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ANSI/ASHRAE Standard 94.2-1981 (RA 2006)
Reaffirmation of ANSI/ASHRAE Standard 94.2-1981

ASHRAE STANDARD

Method of Testing Thermal Storage Devices with Electrical Input and Thermal Output Based on Thermal Performance

Approved by the ASHRAE Standards Committee on January 27, 1981, and reaffirmed January 21, 2006; by the ASHRAE Board of Directors on January 29, 1981, and reaffirmed on January 26, 2006; and by the American National Standards Institute on June 8, 1981, and reaffirmed on January 27, 2006.

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Approved American National Standard

ANSI

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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 94.2-1981. This standard falls under the Standards Committee classification of Standard Method of Measurement. 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.

There are essentially two types of heat storage devices in existence that can be tested by this standard: central devices and room devices. Central devices are located at a central location from which their output is ducted or piped to the point of use or to a heat exchanger. Room devices are installed within the space to be heated; they are sometimes referred to as radiator devices because they release their heat by either radiation or convection or a combination of the two. Separate testing procedures are prescribed for the two types of storage device.

The financial contribution of the U.S. Department of Energy, which paid for the travel expenses of some of the Project Committee members to accelerate the preparation of this standard, is gratefully acknowledged.

There were no changes made for the 2006 reaffirmation.

1. PURPOSE

The purpose of this standard is to provide a standard procedure for determining the energy performance of electrically charged thermal energy storage devices used in heating systems.

2. SCOPE

2.1 This standard applies to thermal storage devices that are charged electrically and discharged thermally. The energy may be stored as latent heat or as sensible heat or as a combination of the two.

2.2 The device is charged by electric-resistance heating, and the electric-resistance mechanism is an integral part of, or is located inside, the storage device.

2.3 The device is discharged by a heat transfer fluid that enters the device through a single inlet and leaves the device through a single outlet. Storage devices having more than one inlet and/or outlet may be tested according to this standard, but each flow configuration involving a single inlet and single outlet must be tested separately. This standard is not applicable to those configurations in which there is simultaneous flow into the storage device through more than one inlet and/or simultaneous flow out of the storage device through more than one outlet. The transfer fluid may be either a gas or a liquid or a mixture of the two.

2.4 This standard does not include factors relating to cost, life, reliability, or the consideration of requirements for interfacing with specific heating and cooling systems.

2.5 The test procedure and equipment outlined in this standard are most easily adaptable to devices used to store thermal energy on the order of 10^{11} J (10^{8} Btu) or less.

3. DEFINITIONS

The following definitions are stipulated for this document:

ambient air: the air in the space surrounding the central thermal energy storage device or calorimeter.

cycling (latent heat-type storage device): a process in which heat is supplied to and removed from the storage device in a cyclic manner, and the phase of the storage medium is changed twice in each cycle.

discharge capacity: the amount of heat that can be removed from the storage device during a period of time and for a specific set of charging conditions.

standard air: air weighing 1.2 kg/m^3 (0.075 lb/ft^3), which approximates dry air at a temperature of 21.1°C (70°F) and a barometric pressure of 101.3 kPa (29.92 in. of Hg).

standard barometric pressure: the barometric pressure of 101.3 kPa (29.92 in. of Hg) at 0°C (32°F).

storage device: the container(s) plus all contents of the container(s) used for storing thermal energy. The transfer fluid, electrical input elements, and accessories such as heat exchangers, flow-switching devices, valves, and baffles that are integral with the thermal storage container(s) are considered a part of the storage device.

storage medium: the material in the storage device, independent of the containing structure, in which the major portion of the energy is stored.

transfer fluid: the fluid that carries energy out of the storage device.

4. CLASSIFICATIONS

In this standard, thermal energy storage devices are classified according to the method they use to store energy, the type of transfer fluid they employ, and the usage of the unit.

4.1 Sensible heat-type storage devices are those in which the heat absorbed by or removed from the system results in an increase or decrease in the temperature of the storage medium, and there is no change of phase of any portion of the storage medium. Typical sensible heat-type storage devices employ water, water glycol, natural or artificial stone, and other materials singly or in combination.

4.2 Latent heat-type storage devices are those involving a change of phase of the storage medium. In this type of storage device, most of the heat added to or removed from the system goes into changing the enthalpy of the storage medium during