoor air relative humidity:	45% rh ± 10% rh
	Call for cooling:	YES
• Fault present:	Economizer damper position:	HALFWAY OPEN
• Fault not present:	Economizer damper position:	MINIMUM POSITION

HIGH TEMPERATURE TEST: DAMPER ALLOWING INSUFFICIENT VENTILATION OUTDOOR AIR

(***Informative Note:*** Not applicable for systems with separate minimum outdoor air dampers or fixed louvers.)

• Test code:	ECON-HI-LOWOA	
	Outdoor air temperature:	95°F ± 5°F (35.0°C ± 2.8°C)
	Outdoor air relative humidity:	45% rh ± 10% rh
	Call for cooling:	YES
• Fault present:	Economizer damper position:	FULLY CLOSED
• Fault not present:	Economizer damper position:	MINIMUM POSITION

MODERATE TEMPERATURE TEST: DAMPER ALLOWING INSUFFICIENT ECONOMIZING OUTDOOR AIR

(***Informative Note:*** Not applicable for systems with separate minimum outdoor air dampers or louvers.)

• Test code:	ECON-MOD-LOWOA	
	Outdoor air temperature:	65°F ± 5°F (18.3°C 2.8°C)
	Outdoor air relative humidity:	25% rh ± 10% rh
	Call for cooling:	YES
• Fault present:	Economizer damper position:	MINIMUM POSITION
• Fault not present:	Economizer damper position:	FULLY OPEN

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LOW TEMPERATURE TEST: DAMPER ALLOWING INSUFFICIENT VENTILATION OUTDOOR AIR

(***Informative Note:*** Not applicable for systems with separate minimum outdoor air dampers or louvers.)

• Test code:	ECON-LO-LOWOA-NOCOOL	
	Outdoor air temperature:	45°F ± 5°F (7.2°C ± 2.8°C)
	Outdoor air relative humidity:	50% rh ± 30% rh
	Call for cooling:	NO
• Fault present:	Economizer damper position:	FULLY CLOSED
• Fault not present:	Economizer damper position:	MINIMUM POSITION

LOW TEMPERATURE TEST: DAMPER ALLOWING EXCESS OUTDOOR AIR

• Test code:	ECON-LO-EXSO	
	Outdoor air temperature:	45°F ± 5°F (7.2°C 2.8°C)
	Outdoor air relative humidity:	50% rh ± 10% rh
	Call for cooling:	NO
• Fault present:	Economizer damper position:	HALFWAY OPEN
• Fault not present:	Economizer damper position:	MINIMUM POSITION

7. REFERENCES

1. ASHRAE. ~~2013~~2020. ANSI/ASHRAE Standard 41.1, *Standard Method for Temperature Measurement.* Atlanta: ASHRAE.
2. ASHRAE. ~~2014~~2021. ANSI/ASHRAE Standard 41.6, *Standard Method for Humidity Measurement*. Atlanta: ASHRAE.

POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted Standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the Standards and Guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive Technical Committee structure, continue to generate up-to-date Standards and Guidelines where appropriate and adopt, recommend, and promote those new and revised Standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date Standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating Standards and Guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.

ASHRAE · 180 Technology Parkway NW · Peachtree Corners, GA 30092 · www.ashrae.org

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Founded in 1894, ASHRAE is a global professional society committed to serve humanity by advancing the arts and sciences of heating, ventilation, air conditioning, refrigeration, and their allied fields.

As an industry leader in research, standards writing, publishing, certification, and continuing education, ASHRAE and its members are dedicated to promoting a healthy and sustainable built environment for all, through strategic partnerships with organizations in the HVAC&R community and across related industries.

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