ASHRAE STANDARD

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

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Cognizant TC: TC 6.5, Radiant and In-Space Convective Heating and Cooling
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SPECIAL NOTE

This American National Standard (ANS) is a national voluntary consensus standard developed under the auspices of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). Consensus is defined by the American National Standards Institute (ANSI), of which ASHRAE is a member and which has approved this standard as an ANS, as "substantial agreement reached by directly and materially affected interest categories. This signifies the concurrence of more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that an effort be made toward their resolution." Compliance with this standard is voluntary until and unless a legal jurisdiction makes compliance mandatory through legislation.

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b. participation in the next review of the Standard,
c. offering constructive criticism for improving the Standard,
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NOTE

When addenda, interpretations, or errata to this standard have been approved, they can be downloaded free of charge from the ASHRAE Web site at http://www.ashrae.org.

(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

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 (75°F) to 65°C (149°F) for nonmetal heat transfer elements in the ceiling panel or from 24°C (75°F) to 150°C (302°F) for metal heat transfer elements in the ceiling panel. Sensible cooling ceiling panels are tested from 14°C (57°F) to 24°C (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.

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 (75°F) to 65°C (149°F) for nonmetal heat transfer elements in the ceiling panel or from 24°C (75°F) to 150°C (302°F) for metal heat transfer elements in the ceiling panel.
- *Sensible Cooling Ceiling Panels*: from 14°C (57°F) to 24°C (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 (ft or in.). The unit of mass is the kilogram, designated kg (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, °F), or kelvin, designated K (degree rankine, designated °R). The unit of force is the newton, designated N (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 per second, m^3/s (ft^3/s).

3.3.4 Pressure. The unit of pressure is pascal, designated Pa, or the kilopascal, kPa (lb_f/ft^2).

3.3.5 Energy, Work, and Power. The unit of energy and work is joule, designated J (Btu). The unit of power is watt, designated W (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 (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)).

4. SYMBOLS

A_c = sum of the surface area of the test chamber ceiling that is not obstructed by the ceiling panels, m^2 (ft^2)

A_{ce} = sum of the surface area of the test chamber ceiling that is directly exposed to thermally effective surfaces of ceiling panels (if ceiling panels are detached from the ceiling surface), m^2 (ft^2)

A_e = interior surface area of the simulated exterior wall of the test chamber, m^2 (ft^2)

A_p = sum of the thermally effective panel surface area of a test panel (projected surface area shall be used if the surface is heat transfer augmented, such as with fins or corrugation), m^2 (ft^2)