



STANDARD

**ANSI/ASHRAE Standard 41.6-2014**  
(Supersedes ANSI/ASHRAE Standard 41.6-1994 [RA 2006])

# Standard Method for Humidity Measurement

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**NOTE**

**Approved addenda, errata, or interpretations for this standard can be downloaded free of charge from the ASHRAE Web site at [www.ashrae.org/technology](http://www.ashrae.org/technology).**

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## FOREWORD

The 2014 revision represents a significant update to ASHRAE Standard 41.6, which was last published in 1994 (RA 2006). A change results from the completion of ASHRAE research project RP-1460, "Design Specifications for Wet-Bulb Aspirator Apparatus." The aspirated wet-bulb psychrometer descriptions are no longer included in ASHRAE Standard 41.1-2013, Standard Methods for Temperature Measurement.

Additional updates include the removal of moist-air properties calculations, the inclusion of uncertainty analysis for humidity measurements, and changes to bring the standard into compliance with ASHRAE's mandatory language and SI (I-P) units' requirements. The standard has also been arranged consistent with recently published ASHRAE Standard 41-series standards, which include a classifications section and updated definitions and references.

## 1. PURPOSE

This standard prescribes methods for measuring the humidity of moist air with instruments.

## 2. SCOPE

**2.1** This standard applies to the measurement of humidity of moist air from sea level to 3048 m (10,000 ft), within the dry-bulb temperature range of  $-50^{\circ}\text{C}$  to  $160^{\circ}\text{C}$  ( $-58^{\circ}\text{F}$  to  $320^{\circ}\text{F}$ ), and within the dew-point temperature range of  $-50^{\circ}\text{C}$  to  $99^{\circ}\text{C}$  ( $-58^{\circ}\text{F}$  to  $210^{\circ}\text{F}$ ).

**2.2** This standard applies to methods for the direct measurement of wet-bulb temperature, dew-point temperature, relative humidity (RH), and humidity ratio.

**2.3** This standard requires determining the uncertainty of direct humidity measurements due to various sources of errors.

## 3. DEFINITIONS

**absolute humidity:** in a mixture of water vapor and dry air, the mass of water vapor in a specific volume of the mixture.

**accuracy:** the degree of conformity of an indicated value to an accepted standard value, or true value. The degree of inaccuracy is known as *total measurement error* and is the sum of bias error and precision error.

**adiabatic saturation temperature:** the saturation temperature to which moist air is adiabatically cooled by evaporation of water at the same temperature into the moist air. Also referred to as *thermodynamic wet-bulb*, this is the temperature plotted on a psychrometric chart and is used for the calculation of moist-air properties.

**dew-point temperature:** temperature at which water vapor has reached the saturation point (100% rh).

**error:** the difference between the true value of the quantity measured and an observed value. Since the true value is often not known, it is estimated by the mean. The difference between the mean and an observed value is often called its *deviation*.

**fixed, bias, or systematic error:** the difference between the true or actual value to be measured and the indicated value from the measuring system that persists and is usually due to the particular instrument or technique of measurement.

**frost point:** the temperature at which visible frost forms on a surface being chilled.

**hygrometer:** an instrument responsive to relative humidity—in this standard, relative humidity in the atmosphere.

**mixing (humidity) ratio:** the ratio of the mass of water vapor to the mass of dry air.

**precision:** the closeness of agreement among repeated measurements of the same characteristic by the same method under the same conditions.

**psychrometer:** An instrument used to determine the humidity of air by simultaneously measuring both the wet-bulb and dry-bulb temperatures. The difference between these temperatures is referred to as the *wet-bulb depression*.

**random error (or precision error):** a statistical error that is caused by chance and is not recurring. There are two types of random errors:

- *additive errors*, which are independent of the magnitude of the observations
- *multiplicative errors*, which are dependent on the magnitude of the observations.

**relative humidity:**

- a. ratio of the partial pressure or density of water vapor to the saturation pressure or density, respectively, at the same dry-bulb temperature, and barometric pressure of the ambient air.
- b. ratio of the mole fraction of water vapor to the mole fraction of water vapor saturated at the same temperature and barometric pressure.

**repeatability:** the closeness of agreement among repeated measurements of the same characteristic under the same conditions by the same instrument.

**sensitivity:** the relationship between an observed change in the position of an instrument pen, pointer, or indicator and the magnitude of change in the measured quantity required to produce that reaction of the indicator. It is expressed as a numerical ratio if the units of measurement of the two quantities are stated. An increase in sensitivity means a corresponding increase in the ability of an instrument to react to extremely small changes in the measured quantity.

**specific humidity:** ratio of the mass of water to the total mass of a moist air sample.