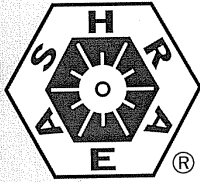


ANSI/ASHRAE Standard 37-2005



# ASHRAE STANDARD

## Methods of Testing for Rating Electrically Driven Unitary Air-Conditioning and Heat Pump Equipment

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1791 Tullie Circle NE, Atlanta, GA 30329  
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#### NOTE

When addenda, interpretations, or errata to this standard have been approved, they can be downloaded free of charge from the ASHRAE Web site at <http://www.ashrae.org>.

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## FOREWORD

*ANSI/ASHRAE Standard 37-2005 provides a comprehensive updating of Standard 37, which was last published in 1988. Incorporating the project committee's research into advances in unitary air conditioners and heat pumps and its research into improved testing methods, this edition of the standard updates the older version by*

- *refining the equations to improve the accuracy and efficiency of the testing methods;*
- *using more generic terms such as "liquid" instead of "water" to include refrigerant, oil, or other substances;*
- *improving the drawings and illustrations to make it easier to follow the test procedures; and*
- *updating the reference section to reflect the most recent editions of the standards cited.*

*These improvements should bring the standard up to date with current technology and make it easier to use.*

## 1. PURPOSE

**1.1** The purpose of this standard is to provide test methods for determining the cooling capacity of unitary air-conditioning equipment and the cooling or heating capacities, or both, of unitary heat pump equipment.

**1.2** These test methods do not specify methods of establishing ratings that involve factors such as manufacturing tolerances and quality control procedures.

## 2. SCOPE

**2.1** This standard applies to electrically driven mechanical-compression unitary air conditioners and heat pumps consisting of one or more assemblies that include an indoor air coil(s), a compressor(s), and an outdoor coil(s). Where such equipment is provided in more than one assembly, the separated assemblies are designed to be used together.

**2.2** This standard does not include methods of testing the following:

- (a) cooling coils for separate use
- (b) condensing units for separate use
- (c) room air conditioners
- (d) heat-operated unitary equipment
- (e) liquid chilling packages
- (f) multiple indoor air coils operating simultaneously in heating and cooling modes

## 3. DEFINITIONS

**air, standard:** dry air having a mass density of 1.204 kg/m<sup>3</sup> (0.075 lb/ft<sup>3</sup>).

**apparatus:** as used in this standard, this term refers exclusively to test room facilities and instrumentation.

**capacity, heating:** the rate, expressed in watts (Btu/h), at which the equipment adds heat to the air passing through it under specified conditions of operation.

**capacity, latent cooling:** the rate, expressed in watts (Btu/h), at which the equipment removes latent heat from the air passing through it under specified conditions of operation.

**capacity, sensible cooling:** the rate, expressed in watts (Btu/h), at which the equipment removes sensible heat from the air passing through it under specified conditions of operation.

**capacity, total cooling:** the rate, expressed in watts (Btu/h), at which the equipment removes heat from the air passing through it under specified conditions of operation.

**coil, indoor:** the heat exchanger that removes heat from or adds heat to the conditioned space.

**coil, outdoor:** the heat exchanger that rejects heat to or absorbs heat from a source external to the conditioned space.

**equipment:** as used in this standard, this term refers exclusively to the unitary equipment to be tested.

**equipment, unitary:** this term shall be defined as provided in Section 2 and Section 4.

**indoor side:** that part of the system that removes heat from or adds heat to the indoor airstream.

**outdoor side:** that part of the system that rejects heat to or absorbs heat from a source external to the indoor airstream.

**pressure, standard barometric:** 101.325 kPa (14.696 psi).

**refrigerant, volatile:** a refrigerant that changes from the liquid to the vapor state in the process of absorbing heat.

**shall:** where "shall" or "shall not" is used for a provision, that provision is mandatory if compliance with the standard is claimed.

**should, recommended, or it is recommended:** "should," "recommended," or "it is recommended" are used to indicate provisions that are not mandatory but that are desirable as a good practice.

## 4. CLASSIFICATIONS

Unitary equipment within the scope of this standard may be classified as follows:

#### 4.1 Component Arrangement:

- (a) Units employing compressor(s), indoor air coil(s), and outdoor coil(s) in a single package assembly.
- (b) Units employing compressor(s) and indoor coil(s) in one or more assemblies with remote outdoor coil(s).
- (c) Units employing indoor coil assemblies, with outdoor coil(s) and compressor(s) in one or more assemblies.

#### 4.2 Method of Outdoor Coil Heat Exchange:

- (a) air,
- (b) liquid, and
- (c) evaporative cooled condensing.

