



STANDARD

ANSI/ASHRAE Standard 25-2018
(Supersedes ANSI/ASHRAE Standard 25-2001)

Methods of Testing Forced-Circulation Free-Delivery Unit Coolers for Refrigeration

Approved by ASHRAE on December 17, 2018, and by the American National Standards Institute on December 17, 2018.

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ISSN 1041-2336



Includes access to online temperature glide calculator.
(Requires Microsoft Excel.)



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Online supporting files: <https://www.ashrae.org/25-2018>

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

This 2018 edition of ASHRAE Standard 25 incorporates technical revisions, including new requirements for glide refrigerants. Additionally, the standard has been revised in places to make it compliant with ASHRAE's mandatory language requirements, and references have been updated. This standard includes online supporting files that can be downloaded at <https://www.ashrae.org/25-2018>.

1. PURPOSE

This standard establishes uniform methods of testing for obtaining performance data, lists and defines the terms used in testing, specifies data to be recorded and formulas to be used in calculations, and sets limits and tolerances in testing.

2. SCOPE

This standard applies to factory-made, *forced-circulation free-delivery unit coolers* operating with a *volatile refrigerant* fed by either direct expansion or liquid overfeed at wet and/or dry conditions. This standard does not include the following:

- Air conditioning units used primarily for comfort cooling for which testing methods are given in other standards
- Unit coolers* operating at latent load conditions with a refrigerant saturation temperature of less than 32°F (0.0°C)
- Unit coolers* installed in or connected to ductwork or with external air resistance devices not provided by the manufacturer
- Unit coolers* using zeotropic refrigerants with *glides* greater than 12.6°F (7.0°C)
- Field testing of *unit coolers*

3. DEFINITIONS AND SYMBOLS

3.1 Definitions

calculated inlet evaporator temperature: temperature at evaporator inlet calculated using thermodynamics properties in REFPROP¹ or refrigerant manufacturer's data based on inlet evaporator enthalpy and outlet pressure or using correlations, as shown in Appendix A. In the case of *liquid overfeed unit coolers*, the inlet evaporator temperature is equal to the *bubble point*.

direct-expansion (DX) unit cooler: a *unit cooler* in which the leaving refrigerant vapor is superheated.

dry test condition: test condition where latent cooling is not present.

enthalpy difference (HD): the difference between the enthalpy of the air entering the *unit cooler* and the calculated

enthalpy of saturated air at the *dew point* at the *unit cooler* outlet, Btu/lbm (kJ/kg).

forced-circulation free-delivery unit coolers (unit coolers): a factory-made assembly, including means for forced-air circulation and elements by which heat is transferred from air to refrigerant without any element external to the cooler imposing air resistance. (**Informative Note:** These may also be referred to as "air coolers," "cooling units," "air units," or "evaporators.")

glide: the absolute value of the difference between the starting and ending temperatures of a phase-change process by a refrigerant within a component of a refrigerating system at constant pressure, exclusive of any subcooling or superheating, °F (°C). This term usually describes condensation or evaporation of a zeotrope.

gross total cooling effect (cooling capacity): the heat absorbed by the refrigerant, Btu/h (W). This is the sum of the *net total cooling effect* and the heat equivalent of the energy required to operate the *unit cooler*. This includes both sensible and latent cooling.

latent cooling effect: the portion of *gross total cooling effect* that results in water vapor condensation in the air circulating through the *unit cooler*, Btu/h (W).

liquid overfeed unit cooler: a *unit cooler* in which the refrigerant liquid is supplied at a recirculation rate greater than 1.

mean evaporating temperature: for zeotropic, this is equal to the average between the dew-point temperature at the evaporator outlet and the *calculated inlet evaporator temperature*, °F (°C). For azeotropic, this is equal to the saturation temperature.

net total cooling effect: the refrigeration capacity available for space and product cooling, Btu/h (W). This is equal to the *gross total cooling effect* less the heat equivalent of energy required to operate the *unit cooler*. This includes both *latent cooling effect* and *sensible cooling effect*.

recirculation ratio (recirculation rate): the mass ratio of liquid circulated to the amount of liquid vaporized.

sensible cooling effect: the portion of the *gross total cooling effect* that results in changes in dry-bulb temperature of the air and vapor mixture circulating through the *unit cooler*, Btu/h (W).

steady state: a test condition during which fluctuations of required *test measurements* remain within the specified tolerances of Tables 2 and 3.

temperature difference (TD): the difference between the dry-bulb temperature of the air entering the *unit cooler* and the *dew point* at the *unit cooler* outlet, °F (°C).

test glide: the difference between the *dew-point* temperature at the evaporator outlet and the *calculated inlet evaporator temperature*, °F (°C).

test measurement: the reading of a specific test instrument at a specific point in time.

test room: the environmental chamber where all components are installed and tested, which is used to maintain *wet test conditions* and/or *dry test conditions*.