(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

One of the most important predictors of a building's energy efficiency is its HVAC system. There are a number of ways to measure the performance of HVAC systems— energy efficiency ratings being one of the most common— but the airtightness of the equipment is obviously an important factor as well. Air that is not delivered to areas as specified in the building design is air that is not being used efficiently. With this in mind, ASHRAE Standard 193 was created to test the airtightness of HVAC equipment.

Targeted at systems that move less than 3000 cfm (1400 L/s), Standard 193 will provide results that may be used by cognizant authorities who wish to regulate the air leakage of HVAC equipment and by contractors and installers that wish to specify and install equipment with known leakage characteristics.

The approach taken in this method of test is to determine the air leakage rate of HVAC equipment at a fixed reference pressure difference. In this way Standard 193 is similar to other rating standards that perform evaluations at a single condition for comparison purposes rather than attempting to estimate performance for an individual installation. Because this test method can be applied to a wide range of equipment, it is beyond the scope of this standard to fully specify detailed test arrangements.

Currently the need for minimizing air leakage in HVAC systems is reflected in various ASHRAE standards. ASHRAE Standard 62.2 limits allowable air leakage between garages and houses due to leaks in forced-air HVAC systems. ASHRAE Standard 152 includes HVAC system air leakage in estimates of distribution system efficiency for residential buildings. But while these standards aim to reduce the overall air leakage found in HVAC systems, neither provides a way to determine the effectiveness of specific components in an HVAC system in preventing air leakage. Although ASHRAE Standard 130 includes a test method for measuring air leakage of air terminal units, it does not specify a fixed test pressure suitable for airtightness ratings.

This is a reaffirmation of Standard 193-2010. 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. This version of the reaffirmation has minor editorial changes.

1. PURPOSE

This standard prescribes a method of test to determine the airtightness of forced-air HVAC equipment prior to field installation.

2. SCOPE

2.1 This standard applies to the following:

a. Equipment intended for installation in ducted systems, including furnaces, heat pumps, air conditioners, coil boxes, filter boxes, and associated components.
b. Equipment that moves less than 3000 cfm (1400 L/s) of air.

2.2 This standard does not apply to ducts, plenums, or other field-constructed components.

3. DEFINITIONS

Where the following terms occur in this standard, the definitions provided in this section apply.

air-handling unit (AHU): any device that includes a fan or blower for moving air through ductwork. Examples include furnaces, fan-coil units, energy or heat recovery units, and exhaust fans.

cased coil: a heating or cooling coil that is mounted in a cabinet and contains no fan or blower.

duct-mounted air cleaner: a media air filter or other air-cleaning device that is mounted in a cabinet and has no fan or blower.

standard conditions: for the purposes of this standard, standard conditions are defined as follows: 68°F (20°C) for temperature, 0.07517 lb/ft^3 (1.2041 kg/m^3) for air density, and 29.92 in. Hg (101.325 kPa) for barometric pressure.

variable-air-volume (VAV) box: a terminal air control device that regulates the amount of air entering a space; usually contains a damper but no fan or blower.

4. NOMENCLATURE

P_{baro}	=	barometric pressure, in. Hg (kPa)
Q_{leak}	=	air leakage of equipment under test adjusted to standard conditions and corrected for background leakage, cfm (L/s)
Q_{bg}	=	background air leakage rate of the test apparatus, cfm (L/s)
$Q_{bg,std}$	=	background air leakage rate of the test apparatus adjusted to standard conditions, cfm (L/s)
Q_{meas}	=	measured air leakage rate, cfm (L/s)
$Q_{meas,std}$	=	measured air leakage of equipment under test adjusted to standard conditions, cfm (L/s)
T_{meas}	=	temperature of air flowing through the air flowmeter, °F (°C)

5. TEST APPARATUS AND SPECIFICATIONS

This method of test requires the depressurization and/or pressurization of HVAC equipment to a specified test pressure. The airflow rate required to maintain the applied pressures is the air leakage rate of the equipment under test, Q_{leak}. Schematics of typical test apparatuses are shown in Figures 1 and 2.

