ANSI/ASHRAE Standard 41.1-1986 (RA 2006)
Reaffirmation of ANSI/ASHRAE Standard 41.1-1986

ASHRAE STANDARD

Standard Method for Temperature Measurement

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ASHRAE Standing Standard Project Committee 41.1
Cognizant TC: TC 1.2, Instruments and Measurements
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NOTE

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(This foreword is not a 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.)

FOREWORD

This is a reaffirmation of ASHRAE Standard 41.1-1986. This standard was prepared under the auspices of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (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 standards throughout the industry.

This standard was written to establish methods of temperature measurement that provide consistent procedures that may be referenced in other ASHRAE standards.

There were no changes made for the 2006 reaffirmation.

1. PURPOSE

The purpose of this standard is to set forth recommended practices for temperature measurements and provide adequate and consistent measurement procedures for reference in other standards.

2. SCOPE

The procedures described herein are intended for use in testing heating, refrigerating, and air-conditioning equipment and components. The media in which temperature measurements are made include air, water, brine, and volatile or nonvolatile refrigerants, under both steady-state and transient temperature conditions between -40ºF and 400ºF (-40ºC and 204ºC).

3. DEFINITIONS

***accuracy*:** the ability of an instrument to indicate or record the true value of a measured quantity. The error of indication, which is the difference between the indicated value and the true value of the measured quantity, expresses the accuracy of an instrument.

***precision*:** closeness of agreement among repeated measurements of the same physical quantity by the same method under the same conditions and with the same instrument. (An instrument may be precise but not accurate.)

saturation deficiency: the amount that the humidity ratio of an air sample is below the saturated humidity ratio of air at the same temperature and pressure.

***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 can be 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.

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

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

***steady-state conditions*:** an operating state of a system, including its surroundings, in which the extent of change with time of all the significant parameters is so small as to have no important effect on the performance being observed or measured.

***temperature, dry-bulb*:** the temperature of a gas or mixture of gases indicated by an accurate thermometer after correction for radiation.

***temperature, wet-bulb*:** the temperature at which liquid or solid water, by evaporating into air, can bring the air to saturation adiabatically at the same temperature. Wet-bulb temperature (without qualification) is the temperature indicated by a wet-bulb psychrometer constructed and used according to specifications.

***transducer*:** a device that changes one form of physical quantity into another. In the measurement field, transducers are generally used to sense a variety of measurands, such as line voltage, current, power, pressure, and temperature, and to convert these to a common output signal for use with a controlling or recording instrument.

***transient state*:** the state in which the system undergoes a normal change in operation, such as thermostat cycling or actuation of a defrost control.

4. INSTRUMENTS

4.1 Temperature measurements shall be made with an instrument or instrument system, including read-out devices, meeting the accuracy and precision requirements in Table 1. The following are in common use for this purpose but are not all-inclusive:

a. Liquid-in-glass thermometers
b. Thermocouples
c. Electric resistance thermometers, including thermistors

In general, the response time of liquid-in-glass thermometers is too large to be used in transient testing.

4.2 The rate of heat flow to or from a moving fluid under steady-state conditions is determined by the product of the enthalpy change and the mass flow rate for the fluid. The measurement of heat flow involves two situations that allow different levels of accuracy in temperature measurement to produce equivalent levels of accuracy in the heat flow measurement.

a. For the case of flow of air, water, or nonvolatile refrigerant, relatively small changes in enthalpy are predominantly due to sensible heat changes. These are associated