



**BSR/ASHRAE Addendum c  
to ANSI/ASHRAE Standard 55-2017**

**Public Review Draft**

# **Proposed Addendum c to Standard 55-2017, Thermal Environmental Conditions for Human Occupancy**

**First Public Review (August 2018)  
(Draft shows Proposed Changes to Current Standard)**

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## FOREWORD

*This proposed addendum adds a requirement for projects demonstrating compliance through Section 5.3.1, 5.3.2, or 5.3.3, design compliance to indicate the Comfort Control Classification Levels proposed through the addendum.*

*[Note to Reviewers: This addendum makes proposed changes to the current standard. These changes are indicated in the text by underlining (for additions) and ~~striketrough~~ (for deletions) except where the reviewer instructions specifically describe some other means of showing the changes. Only these changes to the current standard are open for review and comment at this time. Additional material is provided for context only and is not open for comment except as it relates to the proposed changes.]*

## Addendum c to 55-2017

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***Modify Section 3 Definitions as shown below. The remainder of Section 3 is unchanged.***

***corrective power (CP): the ability of a PCS system expressed in degrees (°C, °F) to “correct” thermal conditions toward the comfort zone, measured as the difference between two operative temperatures at which equal thermal sensation is achieved - one a temperature in the comfort zone with no PCS, and one with PCS in use, with all other environmental factors held constant.***

***personal comfort system (PCS): a device to heat and/or cool individual occupants directly or heat and/or cool the immediate thermal environment of an individual occupant, under the control of the occupant without affecting the thermal environment of other occupants.***

***personal environment: the thermal environment immediately surrounding an occupant***

***readily accessible: capable of being reached quickly for operation without requiring those for whom ready access is required to climb over or remove obstacles or to resort to portable ladders, chairs, or other climbing aids.***

***thermal zone: an area of a building designated by the designer such that the comfort zone is maintained within the occupied zone by local controls for its representative occupant(s).***

***Modify Section 6 Design Compliance as shown below.***

**6.1 Design.** Building systems (i.e., combinations of mechanical systems, control systems, and thermal enclosures) shall be designed so that at outdoor and indoor design conditions they are able to maintain the occupied space(s) at indoor thermal conditions specified by one of the methods in this standard.

The building systems shall be designed so that they are able to maintain the occupied space(s) within the ranges specified for internal conditions in this standard, and within the range of expected operating conditions (indoor and outdoor).

### **6.1.1 Design Comfort Control Classification**

For all projects demonstrating compliance through Section 5.3.1, 5.3.2, or 5.3.3, design compliance shall indicate the Comfort Control Classification Level in accordance with Table 6.1 of each space type within the building.

**Table 6.1 Comfort Control Classification Levels**

<b><u>Comfort Control Classification Level</u></b>	<b><u>Control Measure(s) for Environmental Factors Required to Achieve Level</u></b>	<b><u>Informative Examples Meeting Comfort Control Classification Levels</u></b>
<u>1</u>	<u>Each occupant is provided two or more control measures for their personal environment</u>	<ul style="list-style-type: none"> <li>• <u>Private office with a ceiling fan and an occupant adjustable thermostat</u></li> <li>• <u>Shared office with desktop fans and foot warmers for each occupant</u></li> </ul>
<u>2</u>	<u>Each occupant is provided one control measure for their personal environment</u>	<ul style="list-style-type: none"> <li>• <u>Private office with an occupant adjustable thermostat</u></li> <li>• <u>Shared office with a desktop fan for each occupant</u></li> </ul>
<u>3</u>	<u>The room or thermal zone provides multi-occupant control of at least two control measures in their shared environment.</u>	<ul style="list-style-type: none"> <li>• <u>Shared office with an occupant adjustable thermostat and ceiling fan control</u></li> </ul>
<u>4</u>	<u>The room or thermal zone provides multi-occupant control of one control measure in their shared environment.</u>	<ul style="list-style-type: none"> <li>• <u>Shared office with an occupant adjustable thermostat</u></li> </ul>
<u>5</u>	<u>No occupant control of any environmental factors</u>	<ul style="list-style-type: none"> <li>• <u>Shared or private office with an unadjustable thermostat or no thermostat</u></li> </ul>

Each Control Measure for Environmental Factors shall be readily accessible to occupants, when occupancy is expected and be either (1) or (2)

1. A user-adjustable thermostat with ability of user to change setpoint by +/-3 °C (+/-5 °F)
2. Capable of changing the thermal environment of the space or individual occupant by the magnitude specified in either 6.1.1.2. a. or b. in 15 minutes or less from occupant control initiation, while met and clo values are constant. For control measures that apply to a multi-occupant space, the change must meet the requirements for all representative occupants.
  - a. Cooling: At design cooling condition, the measure shall change PMV by -0.5 or
    - i. Average air temperature by - 3°C (-5 °F)
    - ii. Average air speed by + 0.3 m/s (60 fpm)
    - iii. Mean radiant temperature by - 3°C (-5 °F)
    - iv. For personal comfort systems, the measure shall be listed in Table 6.2 or have a minimum corrective power of - 2°C (-4 °F).
  - b. Heating: At design heating condition, the measure shall change PMV by +0.5 or
    - i. Average air temperature by + 3°C (5 °F)
    - ii. Mean radiant temperature by + 3°C (5 °F)
    - iii. For personal comfort systems, the measure shall be listed in Table 6.2 or have a minimum corrective power of + 2°C (4 °F)

**Informative Note:** A single device that is capable of changing PMV in both directions (a and b above) is counted as a single control measure. For example, a thermostat that can affect the temperature in the space by -0.5 and +0.5 PMV counts as one control measure, not two.