5.1 Test Apparatus

The test apparatus shall consist of the following components:

a. An air-moving blower or equivalent device capable of controlling airflow for pressurizing or depressurizing the equipment under test to a pressure difference of 0.5 in. H_2O (125 Pa).
b. An airflow measuring device capable of measuring volumetric airflow at the required test pressure difference with the accuracy stated in Section 5.2.1.
c. A pressure-measuring device capable of measuring the required pressure difference with the accuracy stated in Section 5.2.2.
d. Temperature measurement devices capable of measuring air temperature with the accuracy stated in Section 5.2.3.
e. A pressure-measuring device to measure barometric pressure with the accuracy stated in Section 5.2.4.

5.2 Test Apparatus Specifications

The test apparatus shall meet the following specifications.

5.2.1 Airflows shall be measured with an accuracy equal to or better than 2 cfm (1 L/s) or 5% of measured flow, whichever is larger, and with a precision equal to or better than 1 cfm (0.5 L/s).

5.2.2 Pressures shall be measured with an accuracy equal to or better than 0.004 in. H_2O (1.0 Pa) and a precision equal to or better than 0.002 in. H_2O (0.5 Pa).

5.2.3 Temperature measurements shall be made using devices with an accuracy equal to or better than ±2°F (1°C) and with a precision equal to or better than ±1°F (0.5°C).

5.2.4 Barometric pressures shall be measured with an accuracy equal to or better than 0.15 in. Hg (0.5 kPa).

6. TEST PROCEDURE

This test procedure shall be used to determine the amount of airflow, Q_{leak}, for the equipment under test. Q_{leak} shall be a positive value representing the magnitude of the measured airflow.

The background leakage described in Section 6.1 shall be measured for all test procedures. Table 1 shall then be used to select an additional equipment-specific test method to be performed. The barometric pressure, P_{baro}, and the temperature, T_{meas}, of the air flowing through the measurement device shall be determined for each airflow measurement.

6.1 Background Air-Leakage Rate of the Test Apparatus

6.1.1 An air impermeable blanking cap shall be used to cover the opening of the test apparatus to which the equipment under test is connected.

6.1.2 The air-moving device shall be turned on and used to create a pressure difference of 0.5 in. H_2O (125 Pa) between the inside and outside of the equipment under test, with the inside of the equipment depressurized relative to ambient conditions.

6.1.3 Measure the volumetric airflow, (Q_{bg-}).

6.1.4 Convert the background leakage flows to standard conditions, $Q_{bg-,std}$, using Equation 2 or 3, as applicable.

6.1.5 If positive pressure tests are to be performed, repeat the background leakage test in pressurization mode to determine $Q_{bg+,std}$.

6.2 Air-Leakage Test Methods

6.2.1 Depressurization Test

6.2.1.1 The equipment shall be connected to the air-moving device. An impermeable blanking cap shall be applied to the open end or ends of the equipment under test, if applicable. This connection shall be made with the same air-sealing technique as used for the background air leakage measurements of Section 6.1.

6.2.1.2 The air-moving device shall be turned on and used to create a pressure difference of 0.5 in. H_2O (125 Pa) between the inside and outside of the equipment under test, with the inside of the equipment depressurized relative to ambient conditions. The pressure measurement location shall be selected to avoid, as much as possible, air velocities that could influence the measurement.

6.2.1.3 Determine the volumetric airflow through the measurement device (Q_{meas}) required to maintain this pressure difference. The airflow shall be converted to standard conditions, $Q_{meas,std}$, using Equation 2 or 3, as applicable.

6.2.1.4 The background air leakage rate shall be subtracted from the measured air leakage rate to determine the air leakage rate of the equipment under test using Equation 1:

$$Q_{leak} = Q_{meas,\,std} - Q_{bg,\,std} \qquad (1)$$

6.2.2 Pressurization Test

6.2.2.1 The equipment shall be connected to the air-moving device. An impermeable blanking cap shall be applied to the open end or ends of the equipment under test, if applicable. This connection shall be made with the same air sealing technique as used for the background air leakage measurements of Section 6.1.

