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ANSI/ASHRAE Standard 150-2025
Methods of Testing the Performance of Installed Cool-Storage Systems

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NOTE

Approved addenda, errata, or interpretations for this standard can be downloaded free of charge from the ASHRAE website at www.ashrae.org/technology.

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FOREWORD

ANSI/ASHRAE Standard 150 was developed to provide a uniform method for evaluating the performance of cool-storage systems installed in buildings or central plants. Its intended users are owners, operators, consultants, commissioning providers, and others. The test methods provided in this standard eliminate the need to develop a specific test procedure for each individual project by the design team. Specific additions or modifications will continue to be necessary for some projects. The standard can be used for both newly installed projects and verification testing of the performance and capacity of existing systems.

Hereinafter in this foreword, "system" means "cool-storage system" unless otherwise noted.

Standard 150 is used to determine the performance of a new or existing system at the time of the test. This information may be desired to optimize the system or to determine the system's current capability prior to an increase in load or other changes. The standard includes options for testing a system at times when less than the peak load is available.

It is recognized that field testing is costly, and this standard may not provide sufficient benefit to warrant its use at every cool-storage installation. Some packaged or modular systems can be provided with sufficient data to establish their expected or design performance without detailed field testing. This has been addressed with the development of three methods of system performance and capacity testing or verification.

This standard provides two levels of performance testing and verification. Methods 1 and 2 are for minimum certainty testing for latent and sensible systems. Method 3 provides a more complete testing method with high certainty that the cool-storage systems will meet the design load profile.

Most cool-storage installations are completely or partially dependent on field assembly of components that cannot be prerated or tested prior to assembly of the total systems. For these systems, field testing is the only way to verify that the installed system meets the specified performance or capacity requirements.

It is usually in the best interest of owners, contractors, manufacturers, and designers to establish the system's level of performance and capacity to a level of certainty at the time of installation. This may prevent costly disagreements or litigation after the system has been accepted and operated for a period of time, possibly even under different load conditions than the original design.

The test methods provided in this standard are intended to establish system performance but not to diagnose system operation. These test methods specifically enable the user to determine the available capacity of the storage device, the capacity available to meet a load, and the efficiency of the system in meeting the load. Users are encouraged to use additional instruments and take additional measurements beyond those required by the standard to aid in system diagnosis and optimization.

This standard does not specify how test results will be used. Interpretation of the data obtained from the test is the responsibility of the user.

Test Methods 1 and 2 were developed to provide the base acceptable test of performance and capacity for new and existing systems. Test Method 3 can be used for all cool-storage systems and provides a more accurate evaluation of system performance and capacity. The differences among cool-storage technologies are addressed in Test Method 3 in the definitions of the test conditions.

This standard may be referenced in project specifications requiring performance testing or capacity verification of newly installed systems.

This standard covers the performance of the system and not the performance of the individual components such as chillers, pumps, heat exchangers, valves, or other major equipment related to the cool-storage systems. Users may want to concurrently test refrigeration system performance while performing the tests specified in this standard, as much of the required instrumentation may already be in place.

In keeping with common practice, this standard uses the units of ton-hour and kWh to measure cooling energy stored or delivered capacity. This standard uses the subscripted units kWh_T and kWh_E to differentiate thermal and electrical energy.

Designers desiring to utilize Standard 150 test methods should specify in their design documents the appropriate instrumentation and system configuration as defined in this standard for the applicable test method. The specification should include sufficient detail for the selected sensor or sensors to perform as required.

The instrument accuracy requirements in this standard for Test Method 3 were selected to provide 10% or better uncertainty in the overall calculation of capacity for most systems. The standard recommends that

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users who have stricter requirements conduct an uncertainty analysis prior to testing to aid in the selection of instrument types and the measurement method.

The uncertainty analysis helps confirm that the selected instruments will provide the desired accuracy in the test results. A similar uncertainty analysis should also be completed after testing, using measured data to determine the uncertainty interval in the test results. ASHRAE Guideline 22 discusses the issues addressed in an uncertainty analysis.

In general, the installed instrumentation will be used for all test methods. However, if the instrumentation installed does not meet the requirements of Test Method 3, then field instrumentation will be required.

1. PURPOSE

This standard prescribes a uniform set of testing procedures for determining the performance of installed cool-storage systems, including cooling capacities, efficiencies, flows, peak and key charging and discharging, and other performance requirements.

2. SCOPE

2.1 This standard covers cool-storage systems composed of chillers, storage medium, storage device or vessel, heat sink equipment or heat sink systems, and other auxiliary equipment required to provide a complete and working system. The standard is limited to daily loads, weekly loads, and short-term industrial or food industry loads.

2.2 This standard includes the following:

a. Three uniform methods of testing:
   1. Method 1—base acceptable testing of latent ice storage systems
   2. Method 2—base acceptable testing of sensible stratified chilled water or low-temperature fluids systems
   3. Method 3—enhanced performance test
b. Identification of test equipment for performing such tests
c. Identification of data required and calculations to be used
d. Definitions and terminology

2.3 This standard does not cover the following:

a. Testing of the air-side distribution
b. Seasonal storage systems
c. Warm-storage systems

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3. DEFINITIONS

accuracy: the ability of an instrument to indicate the true value of a measured quantity.[1]

capacity: see *thermal storage capacity*, *cool-storage system capacity*.

charge: operational mode that replenishes the thermal energy storage (TES) tank thermal capacity.

chilled water return (CHWR): chilled water that is returned to the tank after cooling has been provided during discharge mode or leaving the tank during charge mode.

chilled water supply (CHWS): chilled water that is supplied from the tank to provide cooling during charge mode or leaving the tank during discharge mode.

cool-storage system: a system that uses a thermal storage device to meet all or part of a cooling or refrigeration load. A cool-storage system is composed of chillers, thermal storage medium, thermal storage device or vessel, heat sink equipment or heat sink systems, and other auxiliary equipment and may be a part or subset of a larger cooling system.

cool-storage system capacity: the maximum amount of cooling energy that can be supplied by a cool-storage system in response to a particular load profile, as determined by the cool-storage system capacity test.

critical discharge point: the point in the load profile at which the combination of the required discharge rate and the current storage inventory causes the discharge temperature from the thermal storage device to rise to its highest value.

cycle: see *storage cycle*.

discharge: operational mode that withdraws the TES tank thermal capacity.

discharge capacity: the capacity of the thermal storage device as determined by the discharge test. This capacity is equivalent to the usable storage capacity if the fully discharged condition is defined by the criterion given in Section 11.3(k)(1)(i).