

**ANSI/ASHRAE 94.2-2010**

(Supersedes ANSI/ASHRAE Standard 94.2-1981 [RA 2006])



# ASHRAE STANDARD

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

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#### NOTE

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## FOREWORD

*This is a revision of Standard 94.2-1981 (RA 2006). 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.*

*The changes made or the 2009 revision were:*

- *References were updated*
- *Adding an Informative Annex*
- *Standards referenced in the body of the standard were updated to be consistent with the references section.*

## 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  $1.2 \text{ kg/m}^3$  ( $0.075 \text{ lb/ft}^3$ ), which approximates dry air at a temperature of  $21.1^\circ\text{C}$  ( $70^\circ\text{F}$ ) and a barometric pressure of  $101.3 \text{ kPa}$  ( $29.92 \text{ in. of Hg}$ ).

**standard barometric pressure:** the barometric pressure of  $101.3 \text{ kPa}$  ( $29.92 \text{ in. of Hg}$ ) at  $0^\circ\text{C}$  ( $32^\circ\text{F}$ ).

**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 a change of phase process. Some heat is also stored as sensible heat, since charging and discharging of the storage involves a finite change in the temperature of the system.

**4.3** Central thermal storage devices are those in which the output is ducted or piped from the device in a "central" location to the space or to heat transfer devices.

**4.4** Room thermal storage devices are those in which the storage device is installed within a space or room. The output