6.2.2.2 The air-moving device shall be turned on and used to create a pressure difference of 0.5 in. H_2O (125 Pa) between the inside and outside of the equipment under test, with the inside of the equipment pressurized relative to ambient conditions. The pressure measurement location shall be selected to avoid, as much as possible, air velocities that could influence the measurement.

6.2.2.3 Determine the volumetric airflow through the measurement device (Q_{meas}) required to maintain this pressure difference. The airflow shall be converted to standard conditions, $Q_{meas,std}$, using Equation 2 or 3, as applicable.

6.2.2.4 The background air leakage rate shall be subtracted from the measured air leakage rate to determine the air leakage rate of the equipment under test using Equation 1.
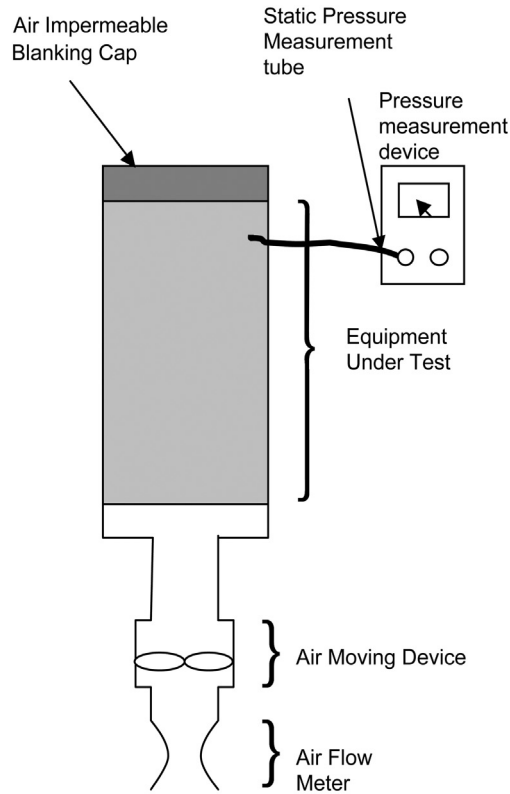
Figure 1   Schematic of test apparatus and equipment under test for pressurization or depressurization testing.
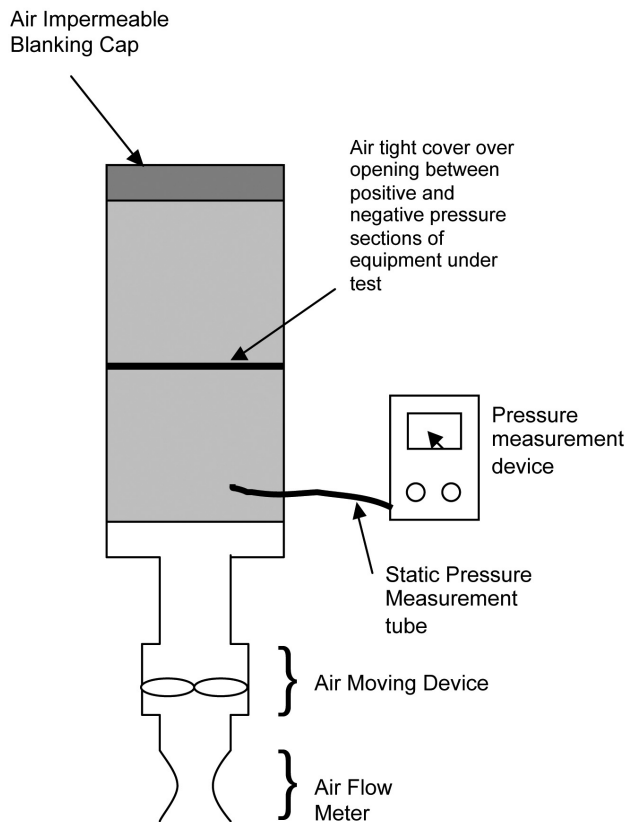

Figure 2   Schematic of test apparatus and equipment under test for split-test procedure.