**Table 6.2 Prescriptively Compliant Personal Comfort Systems**

<b><u>Description</u></b>	<b><u>Requirements</u></b>
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Cooling	
<u>Desk fan aimed at head/face/upper body</u>	<u>Capable of providing air speed at the occupant's head/face/upper body within range of 0.36 – 0.8 m/s (70.9 – 157.5 fpm)</u>
<u>Cooled chair</u>	<u>Capable of extracting 20 watts from the body</u>
Heating	
<u>Footwarmer</u>	<u>Capable of adding 6 W to the body</u>
<u>Heated chair</u>	<u>Capable of adding 14 W to the body</u>

**6.2 Documentation** The method and design conditions appropriate for the intended use of the building shall be selected and documented as follows.

**Informative Note:** Some of the requirements in items (a) through (h) below are not applicable to naturally conditioned buildings.

- a. The method of design compliance shall be stated for each space and/or system: Graphic Comfort Zone Method (Section 5.3.1), Analytical Comfort Zone Method (Section 5.3.2), Elevated Air Speed Comfort Zone Method (Section 5.3.3), or the use of Section 5.4 for Occupant-Controlled Naturally Conditioned Spaces.
- b. The design operative temperature ( $t_o$ ) and humidity (including any tolerance or range), the design outdoor conditions (see 2009 *ASHRAE Handbook—Fundamentals*<sup>1</sup>, Chapter 14), and total indoor loads shall be stated. The design exceedance hours (see Section 3, “Definitions”) shall be documented based on the design conditions used.
- c. Values assumed for comfort parameters used in the calculation of thermal conditions, including operative temperature  $t_o$ , humidity, average air speed  $V_a$ , clothing insulation  $I_{cl}$ , and metabolic rate, shall be stated for heating and cooling design conditions. If an acceptable level of comfort is not being provided to any representative occupants, this shall be stated. Where Table 5.2.1.2 gives a range, the basis for selecting a single value within that range shall be stated. If the clothing insulation or metabolic rate parameters for a given space are outside the applicable bounds defined by the standard, or if the space is not regularly occupied as defined in Section 2.3, the space shall be clearly identified as not under the scope of the standard.
- d. Local thermal discomfort shall be addressed, at a minimum, by a narrative explanation of why an effect is not likely to exceed Section 5 limits. Where calculations are utilized to determine the effect of local thermal discomfort in accordance with Section 5, the calculation inputs, methods, and results shall be stated.
- e. System equipment capacity shall be provided for each space and/or system documenting performance meeting the design criteria stated. For each unique space, the design system or equipment heating and/or cooling capacity shall meet the thermal loads calculated under the heating and cooling design conditions stated for compliance with this standard.
- f. Where elevated air speed with occupant control is employed to provide acceptable thermal conditions, documentation shall be provided to identify the method and equipment for occupant control.
- g. Air speed, radiant temperature asymmetry, vertical air-temperature difference, surface temperatures, and temperature variations with time shall be determined in accordance with generally accepted engineering standards (e.g., *ASHRAE Handbook—HVAC Applications*, Chapter 57). The method used and quantified selection criteria, characteristics, sizes, and indices that are applicable to the method shall be stated.
- h. When direct beam solar radiation falls on a representative occupant, documentation shall include solar design condition (solar altitude, direct beam intensity), the method in Section 5.3.2.2.1 used for compliance, and the resultant mean radiant temperature  $t_r$ .

- i. Comfort Control Classification Level shall be documented for each space type with supporting calculations and design documents indicating the Control Measure(s) for Environmental Factors, the means of control, and the degree to which control changes the environmental factor.

**Informative Note:** See Informative Appendix K for sample compliance documentation.

**Modify Section 7.2.1 as shown below.**

**7.2.2.1 Mechanically Conditioned Spaces.** Use Section 5.3.1.2 to determine the PMV-based comfort zone for the occupants' expected clothing and metabolic rate. The modeled clothing and activity levels of the occupants must be as observed or as expected for the use of the indoor space in question. Use Section 5.3.3 to adjust the comfort zone's lower and upper operative temperature limits for elevated air movement. Occupied zone conditions must also conform to requirements for avoiding local thermal discomfort (as specified in Section 5.3.4) and to limits to rate of temperature change over time, as specified in Section 5.3.5.

Parameters to be measured and/or recorded include the following:

- a. Occupant metabolic rate (met) and clothing (clo) observations
- b. Air temperature and humidity
- c. Mean radiant temperature  $\bar{t}_r$ , unless it can be otherwise demonstrated that, within the space,  $\bar{t}_r$  is within 1°C (2°F) of  $t_a$
- d. Average air speed, unless it can be otherwise demonstrated that, within the space, average air speed  $V_a$  meets the requirements of Section 5.3.3
- e. Control measures for environmental factors

**Modify Section 7.3.3 as shown below.**

**7.3.3 Timing of Physical Measurements.** Measurement periods shall span two hours or more and, in addition, shall represent a sample of the total occupied hours in the period selected for evaluation (year, season, or typical day) or shall take place during periods directly determined to be the critical hours of anticipated occupancy.

Measurement intervals for air temperature, mean radiant temperature  $\bar{t}_r$ , and humidity shall be five minutes or less, and for average air speed shall be three minutes or less.

Assessment of control measures for occupant control of environmental factors shall be evaluated for compliance with the requirements of Section 6.1.1 including: accessibility, time response and magnitude of PMV influence.