AHRI Guideline T
(formerly ARI Guideline T)

2002 Guideline for

Specifying The Thermal Performance Of Cool Storage Equipment

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IMPORTANT

SAFETY RECOMMENDATIONS

It is strongly recommended that the product be designed, constructed, assembled and installed in accordance with nationally recognized safety requirements appropriate for products covered by this guideline.

ARI, as a manufacturers' trade association, uses its best efforts to develop guidelines, employing state-of-the-art and accepted industry practices. However, ARI does not certify or guarantee safety of any products, components or systems designed, tested, rated, installed or operated in accordance with these guidelines or that any tests conducted under its guidelines will be non-hazardous or free from risk.

This guideline supersedes ARI Guideline T-1994.

INTRODUCTION TO THERMAL STORAGE GUIDELINE

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 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 ARI 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 10 ton-hours [35 kW·h] or less.

Section 3. Definitions

All terms in this document will generally follow the standard industry definitions in the current edition of ASHRAE *Terminology of Heating, Ventilation, Air-Conditioning, and Refrigeration* unless otherwise defined in this section. For the convenience of the users of this guideline, definitions for the more important terms employed in this guideline are provided below:

3.1 *Ambient Air.* The air in the space surrounding the Thermal Storage Device.

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

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

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

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

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

3.7 *Heat Transfer Fluid.* Any liquid used for heat transmission without a change in its phase, having no flash point or a flash point above 150°F [66°C]. Sometimes referred to as "Fluid," "Secondary Coolant" or "Coolant."

3.7.1 *Charge Fluid.* The Heat Transfer Fluid used to remove heat from a Thermal Storage Device or Thermal Storage Generator during the charge period.

3.7.2 *Discharge Fluid.* The Heat Transfer Fluid used to add heat to the Thermal Storage Device or Thermal Storage Generator during the Discharge Period.

3.8 *Ice-on-Coil.* A Thermal Storage Device consisting of coils, plates or other heat transfer surface submerged in a water-filled tank.

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.

3.11 *Net Ice Making Capacity.* The net ice producing capability of a Thermal Storage Generator operating in a Charge mode, typically expressed in tons [kW].

3.12 *Net Storage Inventory.* General indication of the actual amount of stored cooling remaining in the storage device at a given point in the Discharge Cycle.

3.13 *Net Usable Storage Capacity.* The actual 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 ton-hours [kW·h].

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