AHRI Guideline T (SI)

2013 Guideline for

Specifying the Thermal Performance of Cool Storage Equipment

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IMPORTANT

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Note:

This guideline supersedes AHRI Guideline T-2002.

For I-P, see AHRI Guideline T (I-P)-2013.

FOREWORD

Thermal energy storage (TES) is a proven technology which enables the use of lower cost, off-peak electricity (usually at night) to produce and store cool energy. This cool energy in storage is used the next day for air-conditioning or process cooling. With TES, relatively small equipment operates at night, reducing the use of expensive electricity during the day.

The types of equipment used in connection with this technology may vary widely.

Unlike most air-conditioning and refrigeration equipment, Thermal Storage Devices have no sustained, steady-state operating point which can be used to characterize the product performance.

Similarly, the usable capacity of a particular Thermal Storage Device may vary appreciably with the application. For example, very high loads discharged over a short period, and/or relatively low discharge temperatures may reduce the usable capacity to a fraction of the nominal value.

These intrinsic characteristics of Thermal Storage Equipment can add complexity to the tasks of rating, selecting and specifying such devices. This guideline has been prepared by the Air-Conditioning, Heating and Refrigeration Institute to establish a common, consistent nomenclature and terminology for the industry, and to set forth the minimum performance information that designers should include in their specifications and manufacturers should provide in their proposals for Thermal Storage Equipment. In addition, all of the member manufacturing companies in the AHRI Thermal Storage Equipment product section are available to assist the designer in properly specifying the product.

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GUIDELINE FOR SPECIFYING THE THERMAL PERFORMANCE OF COOL STORAGE EQUIPMENT

Section 1. Purpose

1.1 *Purpose.* The purpose of this guideline is to establish the minimum information required for specifying cool storage equipment:

a. User-specified application recommendations
b. Supplier-specified thermal performance data

1.1.1 *Intent.* This guideline is intended for guidance of the industry, including manufacturers, engineers, installers, contractors and users.

1.1.2 *Review and Amendment.* This guideline is subject to review and amendment as technology advances.

Section 2. Scope

2.1 *Scope.* This guideline applies to Thermal Storage Equipment, for use in cooling systems, which may be charged and discharged with any of a variety of heat transfer fluids, and is either fully factory assembled, assembled on site from factory supplied components or field erected in accordance with pre-established design criteria, all as further described in Sections 3 and 4.

2.2 *Exclusions.* This guideline does not apply to Thermal Storage Equipment with thermal storage capacities of 25 kW·h or less.

Section 3. Definitions

All terms in this document will follow the standard industry definitions in the ASHRAE Wikipedia website (http://wiki.ashrae.org/index.php/ASHRAEwiki) unless otherwise defined in this section.

3.1 *Ambient Air.* The air in the space surrounding the thermal energy storage device.

3.2 *Ambient Heat Load.* The load (typically expressed in kW) imposed on the storage device due to heat gain from the ambient.

3.3 *Charge Fluid.* The heat transfer fluid used to remove heat from a thermal storage device.

3.4 *Charge Period/Cycle.* The period of time when energy (heat) is removed from the storage device.

3.5 *Charge Rate.* The rate (typically expressed in kW) at which energy (heat) is removed from the storage device during the charge period.

3.6 *Discharge Fluid.* The heat transfer fluid used to add heat to the thermal storage device.

3.7 *Discharge Period/Cycle.* The period of time when energy (heat) is added to the storage device.

3.8 *Discharge Rate.* The rate (typically expressed in kW) at which energy (heat) is added to the storage device during the Discharge Period.

3.9 *Initial Charge Cycle.* The elapsed time required to bring the storage device from ambient conditions to its fully charged condition and the minimum temperature of the Heat Transfer Fluid attained during the cycle.

3.10 *Latent Heat of Fusion.* The change in enthalpy accompanying the conversion of a unit mass of a solid to a liquid at its melting point at constant pressure and temperature.

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3.11 *Net Storage Inventory*. Net accumulated measured storage capacity at a given period of time during a 24 hour cycle.

3.12 *Net Usable Storage Capacity.* The amount of stored cooling, that can be supplied from the storage device at or below the specified cooling supply temperature for a given Charge and Discharge Cycle, typically expressed in kW·h.

3.13 *Nominal Storage Capacity.* A theoretical capacity of the storage device as defined by the storage device manufacturer (which in most cases is greater than the Net Usable Storage Capacity).

3.14 *Phase Change Material (PCM).* A substance that undergoes changes of phase while absorbing or rejecting thermal energy, normally at a constant temperature.

3.15 *Saturated Evaporator Temperature.* The dew point temperature of the refrigerant corresponding to the saturation pressure at the outlet connection of the evaporator.

3.16 *Secondary Coolant.* Any liquid cooled by a refrigerant and used for heat transmission without a change in state, having no flash point or a flash point above 66°C.

3.17 *Sensible Heat.* Heat that causes a change in fluid temperature.

3.18 *Should.* This term is used to indicate provisions which are not mandatory but which are desirable as good practice.

3.19 *Thermal Storage Device.* Equipment which stores cooling capacity using sensible and/or latent heat. May consist solely of a storage means or be packaged with one or more components of a mechanical refrigeration system.

3.20 *Thermal Storage Equipment.* Any one of, or a combination of, Thermal Storage Devices and/or Generators, that may include various other components of a mechanical or absorption refrigeration package, as indicated in Section 4. Also referred to as “Cool Storage Equipment.”

3.21 *Thermal Storage System*. All of the equipment installed to meet a specified Thermal Storage System Load which may include mechanical or absorption refrigeration equipment, see Figure 1.

3.22 *Thermal Storage System Load (or Load).* A specified cooling load to be met by the Thermal Storage System. Typically, it is expressed in kW (often referred to in this guideline as "the Load").

3.23 *Ton-Hour*. A quantity of thermal energy equal to 3.5 kW of refrigeration provided for one hour.

3.24 *Unitary Thermal Storage System (UTSS).* An assembly of components including a thermal storage device and refrigeration equipment for charging, whose overall performance as a Unitary Thermal Storage System is rated by the manufacturer.

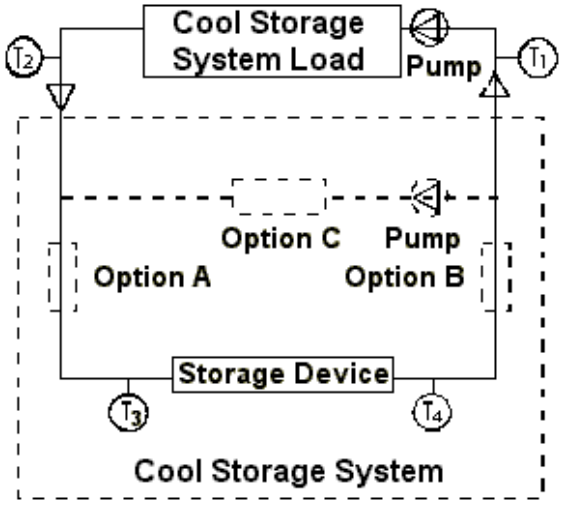


Figure 1. Cool Storage System

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