ANSI/ASHRAE Standard 138-2009
(Supersedes ANSI/ASHRAE Standard 138-2005)

ASHRAE STANDARD

Method of Testing for Rating Ceiling Panels for Sensible Heating and Cooling

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NOTE

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FOREWORD

Standard 138 establishes uniform methods of laboratory testing for rating the thermal performance of ceiling panels manufactured for radiant panel heating and cooling of indoor spaces. This standard covers steady-state testing of ceiling panels at panel surface temperatures from 24°C to 65°C (75°F to 149°F) for nonmetal heat transfer elements in the ceiling panel or from 24°C to 150°C (75°F to 302°F) for metal heat transfer elements in the ceiling panel. Sensible cooling ceiling panels are tested from 14°C to 24°C (57°F to 75°F). This standard provides correction factors with respect to defined test conditions for the size of the test room, barometric pressure in the test location, and average air velocity in the vicinity of the test panels in order to ensure repeatable test results.

This is a revision of ANSI/ASHRAE Standard 138-2005. 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.

This revision updates the references, and the dates of the referenced works cited in the body of the text have been removed and are now only found in Section 12. In addition, I-P units were editorially added in Section 8.4.2, item 10. Other minor editorial changes were made as well.

1. PURPOSE

This standard establishes uniform methods of laboratory testing for rating steady-state thermal performance of ceiling panels used in indoor spaces for sensible heating or sensible cooling, or both. The objective is to rate ceiling panels under repeatable conditions.

2. SCOPE

2.1 This standard specifies procedures, apparatus, and instrumentation for rating thermal performance of ceiling panels in a specific indoor configuration and thermal conditions.

2.2 Thermal performance of a ceiling panel is measured in terms of heat delivered or heat removed by the ceiling panel as a function of average fluid temperature of the heat transfer medium in the ceiling panel and the temperatures characterizing the surrounding indoor space.

2.3 This standard covers testing of ceiling panels in the following effective panel surface high and low temperature range limits.

- *Sensible Heating Ceiling Panels*: from 24°C to 65°C (75°F to 149°F) for nonmetal heat transfer elements in the ceiling panel or from 24°C to 150°C (75°F to 302°F) for metal heat transfer elements in the ceiling panel.
- *Sensible Cooling Ceiling Panels*: from 14°C to 24°C (57°F to 75°F).

2.4 This standard does not cover the following ceiling panels:

a. hybrid (combined thermal radiation and forced-convection: load-sharing) ceiling panels;
b. ceiling panels that are embedded into the ceiling, wall, or floor structure; or
c. test methods for design, production, or field-testing of ceiling panels.

3. UNITS OF MEASUREMENT

3.1 System of Units. In this standard the International System of Units (SI) is used. Inch-pound (I-P) units are shown parenthetically. Values shall be based on the National Institute of Standards and Technology (NIST) values, which, in turn, are based on the fundamental values of the International Bureau of Weights and Measures.

3.2 Basic Units. The unit of length is meter, designated m (foot or inch, designated ft or in.). The unit of mass is the kilogram, designated kg (pound, designated lb), and the unit of time is the second or hour, designated s or h. The unit of temperature is degree Celsius, designated °C (degree Fahrenheit, designated °F), or kelvin, designated K (degree rankine, designated °R). The unit of force is the newton, designated N (pound-force, designated lb_f).

3.3 Derived Units

3.3.1 Velocity and Acceleration. The unit of velocity is m/s (ft/s). The unit of acceleration is m/s^2(ft/s^2).

3.3.2 Surface Area. The unit of surface area is m^2 (ft^2).

3.3.3 Volume Flow Rate. The unit of volume flow rate is cubic meter (foot) per second, m^3/s (ft^3/s).

3.3.4 Pressure. The unit of pressure is pascal, designated Pa, or the kilopascal, kPa (pound-force per square foot, designated lb_f/ft^2).

3.3.5 Energy, Work, and Power. The unit of energy and work is joule, designated J (British thermal unit, designated Btu). The unit of power is watt, designated W (British thermal unit per hour, designated Btu/h).

3.3.6 Heat Flux. The unit of heat flux is W/m^2 (Btu/($h \cdot ft^2$)).

3.3.7 Thermal Resistance. The unit of thermal resistance is $m^2 \cdot K/W$ ($h \cdot ft^2 \cdot °F/Btu$).

3.3.8 Mass Density. The unit of mass density is kilogram per cubic meter, kg/m^3 (pound per cubic foot, lb/ft^3).

3.3.9 Dynamic Viscosity and Kinematic Viscosity. The unit of dynamic viscosity is Pa·s ($lb_f/(ft \cdot s)$). The unit of kinematic viscosity is m^2/s (ft^2/s).

3.3.10 Specific Heat. The unit of specific heat is J/(kg·K) (Btu/(lb·°F)).