*Note:* Related Air-Conditioning and Refrigeration Institute (ARI) classifications for unitary air conditioners and heat pumps are given in Tables A-1 and A-2, respectively, in Appendix A, and are illustrative but not restrictive.

### 5. INSTRUMENTS

#### 5.1 Temperature Measuring Instruments

5.1.1 All temperature measurements (with the exception of dew point temperature) shall be made in accordance with ANSI/ASHRAE Standard 41.1-1986 (RA 2001).<sup>1</sup>

5.1.2 If used in determining the water vapor content of the air, dew point hygrometers shall be applied as specified in ANSI/ASHRAE Standard 41.6-1994 (RA 2001)<sup>2</sup> and shall be accurate to within  $\pm 0.2^\circ\text{C}$  ( $0.4^\circ\text{F}$ ).

5.1.3 Inlet air temperature measurements are to be taken upstream of static pressure taps on the inlet duct (if installed). Outlet air temperature measurements shall be taken downstream of the static pressure taps on the outlet.

#### 5.2 Refrigerant, Liquid, and Barometric Pressure Measuring Instruments

5.2.1 Pressure measurements shall be made with one or more of the following instruments:

- (a) liquid column
- (b) Bourdon tube gauge
- (c) electronic pressure transducer

ASHRAE Standard 41.3-1989<sup>3</sup> should be referred to for information on the above instruments.

5.2.2 The accuracy of the pressure measuring instruments shall permit measurements to within  $\pm 2.5\%$  of the reading.

5.2.3 Calibration of the pressure measuring instrument shall be with respect to a deadweight tester or by comparison with a liquid column.

5.2.4 In no case shall the smallest scale division of the pressure measuring instrument exceed two times the specified accuracy.

#### 5.3 Air Differential Pressure and Airflow Measurements

5.3.1 The static pressure difference across nozzles and velocity pressures at nozzle throats shall be measured with manometers or electronic pressure transducers that have been calibrated against a pressure standard to within  $\pm 1.0\%$  of the reading. The resolution of the device shall be equal to or less than  $2.0\%$  of the reading.

5.3.2 Duct static pressure shall be measured with one or more manometers or electronic pressure transducers that are accurate to within  $\pm 2.5$  Pa ( $\pm 0.01$  in.  $\text{H}_2\text{O}$ ).

5.3.3 Areas of nozzles shall be determined by measuring their diameters to within  $\pm 0.20\%$  in four places approximately equally spaced around the nozzle in each of two planes through the nozzle throat, one at the outlet and the other in the straight section near the radius.

#### 5.4 Electrical Instruments

5.4.1 Electrical measurements shall be made with indicating or integrating instruments.

5.4.2 Instruments used for measuring the electrical power input to fan motors, compressor motors, or other equipment accessories shall be accurate to within  $\pm 2.0\%$  of the reading. *Note:* For an efficiency rating purpose, a more accurate measurement of the electrical power input may be required.

5.4.3 Instruments used for measuring the electrical power input to heaters or other apparatus furnishing heat loads (see 7.7.1.2 and Figure 10) shall be accurate to within  $\pm 1.0\%$  of the quantity measured.

5.4.4 Voltages shall be measured at the equipment terminals. Instruments used for measuring voltage shall be accurate to within  $\pm 1.0\%$  of the reading.

#### 5.5 Volatile Refrigerant Flow Measurement

5.5.1 Volatile refrigerant flow shall be measured with an integrating flow measuring system that is accurate to within  $\pm 1.0\%$  of the reading.

#### 5.6 Liquid Flow Measurement

5.6.1 Water and brine flow rates shall be measured with a liquid flow meter or quantity meter that is accurate to within  $\pm 1.0\%$  of the reading.

5.6.2 Condensate collection rates shall be determined using a liquid quantity meter that is accurate to within  $\pm 1.0\%$  of the reading.

#### 5.7 Speed Measuring Instruments

5.7.1 Speed measurements shall be made with a revolution counter, tachometer, stroboscope, or oscilloscope that is accurate to within  $\pm 1.0\%$  of the reading.

#### 5.8 Time and Mass Measurements

5.8.1 Time interval measurements shall be made with an instrument that is accurate to within  $\pm 0.2\%$  of the reading.

5.8.2 Mass measurements shall be made with an apparatus that is accurate to within  $\pm 1.0\%$  of the reading.

5.9 Volatile refrigerant mass composition measurements for zeotropic refrigerants shall be made using an instrument that is in accordance with ARI Standard 700-95.<sup>4</sup>

### 6. AIRFLOW AND AIR DIFFERENTIAL PRESSURE MEASUREMENT APPARATUS

6.1 **Enthalpy Apparatus.** Recommended configurations for the test apparatus are provided below. In all cases, suitable means for determining the dry-bulb temperature and water

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